

# Tracking Printing Costs at Blackstone Research



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## Table of Contents

<b>Tracking Print Costs</b> .....	4
<b>The Color Business Report Test Page</b> .....	4
Which Printer? .....	4
Weighing Cartridges .....	4
What print setting? .....	4
<i>Supplies Costs for Printing the Same Page</i> .....	5
Cartridge Depletion .....	6
Discarded Ink .....	6
Calculating Ink Consumed and Discarded .....	6
Percent Coverage? .....	6
Other Consumables .....	7
<i>HP cp 1160: Supplies Costs for Printing the Same Page</i> .....	7
<b>Photo-printing Cost</b> .....	8
<i>Canon S630 Per-Color Ink Consumption, “N5A Bicycle”</i> .....	8
<i>Preparing an ISO SCID N5A image for 4-up printing</i> .....	8
<i>Supplies Costs for Printing the “N5A Bicycle” on Photo Printers</i> .....	9
<b>Newsletter printing—A Real Job</b> .....	10
<i>Comparative Costs for Printing a 16-page issue of Color Business Report</i> .....	11

## Tracking Printing Costs

Since 1994, Blackstone Research has tested printing costs for numerous ink jet and electrophotographic color printers, publishing results in the *Color Business Report*, a monthly industry newsletter. The testing process is fairly simple—the printers are run until all colorants are depleted. Per-page printing cost is determined by dividing the purchase price of the consumables by the number of pages printed. Three different document types are used to test cost of printing, depending on a printer's capabilities, it will undergo one or two of the tests.

1. The *Color Business Report* test page. Our basic cost of printing test document, composed of text and graphics.
2. ISO N5A Bicycle image. Ink jet printers specifically designed for photo printing are used to print this photographic image.
3. Newsletter printing. Color laser printers capable of printing on 11" by 17" paper are used to print a full edition of the *Color Business Report* newsletter.

### The Color Business Report Test Page

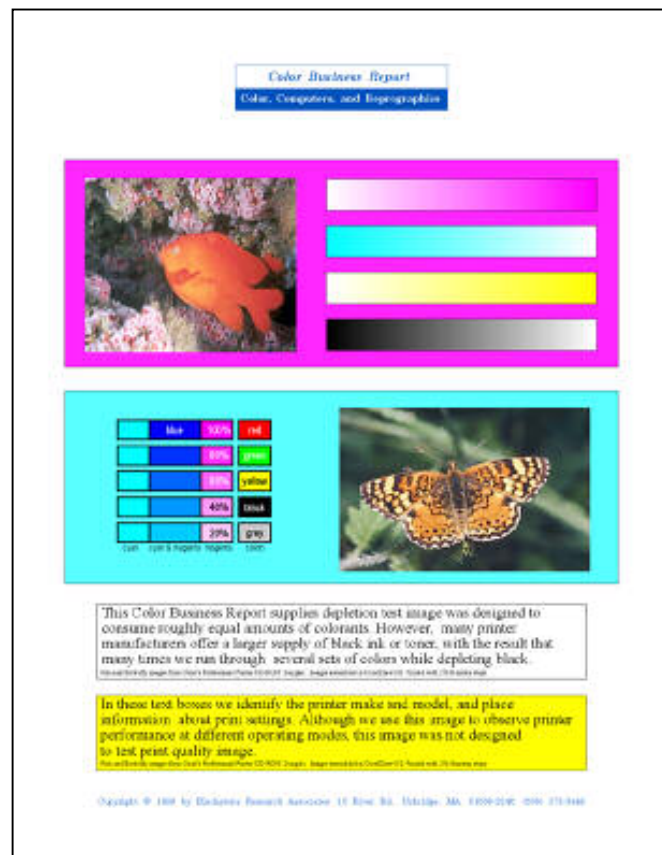
The document printed by almost all printers we have examined is the *Color Business Report* test page. Designed in CorelDRAW, the page mixes black text, color graphics, and color photographic images.

#### Which Printer?

In deciding which printers to evaluate, we usually select recently-introduced products, taking special care to pick printers that integrate new print technology, avoiding printers that have incremental upgrades, compared to earlier models. (For example, the HP Color LaserJet was tested in March 1999, but its successor, the Color LaserJet 4550, will not be tested.) While the majority of the tests over the years have been done on ink jet printers, a good number of electrophotographic machines have been tested, including desktop models like the Lexmark C710 and larger gear such as the Xerox DocuColor 5799 color copier (*see chart*).

#### Weighing Cartridges

Once a printer to be evaluated has been unpacked and set up, its colorants (ink or toner cartridges) are



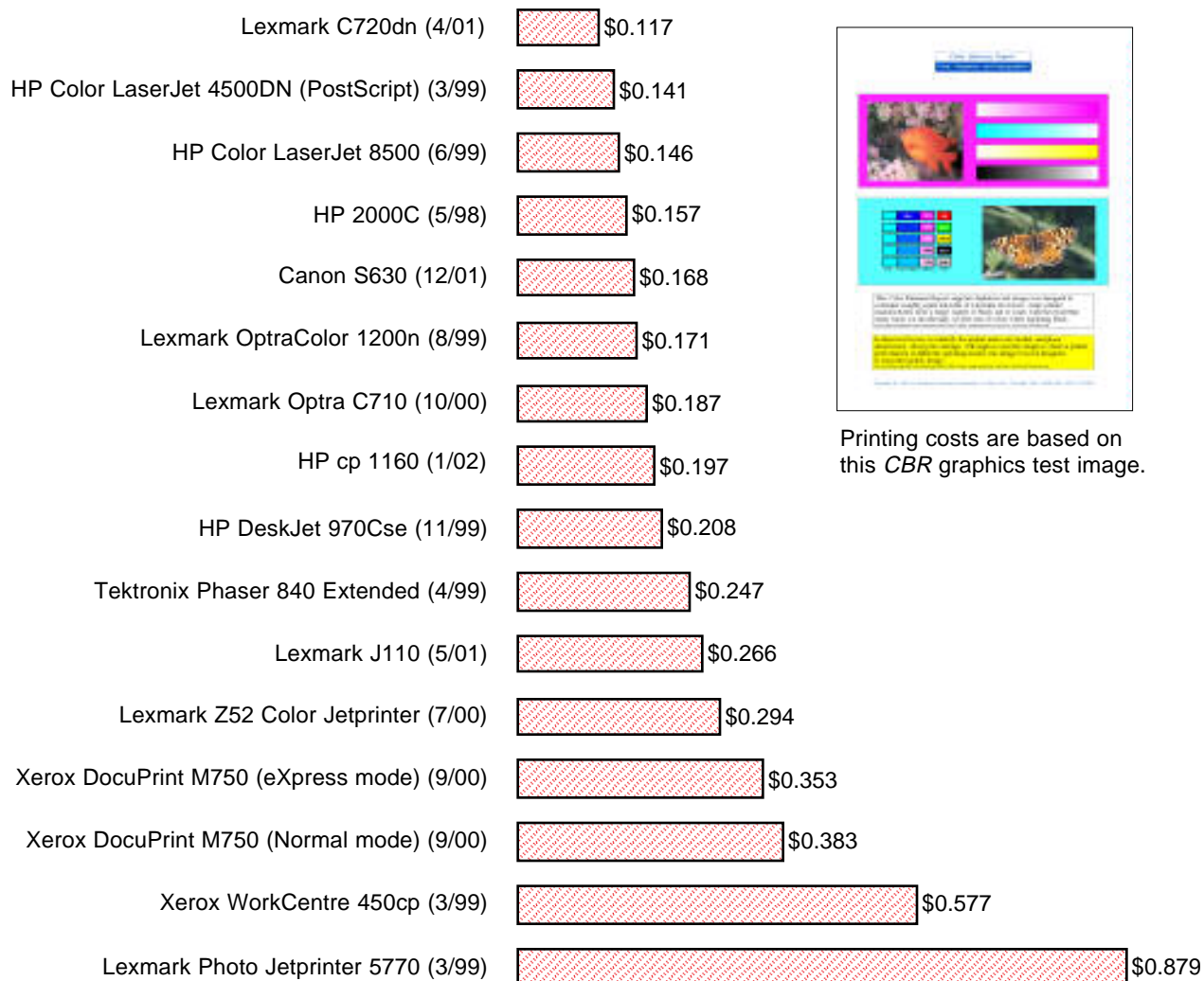
*The Color Business Report test page is designed to deplete colorants more or less evenly.*

weighed, before they are loaded into the printer. When cartridges are depleted, they are weighed again, allowing the amount of useable ink or toner contained in the cartridges to be determined.

#### What print setting?

After the print driver is installed, and a successful test print generated, the print run to determine cost or printing begins. As a rule, prints are made in a printer's default mode. However, our test page has a dual purpose. In addition to its colorant depletion function, the page also helps to demonstrate a printer's ability to print text and graphics. In cases where the default mode of a given device does not produce a print that compares favorably to those produced by other machines tested, the print settings are adjusted to create a more acceptable print.

## Supplies Costs for Printing the Same Page



Note: Printing costs are based on street prices found in an office supply catalog with a December 31, 2001 expiration date. Costs include colorants (ink or toner) and other consumables, where appropriate. Costs do not include paper. Date in parentheses is the issue where the cost data originally appeared.

Source: *Color Business Report*

Cartridge Depletion

Pages are run through the printer until the first colorant supply runs out. Today, most printers keep track of their own consumables levels. Determining when a toner cartridge on an electrophotographic printer has been fully depleted is easy enough; the printer simply stops printing, and displays a “Toner Out” message on its control panel. Detecting a depleted cartridge on ink jet printers involves a little more user intervention. Since our testing ignores “ink low” messages, printing continues until flawed prints with



Print defects usually are a telltale sign that ink or toner has run out.

banding or other defects are observed (*see photo*). To make sure that the defects are not caused by a clogged nozzle, a print head alignment or nozzle cleaning page is run to confirm that a color has truly been depleted. Once the first color cartridge has been depleted, the number of prints made is logged, and printing continues until the rest of the cartridges are empty.

Discarded Ink

Many ink jet printers use a tri-color (cyan, magenta, yellow) ink supply. After the first color in a tri-color cartridge is consumed, some amount of the other two colors remains, to be thrown away when a new ink cartridge is loaded. The cost of this discarded ink is part of the per-page printing cost, of course. Once the first color is depleted, printing continues until the other two colors drop off. The cost of each color consumed is calculated by dividing the per-ink supply cost by the depletion page count for each color. The cost of discarded ink is determined by subtracting the cost of the second and third ink colors consumed per page from the cost of the first ink color consumed (*see chart*).

Calculating Ink Consumed and Discarded				
Color	Ink out page	Ink consumed	Ink discarded	Total ink cost
Yellow	157	0.081	—	0.081
Magenta	177	0.072	0.009	0.081
Cyan	165	0.077	0.004	0.081
Black	731	0.042	—	0.042

Percent Coverage?

With our test process—using the same image over a range of printers—we do not need to know percent coverage for our test images. Vendors often cartridge page yields in terms of page coverage; 5% for black or 15% for color, for example. By comparing vendor cost claims with our test results, we estimate the coverage of our test page to be in the neighborhood of 30%. Although our result is an emphatic and useful comparison of printer cost performance, it is not “projectable” to other page types.

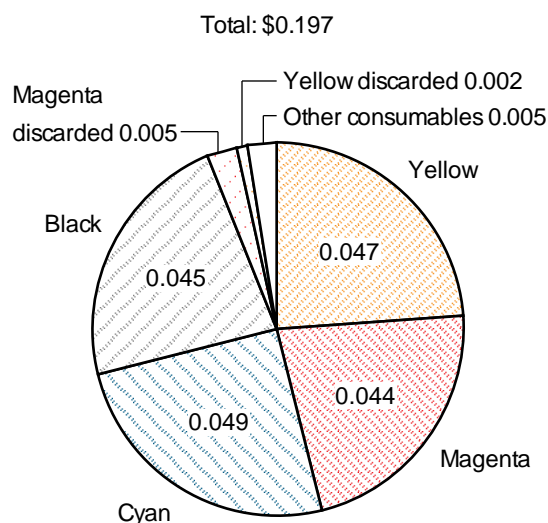
### Other Consumables

Costs for consumables other than colorants a printer uses, such as separate print heads used in ink jets like the Hewlett-Packard cp1160, or imaging drums used by color laser printers, must be accounted for in per-page printing costs. The life of some long-lasting consumables, drums, for instance is determined by meter clicks. In such cases, the cost per page of the component is calculated by dividing their purchase price by the manufacturer's page yield claims. Paper is not included as a consumable in our cost of printing calculations for the *Color Business Report* test page, given that all products can use the same plain paper.

While the "Other Consumables" category encompasses many of the physical components used by printers to generate pages, including fuser oil, transfer drums or belts, or developer, it can also include the cost of service contracts, which are sometimes purchased along with color laser printers and copiers. Such contracts are expensive, high-ticket items. The more expensive and complex the color printer, the more likely a customer will get the service contract. Only two machines we have worked with, the Hewlett-Packard Color LaserJet 8500 and the Xerox DocuColor 5799, include service in their printing costs. The cost per page of a service contract must be based on certain assumptions. For example, when evaluating the Color LaserJet 8500, we assumed that customers would buy an \$1,100 service contract with a three-year term. We also assumed that over the life of the contract, customers would "use" the service at intervals of 6,000 pages per month for 36 months. Using these assumptions, we were able to calculate a \$0.005 per page cost for service for the Color LaserJet 8500.

### HP cp 1160: Supplies Costs for Printing

This month we have added the HP cp 1160 to our supplies consumption evaluation series. We print the same image on all printers, logging the point at which each cartridge 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. "Other consumables" for the cp 1160 include the print head, which has a published life of 30,000 pages.

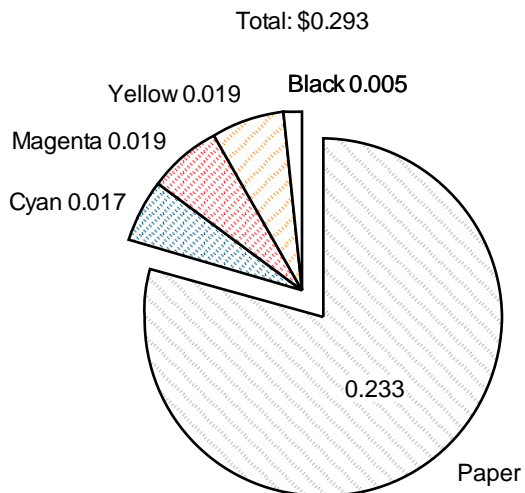


Source: *Color Business Report*

## Photo-printing Cost

Many ink jet printers are designed to print photographic images. To test photo printing costs, we use a commonly available image, the ISO N5A “Bicycle” image, printed four-up on a single sheet of paper. As with the *Color Business Report* test page, the printer is run until the ink cartridges are dry, and ink depletion points are recorded. The method for determining colorant costs is also the same. However, when testing the photo printing costs on ink jet printers, the “Best” or “Photo” modes are enabled, rather than the default mode. Also, when using ink jet photo printers, we load them with the manufacturer’s recommended photo media. The cost of the photo media is included in our calculations, because the application requires it.

### Canon S630 Per-Color Ink Consumption, “N5A Bicycle”



Source: *Color Business Report*



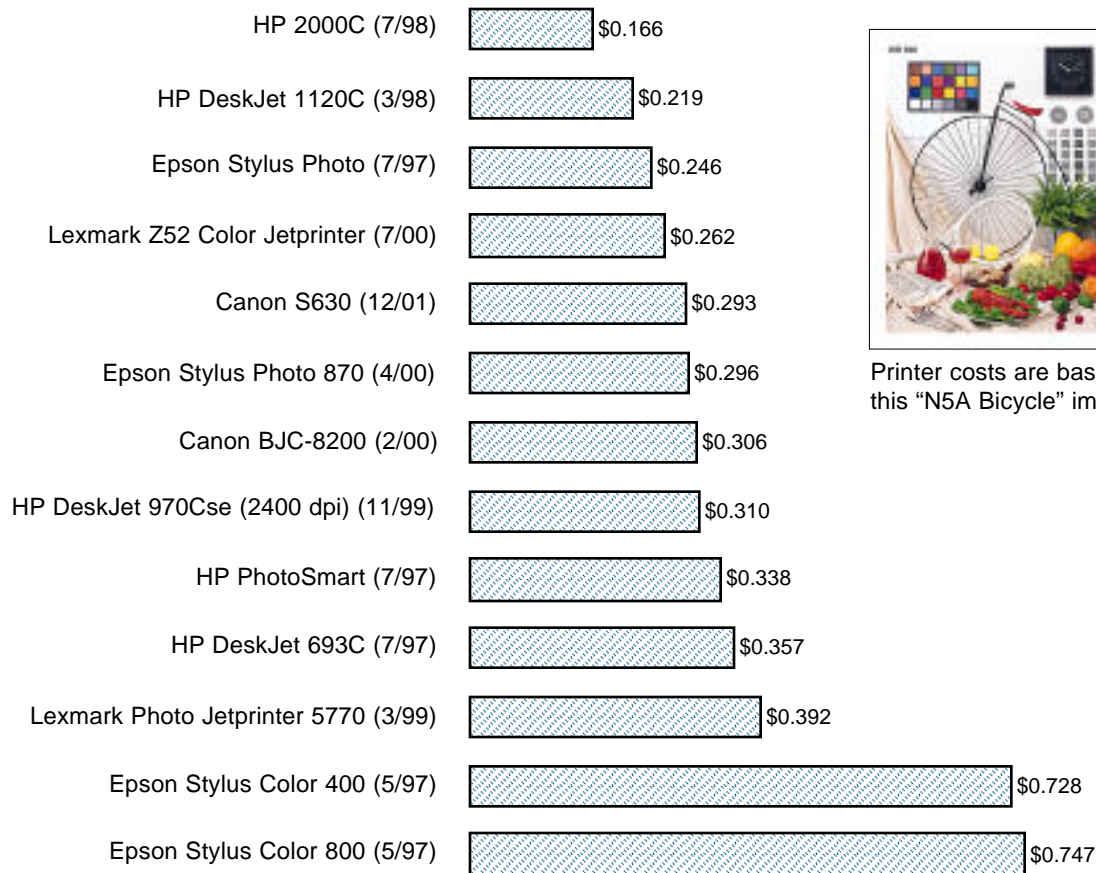
The ISO SCID N5A Bicycle image is used to test cost of printing on ink jet photo printers.

### Preparing an ISO SCID N5A image for 4-up printing:

1. Launch Adobe Photoshop 4.0
2. In preferences, set Printing Ink Setup—Dot Gain to 25%, SWOP Uncoated
3. Under Image—Mode, change to RGB Color
4. Under Image—Image Size, resample bilinear
5. Under Image—Mode, convert to Lab Color
6. Select Lightness under channels
7. Under Filter—Sharpen, apply unsharp mask (124%, radius 2.7, 2 levels)
8. Under Image—Adjust Levels, select “Auto”
9. Under Image—Mode, change to RGB Color

Source: *Color Business Report* and Imcotek

## Supplies Costs for Printing the “N5A Bicycle” on Photo Printers



Printer costs are based on this “N5A Bicycle” image.

Note: Date in parentheses is when the cost data originally appeared. Costs include ink and photo paper.

Source: *Color Business Report*

## ***Newsletter printing—a real job***

When evaluating a color laser printer or copier capable of printing on 11" by 17" paper, we run a full issue of the *Color Business Report* (see photo). The newsletter print run is our closest gauge of the total cost of ownership of a color printer, because each issue is composed of text and graphics pages that resemble the day-to-day document mix more closely than our formal test pages. While the document is different, the process for learning printing costs is the same as with the *Color Business Report* test page. Printing continues until all the toner cartridges have been depleted, and colorant and "other consumables" costs are calculated. However, instead of arriving at a cost per page, a cost per newsletter (between 16 and 20 pages, usually) is determined.

Additional costs are associated with producing finished newsletters. Paper cost is included, to allow us to compare the cost per newsletter to offset (our commercial printer does not break out costs for ink and paper). Out-of-pocket costs include finishing: the printed sheets are taken to our commercial printer to be folded, collated, drilled, and trimmed. When we printed the newsletter on the early non-duplex Tek Phaser 550 and HP Color LaserJet, out-of-pocket costs included extra postage necessary to mail the one-sided letter-sized sheets each machine produced. Before we purchased our own scanner, out-of-pocket also included the cost of bringing transparencies and photos to a service bureau to be scanned. Bringing a publishing job in-house also adds labor costs. Someone has to oversee the printer, to click File>Print from time to time, and to top off the paper trays.

While equipment amortization is probably on the mind of anyone who makes a capital equipment purchase such as a printer, it is not included in our per-

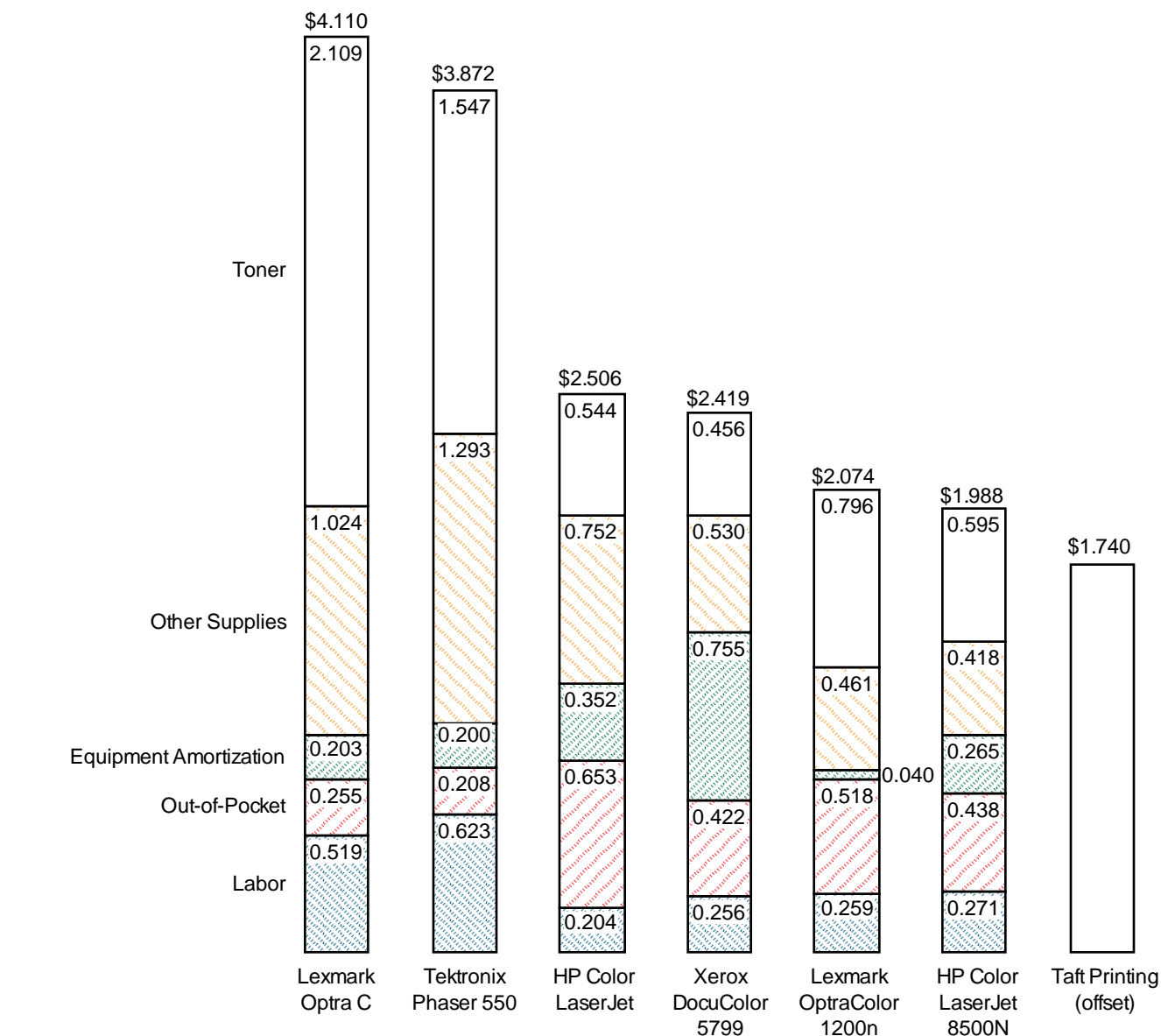


*The Lexmark OptraColor 1200n was used to print the July 1999 issue of Color Business Report.*

page cost figures for the *Color Business Report* test page or the N5A bicycle image. When printing a newsletter run, however, amortization is included in the costs, to allow us to compare costs with a newsletter run on the offset gear used by our commercial printer.

Through the *Color Business Report*, Blackstone Research provides the only publicly available printing cost comparisons for digital color printers. Since 1994, 37 printers have been tested. Blackstone also does cost-of-printing testing on a contract basis, providing confidential reporting to customers, and has published a number of research reports about document technology and color printer adoption. More information about Blackstone Research and the *Color Business Report* are available at [www.blackstoneresearch.com](http://www.blackstoneresearch.com).

## Comparative Costs for Printing a 16-page issue of *Color Business Report*



<b>Original Coverage</b>	1/96	5/96	4/95	11/98	8/99	5/99
<b>Pages in Original Issue</b>	14	18	20	10	16	20
<b>Typical Monthly Volume</b>	5K*	5K*	5K*	15K*	20K	6K*
<b>Printer Street Price</b>	\$6,400	\$6,995 <sup>†</sup>	\$7,000*	\$44,792*	\$7,299	\$7,194

\*CBR estimates, <sup>†</sup>List Price

Supplies costs are based on estimated street prices in May 1999. Printer street prices are based on the street price at the time the printers were introduced. The out-of-pocket cost for the HP Color LaserJet and Tek Phaser 550 includes extra postage. Since those printers were not duplex printers, the newsletter weighed twice as much. Equipment amortization is based on our appraisal of what the typical monthly volume for the class of equipment. Amortization for the HP Color LaserJet 8500 and Xerox 5799 assume that each 16-page newsletter uses eight 11" by 17" pages. Amortization for the Lexmark OptraColor 1200n is based Lexmark's estimate of a five-year useful life of the printer. Amortization for all other printers in this chart is calculated based on a three-year lifespan. If the three-year rule were applied to the Optra Color 1200, the amortization cost would be two cents higher. Labor and out-of-pocket costs have fixed (per-newsletter) and variable (per-page) components.

Source: *Color Business Report*



### About Blackstone Research Associates

Blackstone Research Associates provides custom market research and strategy consulting services to product managers, strategic planners, and R & D executives in the computer industry. Survey-based primary research supports many assignments. In addition to proprietary research, Blackstone Research publishes industry reports. Topics have included plain paper facsimile, color copy quality, color printer and copier cost of ownership, and color peripheral product adoption. Since 1990, Blackstone Research has investigated technology adoption issues for the high-end document publishers that are members of Xplor International.

### *Color Business Report*

Color, Computers, and Reprographics

### About the *Color Business Report*

The *Color Business Report* is a monthly industry newsletter written for product managers, strategic planners, and R & D executives in the computer industry. The editors focus on color computer peripheral product introductions, hands-on product evaluations, end-user reactions to new products, and end-user case studies. The newsletter has been published since 1991.

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