

# the Well-Equipped Desktop

REVIEWS OF HARDWARE, SOFTWARE, BOOKS, AND MORE

## Color within Reach

Hardware: **Desktop color printers**

By Scott Bury

**The best thing** about personal high-technology products is what they enable you to do and how they keep getting better and more powerful. The second-best thing is how they continuously get cheaper. These two phenomena have some unpredictable effects on our lives. For instance, one well-known designer recently upgraded to a Power Macintosh, but kept his older computer as a backup. This means his four-year-old son now plays Kid Pix on a Macintosh Quadra 950 with 64 MB of RAM. All his toddler needs to realize his artistic vision is a color printer. He may soon get one: at \$250 or less, an inkjet printer is now within the reach of most computer-equipped households, and the whole class of desktop color printers has been coming down in price, too.

Today, the well-equipped desktop by definition includes a color printer. Your clients won't accept black-and-white comps with marked overlays. They expect your reports to show color graphs and charts. And being in this business, you know how powerful color is—you can't do without it. Fortunately, you don't have to. You can now buy a low-end color printer for less than \$300, while a color printer fast and powerful enough to serve a group of users goes for well under a thousand. But before you decide to take the plunge, there are a few things you should know: how different color-printing technologies work and which types are best suited to your needs, for instance. Plus, you must realize that there are limitations to what desktop color printers can accomplish. This article will give you what you need to make an informed color-printer buying decision.

### Realistic expectations

In the next section, "What goes on inside," we'll give you an overview of the different classes of color printers (inkjet, solid ink,

thermal wax, dye sublimation, and color laser) to help you decide what type of device will probably fit your needs and budget best. But before you start shopping in earnest, you should have some idea how to determine what you need from a color printer. There are three ways to compare them: image quality, speed, and cost (initial purchase price as well as ongoing maintenance and per-page output costs). In general, moving up along one of those axes

usually involves compromising along one or more of the others.

**Quality.** How much quality you need depends on who will see the output and what they're looking for. To some, quality means bright, opaque colors, such as those you get from a thermal-wax device; to others, it's smoothness of photographs, best given by high-resolution or continuous-tone devices like dye-sublimation printers; and to prepress professionals, it's determined by color accuracy (the ability of the printer

to predict how colors will look on an offset press). If you fit in this last category, you need an accurate, high-resolution device such as a dye-sublimation printer. These can give you a pretty good idea what a job will look like on press if you calibrate them correctly and use a color-management system, but they can't always substitute for film-based proofs on color-sensitive jobs.

On the other hand, many "general business" users want color just to add splash to a report or proposal—so color accuracy isn't as important as speed and cost. Almost any type of color printer will probably provide adequate quality. Nevertheless, color qual-



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ity varies within each printer category, and color quality is a matter of personal preference to at least some degree. So no matter what your color-quality needs are, you should compare output samples from various devices before making a buying decision.



**Speed.** Color printers are slower than monochrome printers because they must process three to four times as much information. However, printer vendors keep improving the speed of their models.

There are several components that determine color-printer speed. First, speed varies with the basic types of color printers and the engines they use to transfer images to paper—dye-sublimation printers take the longest to image, while laser printers have the fastest engines. Second, the printer's processor speed and amount of RAM resident in the printer have a big effect on performance, particularly in PostScript devices. Third, the speed at which the host computer downloads the file to the printer can affect speed, although this may be more of a concern for non-PostScript devices, such as QuickDraw printers, that require image data to be rasterized by the host computer.

Just as with monochrome printers, the rated speed of a color printer can be misleading, because it generally reflects only engine speed, not processing speed as well. For instance, while color laser printers can produce three or four copies of a file per minute, the first page takes much longer to process than the copies.

**Cost.** Initial-purchase costs of desktop color printers are coming down precipitously and will continue to do so. But you must also consider the continuing cost of ownership: the consumables. While most printers today will work on “plain paper”—the same stock you put into your photocopier—brighter, whiter, and smoother (and more expensive) paper may give you better-looking results and help prevent jams. Also, be sure to ask how often you're likely to have to replace colorants and how much that'll cost—inkjet printers require ink cartridges, solid-ink devices use ink sticks, thermal-wax and dye-sublimation printers use color ribbons, and color-laser devices use colored toners. Cost varies among brands and models.



### What goes on inside

Even though the vendors tend to launch new models of color printers with a lot of fanfare, not much has changed in the underlying technology in the past few years, although the manufacturers have been improving image quality, speed of processing, and flexibility. There are five basic types: inkjet, phase change/solid ink, thermal wax, dye sublimation, and color laser. You need to understand a little about each before you can choose the best one for your needs.

**Inkjet.** Ranging from \$250 to \$30,000 or more, inkjets are both the cheapest and the most expensive color printers. These devices use a simple process for imaging:

either heat or hydraulic pressure bubbles colored ink through three or four nozzles onto a page.

Inkjet printers have a relatively low consumables cost, typically around 25 cents per page. But if you want to save money in the long term, make sure that the ink cartridges (which can cost as little as \$35 per color) can be replaced individually—you'll use more black ink than any other color, and if you have to replace all four colors when the black runs out, you'll waste a lot of ink and money. Inkjet printers can print on plain bond or copy paper, and some, such as the Epson Stylus line, can print on transparencies.

On the down side, the liquid ink can spread into the paper, reducing the clarity of the images, and the water-soluble inks are prone to smearing. Inkjets are well suited to quick, in-house proofing, and in some cases for comps for clients. However, desktop inkjet printers don't always provide very vibrant, accurate color, so they're probably not the best choice for professional design work, unless you keep your expectations in line and use them for rough comps. “Sometimes just having even a low-resolution color proof that we can touch and feel helps us with design and meeting a client's expectations,” says Maria Yap, electronic production director at Option X, a design and production studio in Alexandria, Va.

High-end inkjet proofing systems, such as the Realist from Iris Graphics, or wide-format inkjet printers such as Hewlett-Packard's DesignJet 755CM, send a continuous stream of ink; deflectors direct the ink to the appropriate spot on the page, and unused ink returns to a reservoir. However, these high-end systems, costing from \$12,000 to \$30,000 or more, are not desktop printers—they're more for contract proofs, or sometimes for printing large items such as banners, retail displays, and outdoor signs. Look for them at your local service bureau if you have a need for such output (see “Large-format color” on page 34 for more information).

**Phase change/solid ink.** A cousin of inkjet, phase-change technology uses solid-wax colorants instead of liquid ink,

and can output on plain paper as well. The inks are melted, and solidify quickly when sprayed onto the paper. The results are a more solid, better-controlled dot with a more vibrant color.

Costing from about \$5,000 to \$7,000, solid-ink printers are more expensive than liquid inkjet or thermal wax. Phase-change printers are also economical to maintain—the ink sticks they use are cheaper than those for inkjet printers—as low as \$30 per stick.

Solid-ink output works well for general business uses since the color is more durable than inkjet, but the pages have a distinctly waxy feel. They can also be used for transparencies, but in a graphics environment they're best suited for comps and low-fidelity color proofs. Don't try to match or predict on-press color from a solid-ink printer.

**Thermal wax.** In a thermal-wax printer, the color is contained on a ribbon the width of the page to be printed on; unroll the ribbon and you'll see successive panels of the colors used to make the image. These can be three-color (cyan, magenta, and yellow) or four-color (cyan, magenta, yellow, and black). In the three-color versions, the colors are mixed to make black; the four-color types give better blacks and richer colors. The print head melts the wax off the ribbon and transfers it to special paper, leaving colors that are bright and strong.

The price drop in this technology has been dramatic. List prices run from \$2,000 to \$4,000, depending on throughput rate and whether the device prints on 8.5-by-11-inch or 11-by-17-inch media. However, the consumables cost of this technology is high because of the multipaneled color ribbons the printers must use—they go through four passes no matter what's on the page, so you use up a panel of each color for each sheet you print. A 100-print roll of color ribbon can cost from \$70 to \$200, depending on the brand and model. So thermal-wax printers really aren't suited to printing black-only pages, or most "general office" use.

**Dye sublimation.** Dye-sublimation printers are similar to thermal-wax printers: a transfer roll contains the colors in successive yellow, cyan, magenta, and black panels. A four-pass process fuses the colors to the paper. However, dye-sublimation printers use a much higher temperature,

which changes the color directly from solid to gas. This results in a continuous-tone image, and perhaps the smoothest, highest-quality color of all the different types of color printers.

A dye-sublimation printer can cost from \$6,000 to \$8,000 for a model that prints on letter-size paper, or \$15,000 to \$17,000 for tabloid output—it's the most expensive of the "desktop" range of printers. Furthermore, its per-page cost is higher than other technologies—from \$2 to \$10 per page, once you factor in the cost of special paper and the transfer rolls.

The Cabinet Group of Mississauga, Ont. (near Toronto), bought a Kodak ColorEase dye-sublimation printer specifically for producing overhead transparencies with bright, strong colors and smooth blends for its clients. This model also supplies an extra laminate layer that protects the output from fingerprints and fading. President Richard Cabinet admits the unit costs of the prints are quite high—around \$2 per page—and its speed is sometimes frustrating at three minutes per page. However, it prints onto paper or transparencies with a quality that's well suited to presentations in darkened meeting rooms.

Manufacturers and many graphics professionals have found that dye-sublimation technology, when properly calibrated and used, can produce accurate-enough color for prepress proofing. This makes the purchase and continuing cost seem low compared with traditional prepress proofs like MatchPrint or Cromalin, which usually cost from \$75 to more than \$100 per page or sheet.

Jay Stoegbauer's digital and traditional photographic studio in Orange, Calif., uses a dye-sublimation printer for internal decision-making, particularly when assembling photographic images into pages. It's reliable and relatively fast, but they don't use it for proofing. "For color matching, we then go to an analog proof, simply because our clients usually decide where the file will be printed, and it's impossible to calibrate the printer to all the imagers and presses out there," says Stoegbauer.

**Color laser.** Color-laser printers work exactly as do single-color laser printers. A laser beam charges a drum in the area to be printed on the page; the charged drum attracts oppositely charged toner particles, which are transferred to the

page. Heat fuses the toner to the paper. To put down more colors, the printer passes the paper from drum to drum, adding yellow, cyan, magenta, and black toners.

When they're printing multiple copies of the same pages, color-laser printers are the fastest color printers around—this is when they actually approach their rated speeds of four to six pages per minute, once the first copy is out. This suits them particularly well to service bureaus and quick-print shops that cater to the business user. They also provide lots of flexibility: many, such as the Canon CLC series and some Xerox models, are outfitted as color copiers, but can also function as color printers with the addition of a hardware RIP, such as EFI's Fiery or ColorAge ColorQ series.

Color-laser printers are also the cheapest-running types of color printers. The toner cartridges are quite pricey, but they last a long time, and color-laser printers can print on plain paper. All this keeps per-page costs low—well under a dollar.

Quality can range: color toners generally aren't as bright as thermal wax, but the images are sharper and smoother than those from inkjet printers.

**Hybrid devices.** Some manufacturers, such as Tektronix, have released dual-mode printers that can switch between thermal wax and dye sublimation; use the thermal wax for comps or position proofs,

## For further reading

You'll find reviews of specific color printers almost every month in various computer magazines. Here are a few of the most recent round-up articles.

"Colorful Choices," by Hailey Lynne McKeefry, *Windows Magazine*, August 1996, page 193.

"Heavy-Duty Printers," by Cary Lu, *Macworld*, June 1996, page 116.

"Color Laser Printers," by Bill Underwood, *Macworld*, June 1996, page 51.

"Color Goes to Work," by Roman Loyola, *MacUser*, May 1996, page 84.

"Affordable Color Printers," by Peter M Stoller, *Macworld*, April 1996, page 133.

"Buying a Desktop Printer," by Pat Soberanis, *Adobe Magazine*, March/April 1996, page 47.

"Color Printers Mean Business," by Jim Heid, *Macworld*, Sept. 1995, page 122.

"Stepping into Color," by Nicholas H. Allison, *Adobe Magazine*, March/April 1995, page 25.

### Large-format color

When the boss says, "I want a big banner across the ballroom for the annual corporate meeting, something colorful and eye-catching—but not too expensive," you need a large-format color printer.

You probably won't be doing this often enough to buy such a device (they cost around \$12,000 to \$30,000 or more), so head toward a service bureau. Here is some information that'll help you get the best results.

**How they work.** Wide-format color printers are typically roll-fed; the paper moves below the fixed color head, which applies toner, wax, or liquid colorants. The maximum width they can output is determined by the size of the imager—usually from 32 to 52 inches wide. On roll-fed devices, the maximum image length is generally determined by the length of the paper roll. Devices that aren't roll-fed have different limitations; for instance, a new drum-format inkjet device from the Israeli company Idanid can print up to 4 by 8 feet.

Most wide-format color printers use one of three technologies: electrostatic, which uses toner and is

similar to a copier; inkjet, which is the cheapest and can be had for less than \$12,000; and thermal wax, the most expensive, which can print on vinyl, paper, and other substrates. A new device, Kodak's Lambda, uses lasers to image photographic paper up to 50 inches wide.

**Cost.** Output is priced per square foot and ranges from a low of \$5 up to \$15, depending on the size, the quantity, and what kind of mounting and lamination you need. At these prices, wide-format digital printing is economical up to five or ten copies, depending on the size of what you're printing; after that, it's usually cheaper to go to screen printing (once called silkscreening).

**Output quality.** Resolution for wide-format printers ranges from 200 to 400 dpi. While this may seem low, remember that people will view the output from a distance, so super-high resolution isn't necessary. Besides, all wide-format printers use FM (frequency-modulated) screening, which gives you a better image at relatively low resolution. Generally, there's no need for any image to have more

than 100 pixels per inch per color. Ask your service bureau exactly what resolution you should use.

**Finding the right service provider.** Here are some of the questions a qualified provider should ask you before accepting your file(s).

- What is the format of the source document? If it's a bitmap file, what resolution is it?
- Where will this be shown? If it'll be used outdoors, the service bureau should transfer the image onto vinyl. They should also recommend an anti-UV coating to reduce fading and guard against spills in a trade show or mall. If you need a stiffer backing, they should recommend cardboard, gatorboard, or foamcore (but note that in Canada and some states, foamcore is prohibited in trade shows).

—Scott Bury, with thanks to Ron Rodney, Rodney-Spenser Graphics, Toronto; George Klein, Management Graphics Inc., Toronto; and Eric Poupore, Accuplus Reproductions Inc., Toronto.

then the more expensive dye sublimation when you need a prepress proof.

### Making the choice

To make your decision, analyze how you'll use the color prints and who will see them—this may enable you to narrow your search to a few types of devices. Here are some rough guidelines on what types of printers are best suited for certain kinds of situations.

- Color for general business use. If you want to add some impact and sparkle to basic business documents and don't want to spend a lot of money, look into inkjet printers. For something more durable, which will stand up to handling, look into solid ink for comps and roughs. In these instances, color fidelity is not crucial, and speed is secondary.
- Color overheads and transparencies. If you need to produce a lot of overheads, inkjet and solid ink can be problematic, although you can succeed with the right printer and the right transparencies. However, thermal-wax and dye-subli-

mation printers are usually the best choice for transparencies.

- Photographic and continuous-tone images. If you are producing continuous-tone images, dye sublimation is the best bet for volume—although you should also look into more photographic printers from such companies as Lasergraphics, Kodak, and Fujix.
  - Prepress and basic color proofing. In prepress proofing, cost isn't the most important criterion: color fidelity is. This makes the dye-sublimation printer the best choice, although a thermal-wax printer may be acceptable.
  - Color for high volume and workgroups. If you need to share the printer among a large workgroup, or in a copy shop, then the laser printer is probably best.
- Once you have an idea of what type of printer you should be looking for, check out specific reviews of those printers in hardware-oriented trade magazines (see "For further reading" on page 33 for more information). Then test-drive as many units that fit your needs and budget as you

can—and use your own color files for the test. After all, that's what you'll be doing once you buy. If that's not possible, compare printed samples available from vendors (but keep in mind that these samples have been optimized for each printer, and may not give you a very accurate idea how your files will print).

### Color is a consumer product

Color is becoming more and more accessible for the consumer market, and it's no surprise. All the pieces that make that possible are here: low-cost equipment; cheap consumables, including plain paper; and color-management systems that make it reasonably easy to achieve relatively consistent, predictable color on the desktop. But the most powerful factor driving this trend, of course, is demand—no matter what you do, having a color printer can give you a powerful creative and competitive edge. ■

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