Color Business Report

Color, Computers, and Reprographics

September 2000 **Volume 10 Number 9**

Xerox's Speedy M750 Produces eXpress Prints

Last week, in *Time Magazine* and on the TV, we saw George Rodrique's yellow-eyed blue dog selling Xerox SOHO printers. Xerox is making a commitment to earn respect with home and small office computer users. The arena is clogged with substantial and eager competitors, and Xerox is seizing what may be the last opportunity to participate in the consumer and home office environments.

eXpress Mode is Real

At briefings, Xerox executives call their new products "technology-advantaged." Xerox's speedy one-pass "eXpress" printing mode is, indeed, an advantage. No other ink jet printer can do it. And those who think offering one-pass printing is an easy stunt ought to try it.

Xerox's eXpress printing is not a draft printing mode. eXpress prints should be acceptable for most users, most of the time. In the first place, even under magnification, black eXpress-mode *text* is virtually indistinguishable from Normal-mode text. The first job a printer (or print mode) has to get right is to produce text that is acceptable for office work. Our appraisal is that Xerox's eXpress mode does just that.

On plain paper, photographs printed in Normal mode appear slightly more saturated than eXpress prints. The difference in saturation is so slight, though, that it is only noticeable in side-by-side comparisons. Banding has not been completely eliminated, though. Whether or not a print shows banding depends greatly on the nature of the image. Bands can be seen quite easily going across the solid cyan field on the *CBR* test page included with this issue, for instance. Subtle and almost imperceptible bands appear in the background of Corel's "butterfly" photo. The solid magenta field shows no banding. Colors made by mixing or superimposing primaries, such as in the PMS 293 blue *Color Business Report* logo, look exactly the same in each mode.

Xerox uses an "edge-shooter" print head, fabricated by sandwiching a scribed plate with one that is not scribed, forming channels that carry ink. Xerox has crammed 312 nozzles into an 18-mm space. The more-common "side shooters" have orifices

(continued on page 2)

In this issue (highlights):

Nozzles per mm

Printer	Print Head	Total Nozzles	Nozzles/mm
Xerox M 750	Xerox P105	312 for three colors	17.3
HP DeskJet 790 CSe	HP C6578D	408 for three colors	11.3
Lexmark Color Jetprinter Z52	Lexmark 15M0120	192 for three colors	10.7

Source: *Color Business Report*

punched through a flat plate. Most face shooters populate the plate with parallel rows of nozzles. HP's C6578D cartridge, for instance, has 408 nozzles arranged in six parallel rows of 68 nozzles per row, to cover a print swath of about 6 mm. Lexmark's 15M0120 has six sets of nozzles, too, arranged in two parallel rows. A single color can cover a swath of perhaps 3 mm. With parallel rows of nozzles, it is difficult to print a full swath of all colors in a single pass and control unwanted blending of still-moist dots. In addition, some face-shooters share a heater between two nozzles, so they cannot fire all nozzles in a single pass.

How Fast?

The speed benefit is real and it is significant. We feel customers who try eXpress printing will like it. And if the M750 were our day-to-day printer, we would set the default to eXpress mode.

We recognize that customers don't do a great deal of benchmarking. The Xerox M750 clips along quite nicely when the computer's sole responsibility is printing. Today, we have Excel and Word open in addition to Corel, and we are making prints in the background. We don't use a stopwatch in such situations—there are plenty of pauses between passes. With our computer working so hard on other things, eXpress is probably still faster than Normal, but *neither* is especially fast right now. At least some of the time, then, customers may be indifferent to speedy printing. But they won't be indifferent when it is time to buy a new printer. Print speed is one of the performance parameters that customers like to check—a basis for comparison. Xerox has taken the unusual tactic of not being specific about the very feature that makes its product distinctive. No amount of arm twisting, it seems, can wrest page-per-minute specifications by mode from Xerox product managers. The M750's spec sheet simply states, presumably for draft printing, "up to 6 pages per minute color, up to 10 pages per minute black."

For a couple of years, HP took the high road on specs, refusing to cite print resolution. If HP had the high road, Lexmark boldly headed in the other direction. One can (and HP did) dispute Lexmark's "highest resolution on the planet" claim, but one cannot refute the observation made by Lexmark's Paul Johns who emphasized that, "Resolution is an attribute that resonates with customers. On that basis, they buy monitors, scanners, and digital cameras. If someone tells them that resolution doesn't matter, they don't listen." (Johns' comments appeared in the February 2000 *Color Business Report*.) All of HP's market success and market presence could not alter customer perceptions, and, with the DeskJet 970Cse introduced in September 1999, HP abandoned it "no-resolution-spec" strategy.

Xerox explained that there are too many variables involved to be able to make fair and useful comparative statements about print speed. Xerox's press release for the M750 and M760 states, "Xerox M Series products deliver the fastest business quality printing in their class at speeds up to twice as fast as the competition's normal mode…" In the beefy reviewer's guide that accompanied the M750, Xerox pegged its own eXpress printing speed (called "measured print speed" to differentiate the measure from a specification) at 2.4 ppm, or 25 seconds per page. The HP DeskJet 842C, DeskJet 932C, and the Lexmark Z42 print in Normal mode at less than half that speed, according to Xerox.

The caveats around the positive statements that Xerox makes about speed may cause some to be

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Print Speed Comparison, Xerox M750 vs. Lexmark Z52 (min:sec)

	Draft	eXpress	Normal	Best	Maximum
Xerox set-up demonstration page	NA	0:20	0:28	NA	NA
Xerox 750 *CBR* test page, single print	0:34	1:00	1:42	4:00	NA
Xerox M750 *CBR* test page, run of three	1:22	2:41	4:42	11:36	NA
Lexmark Z52 *CBR* test page, single print	0:35	NA	1:36	4:07	7:32
Lexmark Z52 CBR test page, run of three	1:28	NA	4:20	12:05	22:10

(Printed on a 350 MHz Pentium II, Windows 95, and Corel 9. Includes approximately 10 seconds after the print command was given before the print head started moving.)

suspicious. When we hear words like "business quality printing," we wonder if there is something wrong or sub-standard about the output. Now that we have used the printer, we know that is not the case. It's unfortunate that Xerox hasn't found a better way to get the message out.

Our own comparison between the Xerox M750 and the Lexmark Z52 demonstrates that the Lexmark takes 50% longer to print our *CBR* test page on a one-page run. On a single page, Xerox is speedier by half a minute, but not twice as fast. On longer runs, the difference is more noticeable and will be more appreciated. The Xerox printer in eXpress mode is finished with the last page of a three-page run in 2 minutes, 41 seconds. The Lexmark Z52 takes 4 minutes, 20 seconds to complete the same task. Xerox's eXpress-mode prints are comparable to Normal-mode prints from the Lexmark Z52. With the July 2000 issue, we distributed our test print produced in Normal mode on the Lexmark Z52. (Readers who make the comparison should note that the Xerox print was made with Corel 9 with Corel's color management switched on, and the Lexmark print was made with Corel 8 with Corel's color management switched off. No doubt that explains at least some of the difference seen in the photographs.)

No Waste with Individual Ink Tanks

Xerox has less of a claim on its other key sales feature—the use of individual ink tanks to avoid wasting ink. Although Xerox holds patents in the area (US 05997121, for one), separate ink tanks are not especially innovative. Both HP and Canon have desktop in jet printers with separate ink tanks. Xerox itself uses separate tanks in its WorkCentre XK35C and Docuprint C8. Epson uses individual tanks in its Stylus Pro 5000 proofer, a six-color specialist's tool.

On Xerox's behalf, **CompuMetric Labs, Inc**. (Mobile, AL) collected nearly 1,500 used cartridges and determined that, on average, 20% of the ink delivered with the cartridge is still in the cartridge when the first color runs out and the cartridge must be replaced. Unfortunately for Xerox, in its September 2000 issue *Consumer Reports* told its readers that "typical printing tends to consume colors at similar rates." We think *Consumer Reports* is wrong. Xerox has hard data that refutes *Consumer Reports'* statement. Further, our cost-per-page testing process measures ink discarded when the first color runs out. And even though our image was designed to use ink more-or-less evenly, we *still* discard some ink when the first colorant expires. On the Lexmark Z52, for instance, we discarded about 5% of the ink that was still in the cartridge when the first color ran out. (That being said, we explain below that less waste may not always equate to less cost.)

Xerox intends to emphasize its separate-tank configuration as being a less wasteful way to print, which neither HP nor Canon have done. Less-wasteful printing should resonate with customers the way that, well, resolution and pages-per-minute do.

The color ink tanks hold about 6 ml of useable ink. The black tank holds about 48 ml of ink. The tanks are divided into two main compartments. In the back of the

(continued on page 4)

Remaining Ink in Tri-color Cartridges

Cartridge	Printer Example	Cartridges Weighed	Average Ink Remaining
Canon BCI-21	BJC-2000	307	18.5%
Epson S020191	Stylus Color 740	507	31.8%
HP C1823D	DeskJet 722C	324	21.7%
Lexmark 12A1980	Z31	307	20.54

Source: CompuMetric Labs, Inc.

tank, a reservoir of liquid ink can be found. In the front compartment, spongy material is saturated with ink. In the bottom of this front compartment is a 1/4" hole through which ink is drawn into the print head. The spongy material controls flow—it keeps the ink from running out of the tank.

Xerox monitors ink levels with a system called InkLogic, which combines pixel-counting with LED-sensing. A color ink tank starts out with 430 million pixels. From the point a cartridge is first installed, InkLogic maintains a count of how many pixels have been fired. Pixel counting is not enough, though, since other factors can reduce the amount of ink. For instance, head cleaning cycles consume ink. And when the printer is idle for extended periods, the printer periodically spits to keep the nozzles from drying out. During long print runs, heat buildup can change firing characteristics, resulting in larger drops. (The M750 prints bi-directionally in eXpress mode. However, when it senses heat build-up, the printer prints in one direction only for a page, to let heat dissipate.) To provide a more accurate trigger for ink depletion, Xerox resets the pixel count when an LED-based ink level detector senses pending depletion. After the reset, pixel counting from this much lower level resumes. When this new tally of pixels goes to zero, an ink-out message is prompted and printing stops until a new ink tank is installed.

An LED inside the printer's cabinet near the maintenance station on the right shines light on a side-by-side pair of prisms. The prism nearest the outer wall of the tank has silver-colored reflectors. The function of this shiny prism is to confirm that an ink tank is in place and properly seated. When the tank is properly aligned, the prism reflects light back to a sensor. If the returning beam is not detected, a notice is sent to the Status Widow indicating that an ink tank is missing.

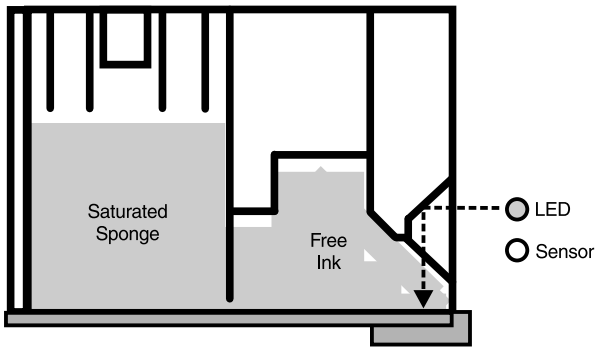
Next to the shiny prism is a prism molded into the translucent plastic walls of the ink tank. When ink is behind the plastic surface, light is absorbed *(see sketch)*. When the ink level falls below the point where the light hits the bottom angle, light is reflected back to a sensor, which re-sets the registers that monitor pixel counts, and the printer begins counting down from a much smaller number. An "ink low" message is triggered when the pixel count indicates that approximately 10% of usable ink remains in the printer. When ink is gone completely, the printer stops, and new ink must be added.

The M750 in Operation

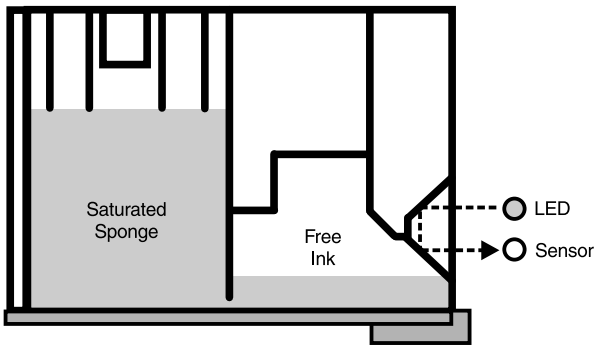
The printer is easy enough to set up. After taking the printer and other parts out of the carton, one attaches the paper tray. The paper input tray is a two-piece unit. The bottom part that extends from the base of the printer is snapped in place by the customer. A green translucent cover snaps in place on top of the input tray, and serves as an output tray. The output tray has a 1" upwards-pointing lip on the back, which effectively seals the throat of the printer, protecting the paper supply somewhat from environmental effects such as humidity. "Snap-in-place" appears to be the way most of the moving parts of the cabinet were assembled. The door to the auxiliary paper feed in the back, for instance, pulls down on plastic hinges and seats itself snugly with a plastic catch. Such simplicity is no doubt one reason why Xerox can hit the relatively low price points required in the competitive markets it is approaching. (The printers are manufactured in the Philippines by SFX partner Sharp. Xerox manufactures print heads and ink tanks in the Rochester, NY area. The Sharp-Fuji Xerox-Xerox partnership is covered in the April 2000 *Color Business Report*.)

Xerox has not burdened customers with excess documentation. A poster contains important "read-me-

LEDs Help Monitor Ink Levels



1. An LED in the maintenance station aims a light beam at a prism built into the wall of the ink tank. When ink is behind the translucent surface of the tank wall, the beam travels through the ink.



2. When the ink level falls below the lower angle of the prism, the beam is reflected back to the sensor, and the pixel counter is re-set for a final, more accurate count down.

Source: *Color Business Report*

first" information about port settings and communications, and instructions for those using the USB interface. Xerox also supplies brief *Getting Started* and *Quick Reference* booklets, which cover basic printer operation, and provide step-by-step illustrated directions on how to use features such as envelope, iron-on, and banner printing. Supplies replenishment, print head changes, and troubleshooting (error codes) are described in the *Quick Reference*. A CD-ROM contains print drivers and a Windows Help-based *User's Guide*.

After clicking the paper tray pieces in place and filling the tray, one connects the 1284 parallel cable to the printer and the computer, and connects the power cord. The next step is to install the print heads. A single print carriage holds both the color and the black print heads. Each is placed in a slot, side-by-side. A single lever clamps both in position. After the heads are latched in place, ink tanks are installed. The ink tanks we used were delivered in an Ink Cartridge Multipack box that holds all four colors. Xerox also packages individual colors three to a box. Each ink tank is shipped in its own plastic bag. After removing the tank from the bag, one must remove the foil that seals the 1/4" opening that mates with a port on the print head. Users are cautioned not to hold the ink tank by its sides, lest too strong a grip squeeze ink out of the tank. To install a tank, one pushes the green "heel" on the base of the tank into an opening on the print head, and rocks the tank forward into its seated position. When pushed home, the tanks are held in place at the top by spring-loaded clips that are part of the print head. Tanks are color- and number-coded, but they *are* interchangeable (except for black, which is considerably wider than the color cartridges).

The next step is to turn the printer and computer on and install the printer driver. The driver installation process proceeds automatically upon inserting the CD into the drive. Near the end of the process, customers are directed to align the print heads. Four sets of lines and/or boxes are printed, and one must identify the ones with proper alignment, and put those numbers into the proper places on the alignment screen. Nothing is aligned mechanically. The black print head uses 310 of the 320 nozzles, and does not print from the first and last five nozzles. Depending on the pattern matched by the customer, the printer will nudge the active set of nozzles up or down.

After aligning the heads, the set-up routine gives customers a chance to try eXpress mode printing. Sample prints are made in each mode, so customers can see how closely eXpress printing matches Normal mode. At that point, users can select either mode as the default.

We have included a print sample in eXpress mode and Normal mode, so readers can judge print quality performance for themselves. Our early prints (not included) were made with Corel 8, and were not acceptable. With Corel's color management turned off, the photo images appeared pale or lacked saturation. With Corel's color management turned on, the photos printed nicely, but the solid yellow printed with magenta dots, instead of being printed with only yellow ink. The culprit, Xerox told us, is Corel's method for delivering its native CMYK information to Windows. Windows is RBG-based. Of course, RGB must be translated again to CMYK in order to print. We fixed the problem by updating to Corel 9. Xerox is working on a profile for Corel 8 users.

Early on, our PMS 293 logo printed incorrectly, too. Xerox saw the prints and upgraded its look-up tables. The driver available now on Xerox's Web site has the updated look-up tables. Drivers in the boxes on store shelves do not, of course.

We had only one paper jam in the course of printing close to 2000 pages, and that was a jam we could have avoided. We were printing a batch of 50, and peeked under the lid of the paper tray to check how much paper was left. We decided to "top off" the stack, and put the new supply on top of a page that had been pulled forward slightly in order to be picked next. When it was time to feed the next page, the printer had at least two to choose from, and a paper jam signal appeared in the status

(continued on page 6)

Price Changes

Announcement Date	Vendor	Product Model	Old Price	New Price	Comments
August 29, 2000	Kodak	DCS 660	$24,995	$15,995	List price for 2000- by 3000-dpi professional SLR digital camera based on a Nikon F5 camera body.
August 29, 2000	Kodak	DCS 560	$24,995	$15,995	List price for 2000- by 3000-dpi professional SLR digital camera developed by Kodak and Canon.
August 29, 2000	Kodak	DCS 330	$4,495	$3,495	List price for 3-megapixel CCD-based professional SLR digital camera.
August 29, 2000	Kodak	DCS 315	$2,995	$1,795	List price for 1.5 megapixel CCD-based SLR professional digital camera. Kodak is also offering a 24- to 70-mm IX-Nikkor zoom lens at no extra charge.

window. Clearing the jam in this case just a matter of pulling the paper out of tray, jogging the pages into a neat stack, and placing the stack in the paper tray. We pushed the "Resume" button on the printer, and printing proceeded. We still "top off" the stack, but slide the paper under the first five sheets.

Cost of Printing

Although Xerox emphasizes that customers will waste less ink, they may not save that much over using three-chamber cartridges. At $0.306 per page for our test image, the Xerox M750 costs about two cents per page more to operate than the Lexmark Z52, an observation that confounds Xerox. "We're delivering more ink than they are, and we are charging less, so how can it cost more to use the M750?" asked Chris Punnett, who is in Marketing with Xerox's Personal Printer Team. Lexmark's tri-chamber print head, which holds 16 ml of ink split between three colors, costs $37.99. Well, we re-ran the Lexmark prints and confirmed the arithmetic, and that's the way it comes out. (The $0.285 figure for the Lexmark Z52 includes 5% waste.) Xerox suggests that multi-pass printers have three (or more) planes of print data across which they can find efficiencies. Xerox sends a single plane. High-coverage pages such as our test page may be more economically handled by multi-pass imaging models. Xerox also reminded us that, since our test page was designed to deplete all colors more or less evenly, the results mask the true benefit that individual ink tanks offer over tri-chamber tanks. About this, we agree. Long-term readers may remember that we used to present the no-waste figure as a "best-case" result. Product managers for the separate-tank HP 2000 convinced us that almost no one would experience the "no waste" or best-case example, which would require them to print flawed prints until the last droplet of the last color was depleted. Xerox explained that its printer should be more economical to operate than the Lexmark when printing a suite of documents. Xerox also sells supplies in money-saving packages. One can purchase individual colors in three-packs, for instance, for $31.99, or $1.83 per tank less than the single-tank price. Customers who tend to use a lot of a single color—printing their logo, for instance—can tailor their supplies purchases to match their consumption.

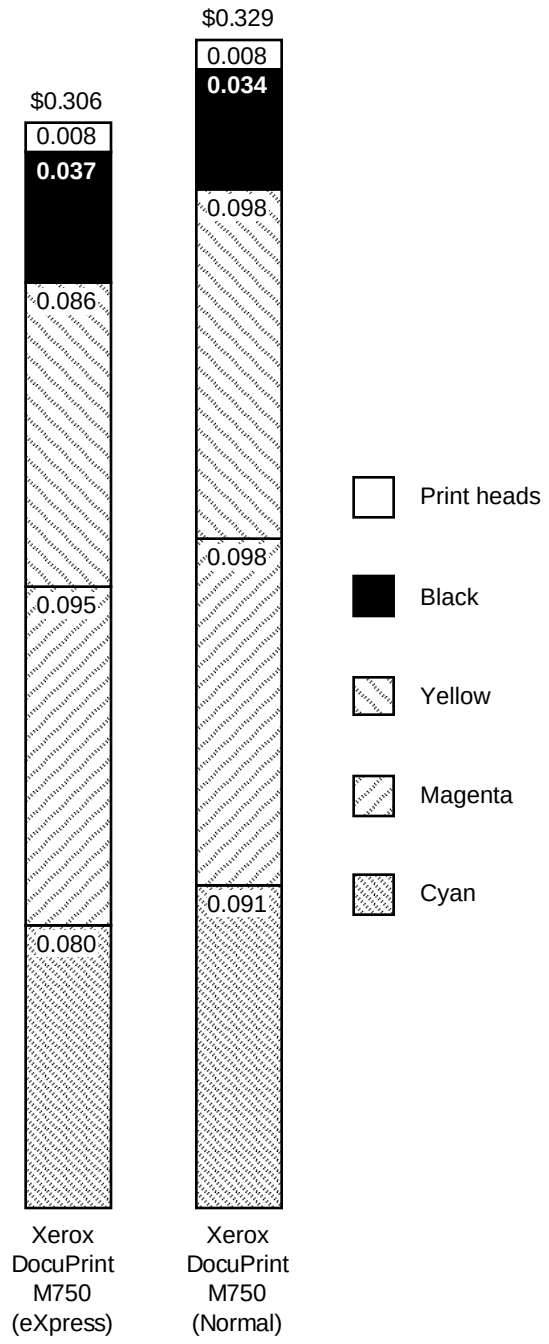
Bi-directional?

In some areas, the printer shows quirky behavior. The printer depends greatly on bi-directional communications through the 1284 cable, which in itself is not . "Not all parallel cables are created equal," warns the "Read Me First" poster that customers must touch

(continued on page 8)

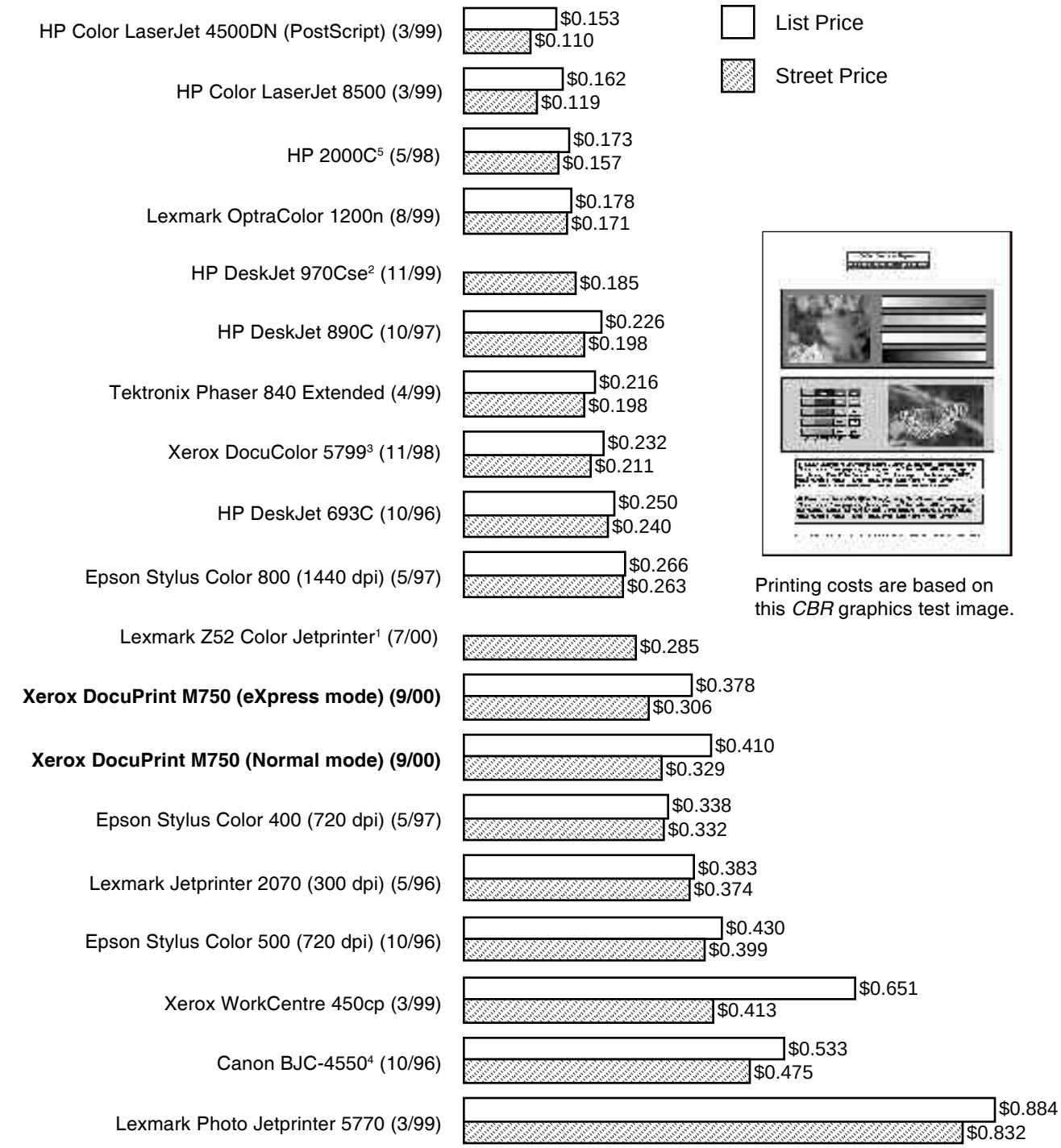
Supplies Costs for Printing the Same Page, Xerox DocuPrint M750

This month we have added the Xerox DocuPrint M750 to our supplies consumption evaluation series. We print the same image on all printers, logging the point at which each colorant runs out. The cost-per-page figures are determined by dividing the street prices for supplies by the number of pages printed until the supplies are depleted.



Source: *Color Business Report*

Supplies Costs for Printing the Same Page



Printing costs are based on this *CBR* graphics test image.

Note: Date in parentheses is when the cost data originally appeared. Costs include colorants (ink or toner) and other consumables, where appropriate. Costs for Xerox DocuColor 5799, HP 8500, and and Lexmark OptraColor 1200n includes service charge. Costs do not include paper, except for the Lexmark 4079 Plus.

[1] Lexmark does not quote list price.

[2] Economy #78 cartridge. HP does not quote list price.

[3] Street price based on 20% discount off list price.

[4] Calculations based on list prices updated 3/99.

[5] Calculations based on high-capacity black cartridge.

Source: *Color Business Report*

Customers can now print twice as fast with the DocuPrint M750. Source: Xerox Corporation

before getting their printer out of the box. The note informs customers that they may have to change their parallel port settings in BIOS to bi-directional if they have communication problems. If we behave ourselves as computer users, we never have to work beyond the Windows Desktop on our computer. The DOS-based Setup menu through which one modifies BIOS is foreign to us, and reminiscent of the dreaded "blue screen of death" that is the sign of a serious system crash. None of the three computers we used to print to the M750 had its port set to bi-directional, so we learned how to change port settings in BIOS. The Read-Me-First note offers the help of the customer support hotline. Xerox reports that about 15% of the calls the hotline receives are about port settings.

With a parallel port set to ECP, the printer works, and is highly functional. But the messages sometimes don't work. Customers who accept communication problems and decide to live with them will have some trouble here and there. When a print job is cancelled, shreds of the job may remain in buffer memory. If the port setting is not right, these lingering bytes can stop all forward progress—the green power light stays on, and pushing the power button does not turn the printer off. When cancelled jobs clogged the printer, we learned to pull the plug—a somewhat extreme means of restarting the printer. Eventually we heard about an un-documented trick. One can restart from the front panel by holding down the "power" button and pressing the paper feed button three times.

The printer stops when it is time to add supplies. If the printer determines that an ink tank is empty *after* printing a job, the message in the status window will change from "Magenta ink is low" to "The printer is out of magenta ink." When ink has run out in the *middle* of a print run, the status menu continues to read "Magenta ink is low," and the note in the status window says that one can continue to print as long as the quality is good. The InkLogic monitoring system usually does not allow the printer to operate with an empty tank. So, in the middle of a job, the printer may stop because it is out of ink. But with the status message still indicating low ink, some users may wonder why their printer has stopped. The real way to tell you are out of ink is to notice the printer's red Ink Status light on the front panel flashing. If you don't check the printer itself, and believe what the status window tells you, you may be tempted to resume printing by using the status menu's "Restart" button on the computer screen. In such a case, the printer does not spring back to life—it appears that nothing happens. (When the ink-out message is in the window, the "Restart" button is greyed out and inactive. When the ink low message appears, though, restart is one of the choices.) Eventually, one will realize that the restart button in the status window has no effect on the printer's blinking red light, and one will open the printer's lid and add ink. (On opening the lid, the status window finally tells users that they are out of ink instead of merely low, and it also tells which color is out.)

We call such behavior quirky. Through its customer support lines, Xerox will hear of such application/system quirks, and some will be fixed in subsequent driver releases. Of course Xerox tested its printer and driver to uncover such problems in advance of release. But there is a virtually endless set of possible system configurations and applications that customers use. In system design and field testing, effort must be focussed on the most common systems, and the most popular software. So when our file printed incorrectly with Corel 8, we upgraded the software, and fixed the problem. When a printer port set to ECP didn't recognize the M750, we learned to change port settings in BIOS. When the status menu doesn't really tell the status of the ink cartridges, we don't care, because we have learned the limitations of that set of messages. (We cured ourselves of thinking that we could resume printing by pressing the on-screen "Restart" button after only one or two tries. If we had been reading the on-screen directions more closely, we might have done it right instead of wrong.)

Deprimed Tanks

After we take a printer out of the box, we send a lot of paper through it. The Xerox M750 printed all day, every day, for many days in a row. Several times during our extended print runs, we "deprimed" ink tanks. Xerox suggests we may have run into this problem because the print heads in our evaluation unit were pre-production print heads. Xerox says customers should not have the problem. If they do, they may have a tough time diagnosing it. A tank that is deprimed no longer

Printers

Announcement Date	Vendor	Product Model	Price	Comments
September 5, 2000	Canon	MultiPASS C555	$199	Street price for 720- by 360-dpi multifunction ink jet printer. Supports walk-up color faxing and copying. Prints 5 ppm monochrome and 2 ppm color. Available in October 2000.
September 5, 2000	Canon	BJC-55	$349	Street price for 720- by 360-dpi portable ink jet printer. Prints up to 5.5 ppm monochrome and 2 ppm color. Supports color scanning when Canon's IS-12 scanner cartridge ($99) is installed. Available in November 2000.
September 5, 2000	Canon	S400	$99	Street price for 1440- by 720-dpi ink jet printer, which uses Canon's ThinkTank individual ink cartridge system. Prints up to 9 ppm black and 4 ppm color.
August 9, 2000	Compaq	IJ1200	$149	Street price for 1200-dpi color ink jet printer, based on the Lexmark Z42. Prints up to 5 ppm in color and 10 ppm in monochrome. Also features USB and parallel connectivity.
September 11, 2000	Epson	Stylus Color 580	$69	Street price for 1440- by 720-dpi ink jet printer. Prints up to 5 ppm black and 3 ppm color, and is Windows- and Mac-compatible. To be bundled with PCs or sold separately.
September 11, 2000	Epson	Stylus Color 480 SX	$59	Street price for 720-dpi ink jet printer. Prints up to 4 ppm black and 2.2 ppm color. Features parallel and USB connectivity. To be sold as part of PC/printer bundles only.
August 24, 2000	Olympus	Camedia P-200	$599	Street price for 320-dpi dye-sublimation photo printer. Makes a 3" by 4" print in 90 seconds. Media slot accepts both SmartMedia and CompactFlash storage cards.
August 29, 2000	Sharp	AJ-1800	$129	Retail price for 1200-dpi ink jet printer. Prints up to 8 ppm in color and 10 ppm in monochrome. Product of Sharp's joint venture with Xerox and Fuji Xerox.
August 29, 2000	Sharp	AJ-2000	$179	Retail price for 1200-dpi ink jet printer. Prints up to 8 ppm in color and 12 ppm in monochrome. Product of Sharp's joint venture with Xerox and Fuji Xerox.
August 29, 2000	Sharp	AJ-6010	Not available	1200-dpi ink jet multifunction printer. Prints up to 8 ppm in color and 12 ppm in monochrome. Supports color copying at 1200 dpi and color scanning at 600 dpi. Product of Sharp's joint venture with Xerox and Fuji Xerox. Available in November or December 2000. Pricing will be determined at that time.

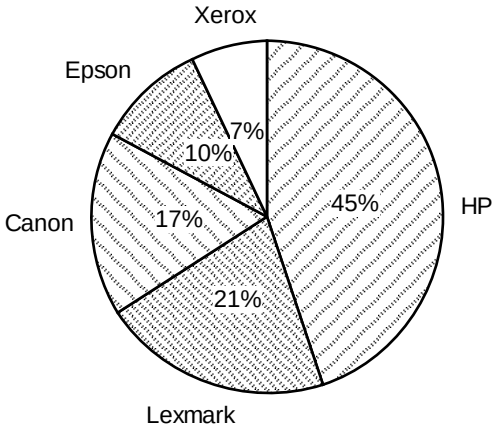
delivers ink, even though there may be plenty of ink in the tank. The problem is an excessive amount of air in the gauze part of the ink tank. A deprimed tank will show bubbles between the gauze and the wall of the tank, while a still-good tank will show the solid color of the saturated gauze against the tank's walls. (How does the air get there? Too many cleaning cycles, maybe. Removing and reinstalling the tank, possibly. But we have deprimed tanks when neither event took place.) Instead of drawing *ink* from a deprimed tank, the print head draws *air*. Prints look like one of the colors has run out. In our case, since our print runs are closely monitored with paper logs, we have a pretty good idea when ink tanks should run out. Levels in the status window "gas gauges" are live levels—those without paper logs will know that something *besides* ink-out has happened. One's first inclination is to clean the heads. However, head cleaning apparently will not resurrect a deprimed tank. The only solution is to replace the tank. But one must do more than merely replace the tank. When a head is deprimed, air fills the entire chamber in the print head between the outlet of the tank and the nozzles. After installing a new tank, a small amount of ink is pumped through the system, to ensure that the new tank is delivering ink correctly. The volume of ink delivered with the "single" prime triggered by tank replacement is insufficient to refill the whole channel

(continued on page 12)

In-store Retail Desktop Color Printer Stocking Audit, September 2000

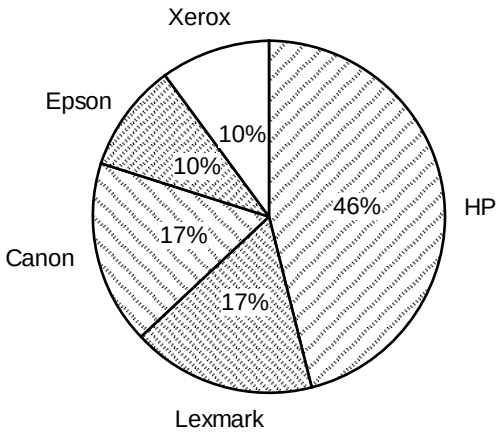
Percent of Shelf Space By Brand

Best Buy, 8/31/00



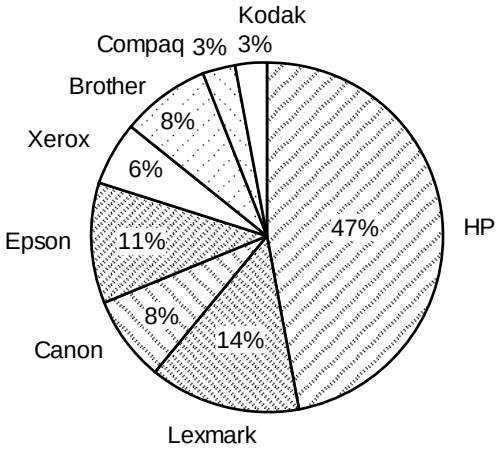
Number of color ink jet printers on shelves: 31
Approximate shelf space dedicated to printers: 47'

Best Buy, 9/8/00



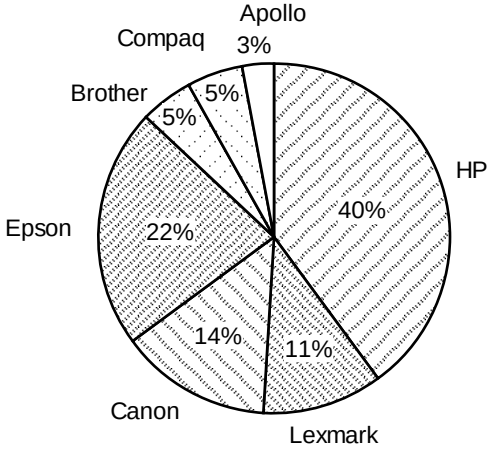
Number of color ink jet printers on shelves: 30
Approximate shelf space dedicated to printers: 45'

Staples, 8/30/00



Number of color ink jet printers on shelves: 36
Approximate shelf space dedicated to printers: 75', plus a 10' section for monochrome HP laser printers.

Comp USA, 8/31/00



Number of color ink jet printers on shelves: 37
Approximate shelf space dedicated to printers: 65', plus a 10' section for monochrome HP laser printers.

Source: *Color Business Report*

between the tank and the print head's nozzles. The deeper prime that accompanies a new print head may be required. When a still-loaded tank stopped delivering ink, we replaced the tank right away instead of trying to resurrect it. The next page demonstrated that we were still pumping air, so we ran a clean cycle, and printed away, hoping that eventually air would work its way out of the channel and we would be firing ink again. Within two pages, we had cleared the channel and we were making perfect prints again. Xerox has a "printer farm" of about 100 printers, generating promotional print samples all day, every day. In addition, Xerox placed hundreds of printers with real end users for months-long product evaluations. Neither the end-user evaluation program nor the printer farm encountered deprimed ink tanks, Xerox told us. Said Chris Punnett, "We don't expect that any of our customers will have a problem with deprimed tanks."

Relying on the Blue Dog

Xerox has joined the battle. Last week, we saw ads on TV from Epson, Lexmark, and Xerox. With the Blue Dog, consumers will see Xerox in a different light. A week ago, the M750 arrived at our local Best Buy, a hard-goods appliance dealer, selling products such as stoves, refrigerators, TV and audio equipment in addition to computers and peripherals. For now, the printer occupies a prized "end-cap" shelf on the aisle. Our visit to three retail outlets underscored Xerox's challenge *(see chart, page 14)*. HP has the most presence, occupying about half the shelf space, with a wide variety of printers. Nearly equal numbers of products from Lexmark, Epson, and Canon are on the shelves. The addition of the M750 itself to Best Buy's offerings has not changed anyone's relative position. However, Xerox told us that merchandising executives in the retail channel are enthusiastic about Xerox's intent to offer a full line of ink jet products. At Best Buy, Lexmark has five products on display. (The Z22, Z32, and Z42 are in the computer section, and the Z11 and Z51 are in the "Home" section with monochrome phone/fax devices). We visited the store before and after the arrival of Xerox's new product. The count of ink jet products went up by one. In addition to the Xerox M750, Best Buy now stocks an HP DeskJet 648C that wasn't there a week ago. Lexmark's Z31 is no longer on the shelves. Xerox now has three products in this particular Best Buy. In addition to the M750, Best Buy has the DocuPrint C8 and the Work Centre 35C on display. Considering shelf space alone, Xerox now is only two products away from Lexmark. Office Depot and Micro Center also carry the M750. Within the next few weeks, Xerox expects to stock Staples, Brandsmart, J & R, Future Shop, and catalogs.

At least for the time being, Xerox is offering a performance advantage and has an operating cost story to tell. And the company expects to follow up its technology investment with the necessary marketing communications investments. If we watch the Olympics in the next several weeks, we expect to see the Blue Dog ads many times.◊

Product Specifications:
HP Business Inkjet 2200 Series

Nozzle Configuration	304 nozzles per color
Resolution	1200- by 600-dpi PhotoREt III
Print Speed	
Black text (Fast)	15 ppm
Color and text (Fast):	14 ppm
Full color (Best)	0.5 ppm
Interface	IEEE-1284-Centronics parallel, serial, HP JetDirect 600N (standard on 2250TN)
Printer Language	HP PCL Level 3 (2200) HP PCL Level 5, HP PostScript Level 2 (2250 and 2250TN)
Memory	8 MB (2200) 24 MB (2250 and 2250TN) Maximum of 88 MB
Processor	96 MHz Motorola RISC (2200) (2250 and 2250TN have dual processors)
Paper Capacity	250 sheets (500 sheets on 2250TN)
Output Tray Capacity	150 sheets
Paper Size Range	Letter, legal, A4, executive, statement
Paper Types	Plain, ink jet, photo, glossy, transparencies, banner, labels, index cards
Paper Weights	16 to 28 lb., 110 lb. index card stock
Printable Area	8" by 13.5" on legal paper
Dimensions	20.2" W by 8.2" H by 20.3" D 20.2" W by 11.5" H by 20.4" D (2250TN)
Weight	23 lb. 32 lb. (2250TN)
Supplies Cost (street)	#11 print heads: $34.99 each #10 black cartridge: $34.99 #11 color cartridges: $33.99 each
Street Price	
2200	$499
2250	$699
2250TN	$999

Source: Hewlett-Packard Company

Printers

HP Business Inkjet 2200: Striving for Laser Parity

On August 21, 2000, **Hewlett-Packard Company** (Palo Alto, CA) introduced three ink jet printers: the Business Inkjet 2200, 2250, and 2250TN. Each uses the same modular ink delivery system used in the 2000C, introduced in April 1998 (see *Color Business Report*, May 1998). As their nomenclature implies, the printers are designed for use by workgroups functioning in a networked environment at small- to medium-sized companies. HP has designed productivity into the 2200 series, giving the printers increased print speeds and paper handling capacity, expandable memory, and a duty

(continued on page 14)

Desktop Ink Jet Printers, September 2000

Brand	Model	Intro Date	Street Price	Paper Input Capacity	Black Draft Speed (ppm)	ColorDraft Speed (ppm)	Max Color Resolution (dpi)	Default Resolution (dpi)
Canon	BJC-2100	4/00	$49	50	5	2	360 by 360	360 by 360
Apollo	P-2100U	6/00	$49	100	4	1	600 by 300	300 by 300
Lexmark	Z12 Color Jetprinter	6/00	$59	100	6	3	1200 by 1200	600 by 600
Epson	Stylus Color 480 SX	9/00	$59	100	4	2.2	720 by 720	360 by 360
Epson	Stylus Color 440	8/98	$69	100	4	2.5	720 by 720	360 by 360
Epson	Stylus Color 580	9/00	$69	100	5	3	1440 by 720	360 by 360
Apollo	P-1200	4/99	$79	50	3.5	1.5	300 by 300	300 by 300
Apollo	Barbie P-1200	6/99	$79	50	3.5	1.5	300 by 300	300 by 300
Epson	Stylus Color 660	8/99	$79	100	5	3.5	1440 by 720	360 by 360
Apollo	P-2200U	3/00	$79	100	6	3	300 by 300	300 by 300
Lexmark	Z22 Color Jetprinter	7/00	$79	100	6.5	3.5	1200 by 1200	600 by 600
Epson	Stylus Color 670	4/00	$89	100	5	3.5	1440 by 720	360 by 360
Lexmark	3200 Color Jetprinter	8/98	$99	100	6	2.5	1200 by 1200	600 by 600
Compaq	IJ300	6/99	$99	100	4	2.5	1200 by 1200	600 by 600
HP	DeskJet 612C	6/99	$99	100	4	1	600 by 300	300 by 300
Lexmark	Z31 Color Jetprinter	7/99	$99	100	8	3.5	1200 by 1200	600 by 600
Canon	BJC-3000	1/00	$99	100	6	4	1440 by 720	720 by 360
Lexmark	Z32 Color Jetprinter	6/00	$99	100	7.5	3.5	1200 by 1200	600 by 600
Epson	Stylus Color 777	9/00	$99	100	8	6	2880 by 720	360 by 360
Canon	S400	9/00	$99	100	9	4	1440 by 720	720 by 360
HP	DeskJet 648C	6/00	$119	100	6	3	600 by 300	600 by 300
Epson	Stylus Color 740	8/98	$149	100	6	5	1440 by 720	360 by 360
Lexmark	Z51 Color Jetprinter	3/99	$149	100	10	5	1200 by 1200	600 by 600
HP	DeskJet 812C	6/99	$149	100	6.5	4.5	600 by 1200	300 by 300
Compaq	IJ750	11/99	$149	100	8	3.5	1200 by 1200	600 by 600
HP	DeskJet 842C	2/00	$149	100	8	5	600 by 1200	600 by 600
Lexmark	Z42 Color Jetprinter	6/00	$149	100	10	5	2400 by 1200	600 by 600
Canon	S450	6/00	$149	100	10	7	1440 by 720	720 by 360
Xerox	DocuPrint M750	6/00	$149	150	10	6	1200 by 1200	600 by 600
Compaq	IJ 1200	8/00	$149	100	10	5	2400 by 1200	600 by 600
Epson	Stylus Color 880	9/00	$149	100	12	9	2880 by 720	360 by 360
Epson	Stylus Color 760	10/99	$159	100	7	6	1440 by 720	360 by 360
Lexmark	Z52 Color Jetprinter	5/00	$179	100	15	7	2400 by 1200	600 by 600
Epson	Stylus Color 860	10/99	$199	100	9.5	7	1440 by 720	360 by 360
HP	DeskJet 932C	2/00	$199	100	9	7.5	2400 by 1200	300 by 300
HP	DeskJet 935C	3/00	$199	100	9	7.5	2400 by 1200	300 by 300

Printer street price does not reflect rebates. Does not include MFPs, photo printers, or graphic arts proofers.
All printers accept pages up to 8-1/2" by 14", unless noted.

Head configurations:

A. Integrated cartridge/print head (black, tri-color).
B. Permanent print head, replaceable black and tri-color cartridges
C. Separate print head and ink cartridge for each color
D. Separate print head, individual ink cartridges

Color Droplet Size	Black Cartidge Cost (street)	Color Cartridge Cost (street)	Head Configuration	Black Nozzles	Color Nozzles	Comments
n/a	$8.99	$22.95	D	64	72	
50 pl	$27.00	$22.39	A	50	144	Based on the HP DeskJet 612C
18 pl	$28.99	$28.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
6 pl	$20.95	$16.95	B	48	45	Parallel interface only.
11 pl	$21.21	$25.46	B	64	63	Parallel interface only.
6 pl	$20.95	$16.95	B	48	45	USB interface.
85 pl	$29.99	$30.99	A	50	144	
85 pl	$29.99	$30.99	A	50	144	
11 pl	$21.21	$25.46	B	64	96	Parallel interface only.
50 pl	$27.00	$22.39	A	50	144	
18 pl	$28.99	$28.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
7 pl	$21.95	$19.95	B	64	96	USB and parallel interfaces.
18 pl	$32.16	$37.86	A	208	192	Parallel interface only. Black droplet: 28 pl.
18 pl	$28.99	$28.99	A	208	192	Based on the Lexmark Z11. Black droplet: 28 pl.
50 pl	$27.00	$22.39	A	50	144	Black droplet: 34 pl.
18 pl	$32.16	$37.86	A	208	192	Parallel interface only. Black droplet: 28 pl.
n/a	$13.95	$11.95 each	D	160	144	
18 pl	$28.99	$28.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
4 pl	$29.95	$24.95	B	144	144	USB and parallel interfaces.
n/a	$13.95	$11.95 each	D	160	144	
70 pl	$27.00	$22.39	A	50	144	Black droplet: 34 pl.
6 pl	$25.46	$25.46	B	144	144	USB and parallel interfaces.
7 pl	$30.99	$37.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
10 pl	$27.00	$33.27	A	300	192	Black droplet: 34 pl.
18 pl	$32.95	$38.95	A	208	192	Based on the Lexmark Z31. Black droplet: 28 pl.
10 pl	$27.00	$33.27	A	300	192	Networking via optional HP JetDirect server. Black droplet: 34 pl.
7 pl	$30.99	$37.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
n/a	$13.95	$11.95 each	D	160	144	
10 pl	$21.99 each	$12.49	D	320	312	Features one-pass eXpress mode. Black droplet: 35 pl.
7 pl	$30.99	$37.99	A	208	192	Based on Lexmark Z42. Black droplet: 28 pl. USB and parallel interfaces.
4 pl	$29.95	$24.95	B	144	144	USB and parallel interfaces.
4 pl	$29.95	$29.95	B	144	144	USB and parallel interfaces.
7 pl	$30.99	$37.99	A	208	192	Parallel and USB interfaces. Black droplet: 28 pl.
4 pl	$29.95	$29.95	B	144	144	USB and parallel interfaces.
5 pl	$19.99	$33.59	A	300	408	Same print engine as 970Cse. Automatic duplexing unit available for $79. Networking via an optional HP JetDirect server. Black droplet: 34 pl.
5 pl	$19.99	$33.59	A	300	408	Same print engine as 970Cse. Automatic duplexing unit available for $79. Networking via an optional HP JetDirect server. Black droplet: 34 pl.

Source: *Color Business Report*

(continued on next page)

Desktop Ink Jet Printers, September 2000 (cont'd.)

Brand	Model	Intro Date	Street Price	Paper Input Capacity	Black Draft Speed (ppm)	ColorDraft Speed (ppm)	Max Color Resolution (dpi)	Default Resolution (dpi)
Xerox	DocuPrint M760	6/00	$199	150	12	8	1200 by 1200	600 by 600
Epson	Stylus Color 980	9/00	$199	100	13	10.5	2880 by 720	360 by 360
HP	DeskJet 722C	9/97	$249	100	8	7	600 by 1200	300 by 300
HP	DeskJet 895Cse	10/98	$249	100	11	8.5	600 by 1200	300 by 300
Xerox	DocuPrint C15	3/99	$279	150	10	6	1200 by 1200	600 by 600
Epson	Stylus Color 900	2/99	$299	100	12	10	1440 by 720	360 by 360
HP	DeskJet 952C	2/00	$299	120	11	8.5	2400 by 1200	300 by 300
HP	DeskJet 970Cse	8/99	$399	150	12	10	2400 by 1200	300 by 300
HP	DeskJet 990Cse	9/00	$399	150	17	13	2400 by 1200	600 by 600
HP	2000Cse	4/98	$499	400	12	10	600 by 1200	300 by 300
HP	DeskJet 1220Cxi	1/00	$499	150	11	9.5	2400 by 1200	600 by 600
HP	Business Inkjet 2200	8/00	$499	250	15	14	600 by 1200	600 by 1200
Xerox	DocuPrint C20	10/98	$699	150	8	4	600 by 600	600 by 600
HP	Business Inkjet 2250	8/00	$699	250	15	14	600 by 1200	600 by 1200
Lexmark	Optra Color 45	6/98	$749	150	8	4	600 by 600	600 by 600
HP	2500Cse	10/98	$999	400	11	9	600 by 1200	600 by 600

Printer street price does not reflect rebates. Does not include MFPs, photo printers, or graphic arts proofers.
All printers accept pages up to 8-1/2" by 14", unless noted.

Head configurations:
A. Integrated cartridge/print head (black, tri-color).
B. Permanent print head, replaceable black and tri-color cartridges
C. Separate print head and ink cartridge for each colo
D. Separate print head, individual ink cartridges

cycle of 10,000 pages per month. The Business Inkjet 2200 series printers also incorporate HP's "High Performance Architecture" technology, which allows the printers themselves to decompress and process page data, decreasing print times.

Speed Rivals Laser

The Business Inkjet 2200 printers print mixed color graphic and text pages at up to 14 ppm, and 15 ppm monochrome in Fast mode (1200- by 600-dpi). This speed is four and five pages faster than the 2000C printing in EconoFast mode, and is competitive with many color and monochrome laser printers. In Normal mode, print speeds are 7.5 ppm in color and 10.6 ppm in monochrome, quicker than most comparable ink jet printers. "We think these printers are going to act and feel like lasers," said Brian Sohr, Product Manager for HP's Business Ink Jet unit. Sohr even identified the Lexmark C710 color laser printer as a potential competitor for the 2200 series. "It would be tough to find a viable ink jet competitor," he added.

Standard paper handling on the 2200 series printer is also competitive with many laser printers. The 2200

Color Droplet Size	Black Cartidge Cost (street)	Color Cartridge Cost (street)	Head Configuration	Black Nozzles	Color Nozzles	Comments
10 pl	$21.99	$12.49	D	320	312	Features one-pass eXpress mode. Black droplet: 35 pl.
3 pl	$32.99	$39.99	B	192	288	USB and parallel interfaces.
10 pl	$27.55	$34.55	A	300	192	Black droplet: 34 pl.
10 pl	$23.99	$39.39	A	300	192	Black droplet: 34 pl.
25 pl	$32.99	$39.99	A	192	208	Based on the Olivetti Artjet 20. Black droplet: 34 pl.
3 pl	$32.99	$39.99	B	192	288	USB interface. The 900N, a version with network connectivity, is available for $549.
5 pl	$19.99	$33.59	A	300	408	Same print engine as 970Cse. Automatic duplexing unit available for $79. Networking via an optional HP JetDirect server. Black droplet: 34 pl.
5 pl	$19.99	$33.59	A	300	408	Features automatic duplexing unit. Networking via an optional HP JetDirect server. Black droplet: 34 pl.
5 pl	$19.99	$33.59	A	300	408	Features automatic duplexing unit. Networking via an optional HP JetDirect server. Black droplet: 34 pl.
8 pl	$38.99	$38.99	C	304	912	Networking available as an option, standard on the 2000CN ($899). Black droplet: 35 pl.
5 pl	$19.99	$33.59	A	300	408	Same print engine as 970Cse. Adobe PostScript 3 version, the 1220C/PS, available for $599. Networking via an optional HP JetDirect server. Black droplet: 34 pl.
4 pl	$34.99	$33.99	C	304	912	Networking available as an option, standard on 2250TN (999). Black droplet: 18 pl.
18 pl	$32.95	$38.95	A	208	192	Based on the Lexmark Optra 45. Features “1200 Image Quality” mode. A networked version, the NC20, is available for $999. Black droplet: 30 pl. Prints on 13" by 19" sheets.
4 pl	$34.99	$33.99	C	304	912	Networking available as an option, standard on 2250TN (999). Black droplet: 18 pl.
18 pl	$32.95	$38.95	A	208	192	Parallel and 10Base T network interfaces. Features “1200 Image Quality” mode. Prints on 13" by 19" sheets.
8 pl	$38.99	$38.99	C	304	912	Networking available as an option, standard on the 2500CM ($1,499). Black droplet: 35 pl.

Source: *Color Business Report*

and 2250 each has a 250-sheet paper tray, and output capacity is 150 sheets. The 2250TN includes a second 250-sheet paper tray, for a total input capacity of 500 sheets—decidedly laser-like.

High Performance Architecture

The faster print speeds are due in part to file compression. HP’s High Performance Architecture (HPA) driver converts page data into an RGB format, and compresses it at ratios up to 700:1. HP claims this both reduces the size of files that are sent to the printers over a network and results in quicker processing times once the files reach the printers.

The 2200 series printers also owe their higher print speeds to built-in Motorola 96 MHz RISC processors; the 2200 has a single processor, while the 2250 and 2250TN have two. On the 2250 and 2250TN, one processor controls the print engine, the printer’s front control panel, and the HPA processing—decompressing files and performing halftoning and color matching. The second processor performs PDL formatting and other processing. The printers also have expandable memory,

(continued on page 16)

up to 88 MB—the 2200 ships with 8 MB of RAM, while the 2250 and 2250TN ship with 24 MB.

New Print Heads, Cartridges

The Business Inkjet 2200 series has a black and color print resolution of 600- by 1200-dpi, in both "Fast" and "Normal" modes. The printers also incorporate HP's PhotoREt III Color Layering Technology for photo printing. While the basic configuration of the modular ink delivery system used in the 2200 series is the same as that on the 2000C, HP has enhanced the print heads and refined the ink. The new #11 print heads (the 2000C used #10 heads and cartridges) can fire smaller ink droplets—18 picoliters for black and 4 picoliters for color. The #11 color ink cartridges contain 28 ml of dye-based ink, which has a faster drying time than the inks used in the 2000C. The formulation of the black pigment-based ink has not been changed. However, only a larger 69-ml capacity #10 cartridge is available (a 28-ml cartridge was also available for the 2000C).

The Business Inkjet 2200 is available for a street price of $499; the 2250 is available for $699, and the 2250TN is available for $999. Color ink cartridges are available for $33.99, and the large-capacity black ink cartridge is available for $34.99. Print heads are available for $34.99 each. An HP spokesperson told us that the Business Inkjet 2200 series printers will be available at Fry's Electronics, Office Depot, and other computer retail stores.

On September 5, 2000, **HP** introduced three ink jet printers, the DeskJet 990Cse, PhotoSmart 1218, and the PhotoSmart 1215, updated versions of the DeskJet 970Cse and PhotoSmart P1000 series printers introduced last fall (see *Color Business Report,* September 1999). Each has an alternate 2400- by 1200-dpi photo printing mode, and both the DeskJet 990Cse and PhotoSmart 1218 have an automatic paper duplexing unit. Enhancements to the basic printer designs are increased print speeds, an optical paper-type sensing system, and infrared file transfer.

Both the DeskJet 990Cse and PhotoSmart 1218 can print up to 17 ppm in black and 13 ppm in color in "Draft" mode, a substantial increase in speed—the 970Cse and PhotoSmart P1100 printed 12 ppm black and 10 ppm in "EconoFast" mode. Print speed in "Normal" mode is 6.5 ppm in black and 5 ppm in color. The PhotoSmart 1215 is slightly slower, printing 15 ppm in black and 12 ppm in "Draft" mode.

The optical paper-sensing technology integrated into the new printers automatically detects the type of paper loaded in the input tray, and adjusts print settings accordingly. Presumably, loading photo paper would cause the printer to print in "Photo" mode. HP claims that the system can detect plain paper, glossy photo papers, transparencies, and specialty media. If users prefer to have manual control of their print settings, they can disable the feature.

Recognizing the potential for widespread adoption of mobile computing devices, HP has built an infrared receiver into each of the new printers, allowing users with compatible digital cameras, laptop computers, and palmtops to print directly, without having to load their files onto a PC.

The DeskJet 990Cse is available now for a street price of $399. The PhotoSmart 1218 and PhotoSmart 1215 will be available in October for street prices of $499 and $399.

On August 14, 2000, **HP** introduced the OfficeJet K series of multifunction ink jet printers, which integrate the same print engine used in the DeskJet 970Cse printer, introduced in August 1999. HP offers two models in the OfficeJet K line: The OfficeJet K80 and OfficeJet K60. The top-of-the-line K80 has a 33.6 Kbps modem and has an interpolated scan resolution of 3600 dpi (optical resolution on both the K80 and K60 is 1200 by 600 dpi). The OfficeJet K60 has a slower 14.4 Kbps modem, slower printing and copying speeds, and a 2400 dpi interpolated scan resolution.

Both the K80 and K60 support walk-up color faxing, independent of a PC. In addition to having a faster modem, the K80 can store 90 pages in memory, 20 more than the K60, and can store 100 speed-dial fax numbers, as compared to the K60's 75 speed dials. Both models have a 20-page automatic document feeder, a PC faxing capability, automatic redial, and can share a phone line with an answering machine.

Like the DeskJet 970Cse, both OfficeJet K models have a 2400- by 1200-dpi photo-printing capability, as well as the option to print photos using HP's PhotoREt III layering technology. The K80 model is faster and has a higher duty cycle than the K60. It can print up to 12 ppm in black and 10 ppm in color in EconoFast mode—the K60 is 3 ppm slower in black and color. HP specs the K80's duty cycle at 5,000 pages per month, but only rates the K60 at 2,000 pages.

The OfficeJet K models can make up to 99 copies of a single original, and can make monochrome copies on legal-sized paper. However, the K80's zoom range is greater—it can reduce copies to 25% and enlarge them to 400%, while the K60 can only reduce and enlarge from 50% to 200%. As with print speed, the K80's copy speed is somewhat faster. It can copy up to 12 cpm in black and 8 cpm in color, while the K60 makes 7 cpm in black and 4 cpm in color.

Both the OfficeJet K80 and K60 ship with HP's NetDirect software, developed by ShareMedia. The software allows the printers to communicate via the Internet, without being connected to a PC. With the

software, the OfficeJet K80 and K60 can send e-mail messages, print incoming e-mail, and access and print web pages.

The OfficeJet K80 and K60 are available through retail channels for street prices of $499 and $399. They will also be available on HP's web site at www.hpshopping.com. The warehouse and club channels will carry K80xi and K60xi versions, which have slightly different fax capabilities (10 more pages in storage memory, 20 fewer speed dials) than the retail versions.◊

On September 5, 2000, **Epson America, Inc.** (Long Beach, CA) introduced three ink jet printers: the Stylus Color 777, Stylus Color 880, and Stylus Color 980. All three printers, which range in street price from $99 to $199, have a maximum print resolution of 2880 by 720 dpi, and can fire color ink droplets as small as four picoliters. The Stylus Color 980, like its predecessor the Stylus Color 900, can fire a three-picoliter color ink droplet.

Epson has increased the horizontal resolution of the new printers from 1440 to 2880 by doubling print carriage movement by half steps, which, Epson claims, improves dot placement accuracy. Steve Semos, Product Manager at Epson, told us that the small droplet size fired by the printers makes increasing the vertical resolution unnecessary. He also commented on the debate about print resolution that HP and Lexmark have been engaged in for some time. "There are lots of numbers games going on out there," said Semos. "Lexmark's smallest droplet is nine picoliters. There's no way they could print 2400 dpi without overlapping the ink droplets, so they have to print fewer dots. That's why you see banding in their prints. Resolution is only one of the factors that determines print quality. Dot size and placement, dot gain, and ink drying time have a lot to do with it. You get that accuracy with piezo print head technology."

The Stylus Color 777, available for $99, prints up to 8 ppm in monochrome and 6 ppm in color. It is designed for what Epson calls the "value-conscious" user. The Stylus Color 777 has both parallel and USB ports. Like the Stylus Photo 870 introduced in February 2000, the printer uses "intelligent" ink cartridges that can be removed and re-installed as the ink-level situation warrants. Available case colors will be white and black, and a version designed for iMac users, the Stylus Color 777i, will have a translucent case with a brightly-colored cover to match the various iMac color schemes. The Stylus Color 777i will be available in October 2000.

The Stylus Color 880, designed for the "power user," prints up to 12 ppm in monochrome and 9 ppm in color. The printer has applications in the home office and small business environments, and has both parallel and USB connectivity. Unlike the Stylus Color 777, it uses standard, unintelligent Epson ink cartridges. The Stylus Color 880 is available for $149.

The Stylus Color 980, available for $249 ($199 after a $50 rebate), can print up to 13 pages in monochrome and 10.5 ppm in color. Like the Stylus Color 777 and 880, it also features parallel and USB connectivity. The Stylus Color 980N, a version with Ethernet and FireWire network connectivity, is available for $449. Although its features and networking options are similar to those of the Stylus Color 900, introduced in February 1999, the 980 will not be replacing the older printer in Epson's product line-up.◊

In July 2000, **Omron Corporation** (Tokyo, Japan) began shipping an anti-counterfeiting software module for color ink jet printers. To defeat would-be counterfeiters whose standard workflow is to use a flatbed scanner and ink jet printer, the software goes to work when an attempt is made to print a phony bill. Omron's image recognition technology automatically evaluates the image characteristics of each file printed, and compares it to currency images stored in the printer's memory. If a match is detected, the print is canceled, and the counterfeiter is thwarted. Omron originally developed the system for use in color copiers, which have integrated the technology since 1993. Omron expects pricing for the software to be about $1 per printer unit. We attempted to contact Omron's Japanese headquarters for more details, but received no response. Omron has been developing currency detectors since 1963. Its other products include face recognition systems, blood pressure monitors, and land mine detectors. Contact information is available on Omron's web site at www.omron.com.◊

Copiers

On August 29, 2000, **Canon USA** (Lake Success, NY) introduced three color electrophotographic copier/printers, the CLC 5000, CLC 3100, and Color imageRUNNER C2050. The two CLC models are intended for the print-for-pay markets, and will most likely compete with the Xerox DocuColor 2060 and 2045, introduced in February 2000 (see *Color Business Report*, March 2000). The Color imageRUNNER C2050 is designed for office printing applications.

The CLC 5000, which has four separate imaging drums, prints color and monochrome pages at a speed of 50 ppm at a print resolution "equivalent" to 800- by 400-dpi. (A Canon spokesperson told us that actual hardware resolution is 400 dpi). Canon hopes to place the CLC 5000 in high-volume print-for-pay shops and central reproduction departments. It has a recommended maximum monthly volume of 200,000 pages. The CLC 5000 has a maximum paper capacity of 5,350 letter-sized sheets (including optional paper

(continued on page 18)

trays), and can print on sheets as large as 12" by 18" and as heavy as 80-lb. cover stock. The CLC 5000 will be available during the first quarter of 2001 for a retail price of $89,500. For print functionality, users must purchase a ColorPASS server, developed by EFI.

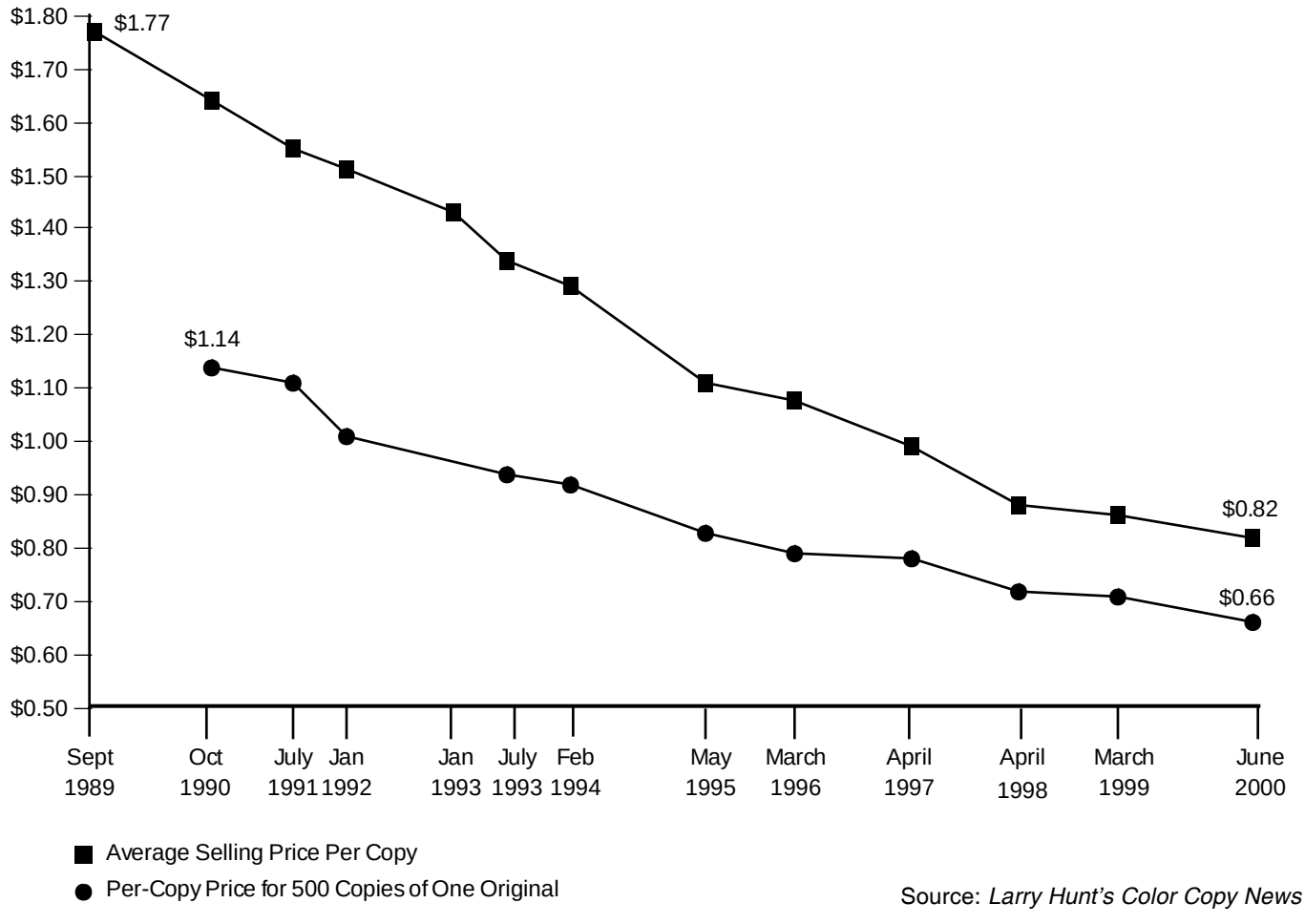
The CLC 3100, which also has a tandem-engine architecture, prints 31 color or monochrome pages per minute at 400 dpi. Intended as a replacement for the CLC 1000 in Canon's product line, the CLC 3100 has a recommended monthly volume of 100,000 pages. It is designed as an entry-level production color machine, meant for use in smaller print-for-pay shops, reproduction departments, and corporate graphics departments. The CLC 3100 can handle paper as heavy as 110-lb. index stock, and can print full-bleed 11" by 17" images on 12" by 18" paper stock. It has a maximum paper capacity of 5,250 sheets, and will be available on October 1, 2000 for $63,100. Server options include the ColorPASS-Z90 or the ColorPASS-Z70.

The 600-dpi Color imageRUNNER C2050 is designed for walk-up use in the corporate environment. It is a tandem-engine copier/printer and prints color and monochrome pages at a speed of 21 ppm. The Color imageRUNNER C2050 can print on 80-lb. cover stock and on sheet sizes up to 12" by 18". The Color imageRUNNER C2050 will be available during the first quarter of 2001. A Canon spokesperson told us that pricing for the C2050 will be available as its shipping date approaches, most likely late March or early April 2001.◊

Larry Hunt's Color Copy News (published by **Larry Hunt Publications**, Tampa, FL 727-781-7825) conducts a yearly survey of its readership of copy shops and quick printers. This year's study was undertaken in June 2000, and 156 of Hunt's subscribers participated. As one might expect, the survey found that color copy prices continue to drop *(see Figure 1)*. Hunt attributes this drop to the shops running high-speed color copiers, such as the Xerox DocuColor 40 and Canon CLC 1000. The average price per copy for these high-speed machines was $0.74, while copies from lower-speed copiers (6 – 9 cpm), such as the Canon CLC 900 and Xerox 5799, had an average selling price of $0.87.

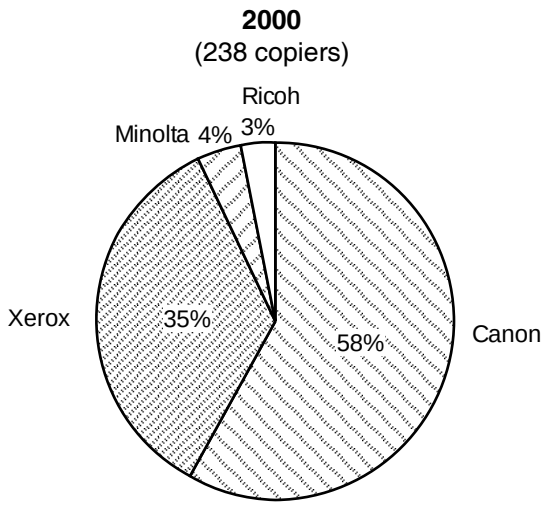
In his survey, Hunt encourages free-form comments

Figure 1: Color Copy Price Trends



Source: *Larry Hunt's Color Copy News*

Figure 2: Color Copier Brand Share



Source: *Larry Hunt's Color Copy News*

from respondents. One reader told Hunt about his strategy to raise copy prices on small jobs, and lower them for high-volume work. The reader's single copy price jumped from $1.25 to $1.50, while the price for 500 copies lowered from $0.70 per copy to $0.55. Perhaps this is a response to the increased presence of color imaging technology—scanners, ink jet printers, and laser printers—in the home and office. Users are less likely to spend more than $1.00 on a color copy when they can print it themselves for substantially less.

Canon continues to enjoy significant share among Hunt's readers *(see Figure 2)*. This year, 58% percent of the 238 machines they work with are Canon color copiers. Second in installed units is Xerox, with 34% share. Minolta is in a distant third place, with 4%, and Ricoh is fourth with 3%.

The Xerox DocuColor 40 and Canon CLC 1000 continue to be staples in the high-speed segment *(see Figure 3)*. Canon and Xerox's latest mid- and high-speed copier models made a strong appearance in the survey. The copiers reported by respondents included 11 CLC 2400s and 17 CLC 1100s. The Xerox DocuColor 12, introduced in August 1999, accounted for 26 of the total units installed since last year's survey.◊

On August 28, 2000, **Ricoh Corporation** (West Caldwell, NJ) introduced the Aficio Color 4506, an electrophotographic copier/printer that prints 31 ppm in black and 6 ppm in color. The Aficio Color 4506's print resolution is 600 dpi, and maximum sheet size is 12" by 18". A Ricoh spokesperson would not give us a price for the 4506, but we expect it will have a similar price tag to the copier it is replacing: the Aficio Color 4106, which is available for $16,300.◊

Figure 3: Installed Base of Color Copiers, 2000 vs. 1999

2000	
High-Speed Color Copiers	***Units***
Xerox DocuColor 40	26
Canon CLC 1000	34
Canon CLC 2400	11
High-speed subtotal	*71*
Mid-Speed Color Copiers	
Xerox DocuColor 12	26
Canon CLC 1120/1150	17
Mid-speed subtotal	*43*
All Other Color Copiers	
Canon CLC 700/800	65
Canon CLC 900/950	12
Xerox 5790/5799	23
Xerox 5765	7
Minolta CF900	10
Ricoh Aficio 5206	7
Other subtotal	*124*
Total	*238*

1999	
High-Speed Color Copiers	***Units***
Xerox DocuColor 40	27
Canon CLC 1000	37
High-speed subtotal	*64*
All Other Color Copiers	
Canon CLC 700/800	83
Canon CLC 900	8
Canon CLC 550	8
Xerox 5790/5799	29
Xerox 5765	15
Xerox 5750	7
Minolta CF900	8
Ricoh Aficio 5206	10
Other subtotal	*168*
Total	*232*

Source: *Larry Hunt's Color Copy News*

Scanners and Image Capture

In August 2000, **Sony Electronics, Inc.** (Park Ridge, NJ) began shipping the Mavica MVC-CD1000 digital camera. The MVC-CD1000 integrates a CD-R drive, which stores digital images on 3-1/2" CD-R media. In his review of the camera, *Business Week* technology writer Larry Armstrong notes how convenient the MVC-CD1000 is—CD-R media can be read by all computers with CD-ROM or DVD drives.

The Mavica MVC-CD1000 captures images at a resolution of 1600- by 1200-dpi, and has a 10X optical zoom lens—equivalent to a 400-mm zoom lens on a conventional 35 mm film camera. The MVC-CD1000 has six automatic exposure modes and gives more advanced users manual controls, such as shutter priority, aperture priority, and a manual focus ring. The camera also features Sony's SteadyShot Picture Stabilization technology, which mollifies the effects of camera shake. Users can compose pictures or review images stored on the CD-R on a 2-1/2" LCD display. The Mavica MVC-CD1000 is available for a retail price of $1,300. CD-R discs for the camera are available for $4 each.◊

Large Format

Large-Format Users Want Faster Printing

Far and away, faster printing (or faster RIPping) is the improvement most desired by participants in CK Associates' fourth study of the wide-format printing market. Written by Ken Freund, *Segment Analysis of the Wide Format Graphics Printing Market* is based on mail survey returns from 689 individuals in eight end-user segments. More than half (134 out of 235) of respondents who presently offer wide-format printing services identified faster printing or faster RIPping as a desired improvement *(see chart)*. Other frequently mentioned improvements include better UV stability and increased resolution.

As one would expect, most respondents are in the print-for-pay business, which explains their interest in productivity. This year, though, CK Associates included in-house corporate users for the first time. In-house large-format printer users comprise 13% of the respondent base. In fact, print-for-pay operators' interest in faster and more capable (wider) large-format products is partially driven by a need for the service industry to defend itself from the effects of corporate "do-it-yourselfers." According to Freund, "In order to protect themselves from low-cost operators and the do-it-yourselfers, many of the early adopters are currently purchasing more capable, and often more costly, output devices which smaller, lower-volume operations cannot economically justify."

Summary of Figure 4D.9: Recommended Improvements—Ink Jet Printers

Hardware	
Faster printing/RIPping	57%
Handle thicker stock	4
Increase ink capacity	3
13 other items mentioned	
Consumables	
Improve UV stability	9%
Improve waterfast properties	5
Increase variety of media	5
Broaden gamut	4
8 other items mentioned	
Image Quality	
Increase resolution	13%
Better color management	4
More consistent color	3
7 other items mentioned	
Ease of Use	
Easier media handling	9%
Cleaner/faster ink replenishment	3
7 other items mentioned	
Reliability	
Improve cartridges	8%
Reduce maintenance requirements	1
Unspecified	4
Financial	
Reduce ink cost	3%
Lower-cost hardware	2
Media	1
Unspecified	4

Number of respondents: 235. In addition to the items in this chart, respondents mentioned 15 items in the "Ease of Use," "Service/Support," and "Other" categories.

Source: CK Associates

The report is based on research conducted in early 2000. Subjects covered by *Segment Analysis of the Wide Format Graphics Printing Market* include wide-format applications and job types, hardware and media used, monthly print volumes and revenues, preferred channels for consumables and hardware, satisfaction with equipment and supplies, and desired improvements. In addition, the author provides wide-format graphics printer market projections through 2004. The full report contains over 500 charts and graphs addressing survey findings and market projections. The entire report is priced at $7,995. Individual segments that address specific classes of users are available for $1,295. Purchasers of individual segment reports will receive

the Executive Summary, Composite Segment (based on all respondents), and Market Size information in addition to their segment of interest. CK Associates can be reached at (949) 552-9576, or ckassoc@aol.com.◊

On August 29, 2000, **Canon USA** (Lake Success, NY) introduced the BJ-W9000 large-format six-color ink jet printer. The BJ-W9000 can print on media up to 42" wide, and has a maximum print resolution of 1200- by 600-dpi. Its maximum print speed is 92 square feet per hour. The printer has six separate 512-nozzle print heads for each color (cyan, magenta, yellow, black, photo cyan, and photo magenta) and prints with Canon's Microfine Droplet Technology, which enables the BJ-W9000 to fire ink droplets as small as eight picoliters. Canon claims that prints made on the BJ-W9000 rival the quality of silver halide prints. Canon's EFI-developed imagePASS-W20 print controller drives the BJ-W9000. The BJ-W9000 will be available during the first quarter of 2001. A Canon spokesperson told us that pricing for the BJ-W9000 and imagePASS-W20 print controller will be between $15,000 to $20,000.◊

On August 29, 2000, **Hewlett-Packard Company** (Palo Alto, CA) introduced three large-format ink jet printers: the DesignJet 5000, DesignJet 500 and DesignJet 800. The DesignJet 5000 is designed for print-for-pay applications, and its feature set gives it flagship status in HP's large-format product line. The DesignJet 800 is aimed at graphics professionals, and the DesignJet 500 is an entry-level large-format printer for small design shops and technical professionals.

The DesignJet 5000 is a six-color printer (cyan, magenta, yellow, black, light magenta, light cyan). Geared for production, it can print up to 569 square feet per hour in "Fast" mode, and has a maximum print resolution of 1200 by 600 dpi. It is available in two widths—one accommodates media up to 42" wide ($10,495), the other media up to 60" wide. The DesignJet 5000PS, a version with an embedded Adobe PostScript 3 RIP, is also available. The 42" machine has a list price of $13,995, and the 60" model is available for $20,995. The DesignJet 5000 has a modular ink delivery system, similar to that used on the DesignJet 1000 series, introduced in February 1999. Dye-based ink cartridges have a volume of 680 ml, and cost $239.99 each. Each print head, which has 512 nozzles, is available for $139.99.

The DesignJet 800 is a four-color printer, and uses the same print heads found in the Business Inkjet 2200 series desktop printers *(see page 11)*. The printer uses the same 69-ml #10 black ink cartridge used in the 2200, and 69-ml #82 color ink cartridges (C,M,Y). The DesignJet 800 is designed for use by corporate graphics departments. It has a maximum print resolution of 2400 by 1200 dpi, and can print up to 85 square feet per hour in "Fast" mode. The printer ships with 96 MB of RAM, a 6 GB hard drive, and connects to an Ethernet network with a built-in HP JetDirect 10/100BaseTX network card. The DesignJet 800 replaces the DesignJet 700 series in HP's product line. It is available in two print carriage widths: a 24" version costs $5,795, and a 42" machine costs $6,995. A version with an embedded Adobe PostScript 3 RIP, the DesignJet 800PS, is available for $6,995 (24") and $8,995 (42").

The DesignJet 500 uses the same print engine as the DesignJet 800, but is designed for technical, CAD, and GIS applications. It can print a D-sized drawing in

(continued on page 22)

Large Format

Announcement Date	Vendor	Product	Price	Comments
September 14, 2000	Gretag Professional Imaging	Carolina Textile Press	$49,995	List price for 309-dpi six-color ink jet printer. Prints with dye-sublimation inks—images are then transferred to fabric by a heat press. Prints on media up to 54" wide at speeds up to 180 square feet per hour.
August 29, 2000	Kodak	Kodak Professional 3062 Large-Format Printer	$17,995	List price for 1440- by 720-dpi six-color large-format ink jet printer. Prints on media up to 62" wide. Print speed at 720 dpi is 36 square feet per hour. Kodak would not reveal the print engine manufacturer, but we suspect that it is Mutoh.
August 3, 2000	Roland	Hi-Fi Jet Pro FJ-400	$17,995	Eight-color large-format ink jet printer fits media up to 42" wide. Can be configured to print six colors. Maximum print resolution is 1440 dpi, and the printer can fire variable-sized droplets ranging from 3 to 40 picoliters. Print speed at 720 dpi is 75 square feet per hour. A 52" version, the FJ-500, is available for $19,995.

90 seconds, and has a maximum print resolution of 1200 by 600 dpi. A DesignJet 500 that can print on media up to 24" wide is available for a list price of $2,495, and a version that can fit 42" media is available for $3,695. An Adobe PostScript 3-version, the DesignJet 500PS, is designed for freelance graphic designers and small ad agencies. A 24" machine is available for $3,495, and a 42" unit costs $4,395.◊

On August 29, 2000, **MacDermid ColorSpan, Inc.** (Minneapolis, MN) introduced the ColorSpan DisplayMaker Esprit large-format ink jet printer. The Esprit can accommodate media up to 52" wide, and can print in eight colors. In addition to the standard CMYK inks, users can load a second set of CMYK inks to get the fastest possible output, load medium- and light-density cyan and magenta inks, or load orange, green, red, and blue to enhance the printer's color gamut beyond the limitations of CMYK. Like other ColorSpan printers, the Esprit uses HP print heads. The Esprit's fastest print speed of 150 square feet per hour can be achieved at 600-dpi print resolution with two sets of CMYK inks loaded. The ColorSpan DisplayMaker Esprit is available for a list price of $14,995. RIPs from ColorGATE, Image Technologies, Onyx, Scanvec-Amiable, and Wasatch support the Esprit. ColorSpan's RIP options for the Esprit include the ColorMark Software RIP, available for $1,995, and two hardware RIPs: the ColorMark Pro 7000, available for $8,495, and ColorSpan's RIPStation 700, available for $4,495.◊

On September 16, 2000, **Gretag Professional Imaging** (San Jose, CA) introduced the LightJet 430, aphotographic large-format color printer designed for printing indoor advertisements, backlit display graphics, and point-of-purchase signage. Developed by Gretag's Cymbolic Sciences division, the LightJet 430 can print at speeds up to 430 square feet per hour, and can print on photographic media up to 50" wide. The LightJet 430 has continuous tone output, which Gretag claims gives prints an "apparent" print resolution of 4,000 dpi, although actual hardware resolution is 300 dpi. The LightJet 430 is available for $139,900.◊

Print and Image Quality

On August 31, 2000, **Epson America, Inc.** (Palo Alto, CA) published new display guidelines for photo prints on its web site. According to Epson, the company has received several customer inquiries about fading prints from the Stylus Photo 870, 1270, and 875DC. Epson claims that atmospheric contaminants such as cigarette smoke, humidity, and high levels of ozone have caused the prints to fade, not exposure to light. To protect prints from such contaminants, Epson recommends that they be framed under glass or plastic, and reiterates the need to keep the prints out of direct sunlight to ensure longevity. If these guidelines are followed, Epson expects that prints made on Epson Matte Paper-

Industry Notes

Announcement Date	Vendor	Comments
September 6, 2000	Collabria/Quark	Collabria to integrate Quark's Digital Media System, a digital asset management system, into its PrintCommerce online print procurement and management service.
August 29, 2000	EFI/Toshiba	EFI's Z4 server to drive Toshiba's FC15 electrophotographic copier/printer.
August 15, 2000	FlashPoint	Makes a software development kit for its Digita operating system for digital cameras available for purchase on its website at www.digitadev.com. A standard version, designed for producing "freeware" applications, is available for $399. The professional version, designed for writing commercial software applications, is available for $2,995.
September 5, 2000	HP/Best Buy/ Shutterfly	Best Buy's online photo sharing site to integrate HP's Cartogra Internet imaging technology. Shutterfly will provide photo printing services to the Best Buy web site.
August 10, 2000	Indigo/ CardStore.com	CardStore.com, an online provider of personalized greeting cards, to use an Indigo UltraStream 2000 digital color press to print greeting cards for its customers.
August 23, 2000	Mimeo.com/ ImageX.com	As part of a strategic alliance, ImageX.com customers will have access to Mimeo.com's printing and overnight delivery services, and Mimeo.com customers will be able to use ImageX.com's web-based design and print procurement services.
August 30, 2000	Minolta-QMS/ Color Savvy	Minolta-QMS to recommend Color Savvy's ColorMouseToo color measurement instruments to its customers.
August 28, 2000	Pantone/Imation	Imation to license Pantone color matching technologies for use in its MatchPrint color proofing systems.
July 12, 2000	Wasatch/Canon	Wasatch's SoftRIP, available for $995, to drive Canon BJC-8500 color ink jet proofer.

Heavyweight will last about 25 years. Prints made on Epson Premium Glossy Photo Paper are expected to last for 10 years, and prints made on Epson Photo Paper should last for six or seven years.◊

Application Profile

Graphics Help Attorneys Tell their Stories

Can there be an environment with more drama or higher stakes than a courtroom? Accused and accuser must marshal their best arguments and explain their perspectives in a persuasive fashion to independent and disinterested parties who make a ruling or judgment. To the uninitiated, a courtroom is an environment with unfamiliar rules and conventions. Although the legal system allows any person with a stake in the outcome of a case to participate directly, mastering the process is daunting enough and the stakes are usually high enough that most people who appear in court are represented by attorneys. The attorney's role, simply put, is to present the client's case in a successful fashion. And as one might imagine, the ability to communicate well is integral to courtroom success.

In *Modern Trial Advocacy*, (2nd ed., 1997. Published by the National Institute for Trial Advocacy, NITA), Northwestern University Law Professor Steven Lubet explained that trials exist because there is a disagreement about historical facts. "Trials…are held in order to allow the parties to persuade the judge or jury by recounting their versions of the historical facts. Another name for this process is storytelling. Each party to a trial has the opportunity to tell a story, albeit through the fairly stilted devices of jury address, direct and cross examination, and introduction of evidence….Thereafter, the party who succeeds in telling the most persuasive story should win."

The stories lawyers tell in court are not written stories—the stories are narrations. Attorneys question witnesses and present evidence to help the judge or jury understand their client's version of the events in question. At the attorney's disposal to support the story-telling process is a litigation-support industry. Service companies provide access to expert witnesses, advise on jury selection, search for documents, offer investigative services, and prepare demonstrative evidence (graphics) to be used in court proceedings. An arsenal of computer technology can help an attorney present information to the court. There was a time when material presented to a jury consisted mostly of photo enlargements or artist-drawn renditions placed on easels. Large format (computer-printed, mostly) graphics are still used, of course. But in addition, judges and juries see animated recreations and interactive computer-driven presentations on wide-screen monitors.

Legal Arts Multimedia: Seasoned Advisors

Some law firms have on-staff graphic artists. Others hire freelance or temporary artists when the need arises. Public relations agencies and advertising agencies can be called on to help, too. But the requirements for courtroom graphics go beyond having good design skills, being able to master sophisticated graphic arts software, and commanding the necessary forces to get the work done in time. If the attorney sees graphic presentation as an important aspect of presenting the case, an experienced graphic artist who knows the rules of evidence can become an important advisor. "As I got more years under my belt, lawyers would start looking to me as someone who could help validate their case themes and strategies," said James Gripp, 25-year industry veteran and President of Legal Arts Multimedia LCC in San Diego, CA. We met with Gripp in Legal Arts' San Diego office last month, to hear about the role of technology in courtroom presentations. "We don't say we are artists. Instead, we help solve visual problems. We view assignments in the context of the legal problem in general. I had to 'go to school' on how lawyers think, how cases are tried, what is admissible and what is not admissible. By mastering such topics, I was better able to counsel my clients as to what should and should not be used. I can help them validate their ideas, and work with expert witnesses to validate *their*

(continued on page 24)

Distribution Notes

Announcement Date	Vendor	Comments
August 31, 2000	Corel/Canto	Corel to bundle Canto Cumulus image archiving software with CorelDRAW 10, which will ship in November 2000 for a retail price of $569.
August 15, 2000	Monaco/X-Rite	Monaco to bundle X-Rite's Digital Swatchbook spectrophotometer with its MonacoPROOF color profiling software. The bundle will be available until December 2000 for a street price of $2,299.
August 28, 2000	Xerox/Preview	Xerox to distribute Preview's package-comping and proofing system for color copiers.

Scanners & Image Capture

Announcement Date	Vendor	Product	Price	Comments
August 15, 2000	Intel	Pocket PC Camera	$149	Retail price for 640- by 480-dpi PC digital camera. Can be used in the field as a digital still camera or be connected to a PC's USB port for video conferencing. Stores up to 128 still pictures or 2 minutes of video on its internal 8 MB of memory.
August 15, 2000	Olympus	C-2100 Ultra Zoom	$999	Street price for 1600- by 1200-dpi digital camera with 10X optical zoom lens (equivalent to 38 to 380 mm). Other features include 2.6X digital zoom, automatic flash, TTL metering, and aperture- and shutter-priority modes. Users can compose and review pictures on a 1.8" LCD.
August 24, 2000	Olympus	Camedia E-100	$1,499	Street price for 1368- by 1024-dpi digital camera, which can capture up to 15 frames per second. Accommodates both CompactFlash and SmartMedia storage cards.
August 15, 2000	UMAX	AstraNET e3420	$129	Retail price for 600- by 1200-dpi flatbed scanner. Capable of transmitting scanned images directly to the Internet. Internet service from NetZero, a one-year membership to ImageOL.com, web page, 50 MB of online storage, and an online photo album are included free.
August 15, 2000	UMAX	AstraNET e3470	$149	Retail price for 600- by 1200-dpi flatbed scanner. Capable of transmitting scanned images directly to the Internet. Includes same free Internet service package as the AstraNET e3420, but integrates a universal transparency cover that allows the e3470 to scan slides and negatives.

ideas. Digital communication has become an integral part of virtually every presentation to a third party, and our role has been integrated into the planning process of the trial. Of course, it's up to the individual lawyer to include us. Some do, and some don't."

Gripp has provided graphic arts services to the legal profession since graduating *cum laude* from San Diego State University in 1980 with a degree in graphic design."The idea of using visual displays to assist the trial lawyer has been around forever," said Gripp. "For example, demonstrative evidence was the subject of *Modern Trials*, a series of books by Melvin Belli in the 1950s. As a student concentrating in design, I saw that the practitioners of what is now the demonstrative evidence or the legal graphics industry, were generally private investigators or medical illustrators—people who were doing it part time. In 1975, there was virtually nobody else doing this in San Diego. No one seemed to have a business concentrating in it, with the owners of that business being formally trained designers."

Companies providing graphic arts services to the legal community tend to be small. Legal Arts is probably among the larger firms, with 21 full-time employees in five offices (San Diego, La Jolla, Palo Alto, and Los Angeles in California, and Washington, D.C.). Other litigation support companies could be considered "full-service," in that they offer services in addition to graphic arts services. Since the working relationship with clients is close and production schedules can be very tight, the client list of graphic artists in the legal arena have a regional flavor. As mentioned above, law firms can look for graphic arts support in several places, so there is a fair degree of competition in the industry. The U.S Department of Commerce does not track litigation support services as a separate industry classification. But one can get a feel for the variety of organizations providing services to the legal community on the FinLaw.com web site, which lists the URLs for over 1,000 organizations, including Legal Arts, under the "Litigation Support" tab within the "Consultants & Experts" category. We scanned the list, and found fewer than forty companies offering graphics or exhibit preparation services.

Gripp estimates that there may be 1,000 companies in the U.S. specializing in litigation graphics. "San Diego County has at least ten different established companies," he said, "and an unknown number of freelancers and firms that produce graphics for litigation on a part-time basis, such as law firms, engineering firms, architects, and economists." The industry is served by the 16-year-old Demonstrative Evidence Specialists Association (DESA), administered from the Metarie, LA offices of Courtroom Graphics and Animations (www.desa.org). DESA has nearly 60 member companies, in 27 states. DESA members receive a newsletter, are included in the directory of members on the DESA web site, and can attend an annual meeting. The 2001 meeting is to be held in Cleveland, OH.

Reasons to Seek Help

Having access to a courtroom-savvy graphic arts team can make a big difference. First, a graphic artist can help the attorney select from a variety of presentation alternatives—alternatives about which the attorney may be completely unfamiliar. Second, not only will the graphic artist understand production-related trade-offs such as time and dollar budgets, but a graphic artist with experience in the demonstrative evidence field will also understand the competitive environment, the rules of evidence, and other courtroom-related conventions. "Lawyers are notoriously slow to adopt new things, and they are not necessarily exposed to a lot of presentation alternatives," said Gripp. "You could poll ten lawyers on the street, and five of them will think that PowerPoint is Star Wars." In fact, NITA has published *PowerPoint for Litigators*. The promotional copy describing the book on the NITA web site (www.nita.com) extols the virtues of visual displays over speech alone, of course, but also has the following warning: "If your opponent uses visuals effectively, that is an advantage you cannot afford to give away."

The attorney is responsible for assembling exhibits that are both appropriate for the case and fit with his or her presentation style. Generally, the exhibits support the story the lawyer is telling. The lawyer needs to be free to select any one item from what may be a very large number of supporting graphics. In other words, technology cannot be allowed to restrict an attorney's flexibility.

The effectiveness of the judicial system depends on rigorous attention to a set of rules that have evolved over centuries. The process places decision-making power in the hands of the judge and jury. The jury hears evidence and makes decisions at the direction of the judge. The judge hears the verdict, and rules accordingly. In addition, the judge governs in the courtroom, ruling on procedural issues. "There are a lot of rules," said Gripp. "There are court-mandated rules and industry rules that have to be followed, rules that are not readily apparent to anyone who is not in the legal industry. That tempers a lot of what we do. There are a lot of restrictions on what you can present and how you present it. The judge is the final arbiter on what is allowed to be shown, and what isn't. Judges are individuals, and have their own individual opinions on admissibility."

Special precautions must be taken with computer-produced illustrations and animations. "A reconstruction has to be accurate," said Gripp. "We have to lay a foundation for everything that we do, and have to profess that the foundation is accurate, in terms of things like scale, and movement, and timing. Such factors have to be decided in a very determined manner rather than in an arbitrary manner. You just don't throw in dramatic lighting—you put lighting in that was the lighting of the scene. And we have to be careful not to prepare exhibits that are going to go into evidence that are argumentative in nature. Argument has its place in a trial or in litigation. You can be as argumentative as you want in a lot of pre-trial graphics, when in arbitration or mediation, for instance. Once you are in a trial, your evidence cannot be argumentative."

Matching the Attorney's Style and Strategy

Computer-based presentations can be "fixed," with the position of each screen within the presentation predetermined, or interactive, with the sequence of exhibits determined on the fly. "Interactivity allows on-screen interaction with whatever is on the screen," Gripp explained. "You may have navigation buttons on the screen, you may have areas on the screen that you can touch with a cursor and something will happen—it will link to another screen, or it may change color, or start motion." With fixed presentations, the attorney merely has the equivalent of a "next" button. "On-the-fly interactivity," Gripp explained, "provides sort of random-access ability to retrieve things. It's a lot like maneuvering on a web site."

"The uses for canned or fixed interactivity are limited in the litigation field," said Gripp. "Theoretically, fixed interactive presentations make perfect sense, particularly when you are packaging a settlement brochure or have a canned tutorial presentation, where you know where you are going and how you are going to get there. But lawyers do not want to be cornered into a rote linear presentation. They like to have the flexibility of pulling up any screen, skipping over things. It is not unusual for us to plan a canned interactive presentation, design all of the screens for it, and never hook everything together, making each screen available for random access retrieval instead."

Even though computer-based presentations offer movement, sound, and color, they have not replaced presentation boards in courtroom presentations. Believe it or not, display boards on easels give the attorney better interaction with the group that counts the most—the jury. A mounted illustration or graphic can be positioned very close to the jury, demanding their attention by blocking their view of at least a portion of the courtroom, giving the attorney the opportunity for a more intimate discussion with the jury. Furthermore, monitor-based presentations are restricted to displaying only one image at a time, while multiple display boards can be propped up around the courtroom and left up to be easily referred to during the trial.

When it is necessary to make cost trade-offs, computer-based presentations can be less expensive. "Cost savings can be realized," Gripp said, "by not

(continued on page 26)

reproducing large hard copy, and instead projecting information onto the screen." If the attorney then asks for computer-based enhancements such as animation after making the decision to use a computer monitor instead of prints, expenses can tip the other way. 3-D computer animations use high-priced equipment and talent, and can be quite time consuming. As a rule of thumb, a demonstrative exhibit budget may be 1% of exposure (on the part of the defense) or recovery (by the plaintiff). " Therefore, a $1 million dollar exposure/recovery would warrant a $10,000 graphics budget," said Gripp.

How many exhibits? Although the numbers of exhibits can be in the thousands, Gripp cautioned that the number of exhibits is closely related to the requirements of the theme and strategy that the attorney has decided are appropriate for a given case. "You don't necessarily have to bombard people with vast amounts of graphics to get your point across. And although the trend nowadays is toward electronic presentation, it would be a mistake to assume that display boards and the use of hard copy is going by the way of the dinosaur. Electronic presentations as well as large displays are simply tools in the trial lawyer's tool chest that he can use or not use." As an example, Gripp recalled an intellectual property case involving two high-tech companies. The opposing side had prepared an extensive set of computer-based and hard-copy exhibits. "Our lawyer said, 'I think I'm just going to go with about 10 boards.' The lawyer is a renowned author in this particular area of intellectual property. He knew what style he needed to use for this particular jury and this particular subject matter. Even though the plaintiff and defendant are in the high-tech industry, the case wasn't about the technology. It was about licensing and contracts, a subject that did not require a high-tech, glitzy presentation involving large amounts of tutorial material for the jury to absorb. A lawyer has to decide strategically how he is going to present his evidence."

Thinking About Graphics Early

Attorneys are including graphics in their strategic thinking earlier in the process for two principal reasons. First, graphics are used more in pre-trial activities. "More than half of the work we do now is used in pretrial. In the 1980s, our work was relegated to trial. It was the end of the process. There are still companies out there that call themselves 'courtroom graphics' or 'trial graphics,' which infers an old way of thinking of graphics." Gripp explained that, since 97% of civil cases settle, clients did not want to pay for graphics until they were sure they were going to be needed in court. Now demonstrative exhibits appear in hearings, particularity for information-intensive cases such as patent infringement. "A Markman hearing tests the validity of the patents at issue, and a Markman hearing is not before a jury," said Gripp. "Increasingly we are including graphics in briefs for summary judgment before the court. Sometimes graphics are instrumental in helping settle cases, by convincing the other side that our side is stronger and will prevail."

The second reason that attorneys are thinking about graphics earlier in the process has to do with project tactics, rather than courtroom tactics. As trial dates draw near, there are fewer options. Sophisticated graphics can take a lot of time to produce. "It is not unusual in a patent case to require literally hundreds of exhibits," said Gripp, "ranging from static graphics to motion graphics, animations, video productions and tutorials. It takes months to produce that."

Operating Across Continents

More often than not, litigation teams are spread out across the country and around the world. "We had a case recently where our client was in New York and his client was in Japan. We needed everybody to sign off on exhibits on a daily basis. The Internet was the only real way to do that." Electronic access to work-in-progress enabled a challenging set of animations—the first animations permitted in Germany's patent court—to be completed on time. "The trial lawyer was in Munich, the lead counsel was in London, the client was in Palo Alto, and the studio was in San Diego. Expert witnesses from Cambridge University were travelling. One of the travelling experts was able to check work in progress from Birmingham, AL. We had 30 days to turn around ten animations. That's not exactly the type of schedule you would prefer, but we were able to get everything done on time." Legal Arts' five offices are connected by T1 lines. Most often, work-in-progress is posted on a secure FTP site. However, not every client is comfortable with electronic files. "Some clients are very sensitive about e-mailing anything, and some use it all of the time."

Increased use of on-line view of work in progress results in fewer prints, which translates into lower fees for clients. Gripp explained, "If three experts and a client in different parts of the country need to review 50 graphics each, we save on 200 sheets of paper (and our print cost to the client). This might equate to a saving of $600 for printing and $50 for courier service."

The Internet, e-mail, and file transfer are used extensively internally, as well. The ability to post files and have them available for other staffers helps with work-load balancing. "We push and pull work between offices every day. If Palo Alto gets a huge case with tight deadlines, instead of hiring temps to work in Palo Alto, they push work out to artists in other offices, who work on it and send it back."

Legal Arts has not used web casting for conferences, because it is not as convenient as e-mail and web downloads. "To get everybody together at one time would

be close to impossible," Gripp explained. "With the FTP site, clients can look at the material anytime they want." However, Legal Arts continues to monitor web-based video conferencing technology. Also on the technology shopping list are increased bandwidth (internal and external), Internet-based long distance telephone service, and web-based extranets for specific clients.

Although the trial date serves as a deadline for graphics preparation, Legal Arts supports many projects throughout the trial itself. A mini-studio will be set up in rented space in the city where the court action is located, staffed with artists familiar with the graphic requirements of the case. Computers and printers will be shipped to the remote site and operated as a "war room" to provide very fast response to day-to-day changes in tactics. The war room is equipped with a wide-format printer (HP) and a desktop color printer (Xerox Phaser). "They can produce thousands of pages to support a two-week trial," said Gripp.

Marketing at Legal Arts

"The general idea of using graphics in your case is well-understood and well-accepted. Virtually anyone who is a trial lawyer has already formed a relationship with somebody. Twenty years ago I was creating market share to grow my business. Today, you almost have to take business away from somebody else." Due to its long-term standing in the industry, word of mouth is responsible for a sizable portion of Legal Arts Multimedia's new business. The need for new accounts is dampened somewhat by long-term strong working relationships with several large accounts. "Our firm has alliances with some large, multi-state law firms. We prepare virtually all of their demonstrative exhibits." Outbound marketing has not ceased, though "We put on continuing legal education seminars, we give presentations to attorneys, or law firms, or litigation groups within law firms. We target particular types of law firms that specialize in areas of litigation where we have experience or strength."

Although the principal method for finding new accounts is targeted direct mail and personal contact, Legal Arts advertises in the local bar magazine and in an international publication written for attorneys with an interest in intellectual property issues.

Legal Arts Multimedia uses a QMS magicolor 330 EX to produce sales literature. Space has been blocked out in an 11" by 17" brochure template to allow for Legal Arts to personalize the brochure and integrate client references and project examples appropriate to the interests of the prospect. "If we are going to make a presentation to a law firm with a practice in construction defect, intellectual property, and employment law, we can sit down at the Mac and create a custom brochure for that firm that has their name on it. We'll write a message about our expertise in those three areas, and then drop in examples of our portfolio related to three areas. Then we'll print 25 to 30 copies." When appropriate, Gripp adds a second 11" by 17" sheet, and staples the two together in the center with a long-reach stapler, producing an eight-page center-stitched 8 1/2" by 11" brochure. "That can be done in a day. We used to send these out to digital color printers, but with photo-quality printing on decent paper, this QMS has given us an incredible amount of flexibility for producing on-the-fly personalized collateral. And the client response is good, because our material is very focused on what they are interested in." Legal Arts uses Wausau Exact 80# matte coated 11" by 17" stock for its brochures.

Equipment in Use

Legal Arts employs a combination of Apple Macintosh and Pentium-based computers running the Microsoft Windows NT operating system. Static graphics are usually prepared on Macs with Macromedia Freehand. Animations and some interactive presentations are usually prepared on "NT" machines, with 3D StudioMax software.

In all, Legal Arts operates 14 color printers, from Tek, HP, and QMS. "For large-format printing, we use HP," said Gripp. "We were a beta test site for the 650, which was their first wide format." (Legal Arts was quoted in press material HP distributed with the DesignJet 650 product launch in 1994. See *Color Business Report*, June 1994.) "Subsequent to that, we were hired by HP in a number of patent infringement cases. We have never considered anything else—we are sort of loyal to them. Their printers really fit the bill." Gripp also sticks with HP supplies. " A lot of studios use alternative (and cheaper) brands, but with our lower volume it's not that big of a deal." Large-format prints

(continued on page 28)

Color Printing Equipment Used by Legal Arts Multimedia

Xerox (Tek) Phaser 850 (5 units, one per office)
Xerox (Tek) Phaser 350 (San Diego)
HP DesignJet 2500 (3 units, in San Diego, La Jolla, and Palo Alto)
HP DesignJet 650 (San Diego)
HP DesignJet 755 (Washington, DC)
HP DesignJet 3500 (San Diego)
QMS 350 (2 units, in San Diego and Palo Alto)

Source: Legal Arts Multimedia LLC
www.legalarts.com

are usually mounted on gator foam. They are not laminated, unless they are to be used in a high-humidity area.

Gripp saw Tek's "Free Black Ink" offer as a way to dodge the high cost of cartridges for desktop ink jet printers. "We were using desktop color ink jet printers from HP and others. At that time, we were doing a lot of black backgrounds, and Tektronix offered free black ink. We were buying a lot of black liquid ink cartridges at $20 apiece. So we got the Tek 350. We like the fact that the ink is not water soluble, and the printer is pretty clean. Now, we use the Tek 850s quite a lot, particularly with photo-realistic printing. It's a quick, inexpensive way to print a lot of copies." In fact, Legal Arts does not have a color copier, preferring instead to print full sets of originals. Gripp estimates that each Tek printer produces about 50,000 pages per year. Volume on the QMS color lasers is about 15,000 annually.

The lack of color matching between products isn't a problem for two reasons. First, the legal community usually are not as demanding as advertisers or others whose work is destined for a printing press. Second, Legal Arts has learned to anticipate color matching problems, and produces its final production runs on the same equipment. "We use color bars as a unifying graphic element, so if you are going to mix and match and you put the prints side by side, you may have two completely different colors. That may cause a problem for a client, or a client may completely ignore it. It hasn't been a problem for clients so far, because when we notice it, we reprint the material on one machine."

Telling a Better Story

It is hard to imagine an environment with as much "structured" communication as a court. In the legal system, there is a time and a place to communicate, and a set of procedures to follow. A great deal of effort usually goes into ensuring that those who are listening (the judge and jury) hear the plaintiff's or defendant's story in the most persuasive way possible. Representing one of the parties in the case, an attorney orchestrates a show for the court, preparing to communicate by conducting investigations, assembling evidence, finding and questioning witnesses, and preparing a set of communication aids to support the client's version of the events which are in dispute. In a court, the latest computer-based graphics technology can help attorneys communicate. But the mission—to tell the client's side of the story in a persuasive fashion, is not technology-dependent. Persuasion depends on factors such as oratory skills, command over case details, and selecting appropriate strategies and tactics. The story is not static as a novel is, so the attorney and the support team must be facile enough to integrate new details and modify the strategy and tactics on the fly, as the case is presented. Today, computer-based graphics are part of the tactical tools attorneys can use.◊