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COPY THAT

TODAY'S MULTIFUNCTION PRINTERS ARE FULL-FLEDGED MEMBERS OF YOUR NETWORK, WITH ATTENDANT MANAGEMENT AND SECURITY CONCERNS. WE TESTED FIVE OF THESE POWERHOUSES AND FOUND XEROX'S WORKCENTRE PRO LIVES UP TO ITS NAME

Copiers were once simple, closed lens-and-mirror analog devices with only a few well-understood security concerns. No longer. The newest generation of Mr. Edison's mimeograph machine comprises full-fledged computers equipped with digital scanners, laser printers and specialized software. Top-end multifunction printers sport Ethernet connections, telephone lines for sending analog faxes and hard drives for storage, making them true document servers.

In the simpler world of closed copiers, IT was mercifully exempt from the purchasing process. However, the security implications of today's printers mean you need a seat at the table: Any device capable of turning a stack of confidential company records into a PDF file and e-mailing it to potentially anyone deserves your full attention. In addition, you must plan for management. Although Web-based management consoles are fairly ubiquitous, telnet support and e-mail alerts on error conditions are not.

Once you've accepted that the copier down the hall is just like any other computer on your network—with management challenges and security concerns—you formulate a policy and weigh in on which product to buy.

To help, we tested top-end devices. We set the bar high for this review—requesting color printers capable of churning out 20 to 40 pages per minute. If you're looking for a lower-end device—in

BY JEFF BALLARD



Xerox WorkCentre Pro C2636

terms of fewer pages per minute or monochrome-only output—the management, driver and output features listed in our features chart (pages 5 and 6) generally transfer to tested devices' less-expensive siblings.

We collected more than 2 tons of elite machinery from Canon, Hewlett-Packard, Ricoh, Sharp Document Solutions Co. of America and Xerox in our University of Wisconsin-Madison labs. IBM declined to participate, saying it had no review units available. We also invited Imagistics, Konica, Panasonic, Samsung, Tally Genicom and Toshiba, but none had products that met our requirements.

HP trusted our mechanical aptitude enough to leave the setup to us; we went from boxes to an initial print in 50 minutes. Canon, Ricoh, Sharp and Xerox representatives assembled their products on site at our University of Wisconsin-Madison labs. Canon's, Ricoh's and Sharp's printers took significantly more than 50 minutes to install. Xerox shipped its WorkCentre Pro C2636 mostly preassembled. Each product had a multi-function finisher attached (for more information on finishers, see "FYI: Photo Finish," page 4).

Sales channels vary. Canon, Ricoh and Sharp sell only through closed distribution: You must buy or lease a unit through select local resellers. Xerox distributes its devices directly. HP follows the same open-distribution model it uses for its printers, meaning you can buy from any vendor that carries HP products.

Test Time

We tested these high-end multifunction printers from the perspective of the IT professional needing to administer these machines for business-class use. Print quality, speed, density and color correctness, though important, were not measured for this review. Also, note that FCO (first copy out) and warm-up times are dependent on environmental conditions, including temperature and the amount of time since the device was last used.

All the products we tested print, copy, scan and fax. They provide an easy way to move information around, and if your company uses a document-management system, these devices will interact with it.

We found management quite flexible as well. We controlled all test devices over each printer's internal Web server, and all the devices interoperated with common management tools using SNMP. The vendors all provided utilities for discovery through broadcast or multicast.

Because many IT people are new to the wonders of multifunction printers, little touches meant a lot. For example, we appreciated the effort Xerox put into its Windows driver. Not only did it display exactly what the printer looked like—even changing the picture when we added the finisher—it also fetched the current configuration directly from the machine. This made setup easy and gave us a good feel for the device. Canon's imageRunner C3220 and Sharp's AR-BC320 also gathered configuration data directly. HP's LaserJet 9500 and Ricoh's Afficio 2228C could fetch some information—but the

data was incomplete, and both required additional software beyond the Windows driver.

All the printers we tested can be loaded with additional software—for example, a custom document-management solution. But we ran into a problem testing such capabilities with the Canon machine. Canon's Java-based development platform, dubbed MEAP (Multifunction Embedded Application Platform), has an SDK. Yet Canon refused to send us the SDK, saying it releases the kit only to large entities with dedicated development staffs or to third-party companies looking to develop software to work on the machine. Despite our promise that we would endeavor not to break the copier, we didn't get to play. If you have better luck, drop us a line.

Finally, we tested how easy it was to collect statistics on the number of pages printed, and by whom. Gartner reports that enterprises spend 1 percent to 3 percent of their revenue on document output, and we believe it: Pricing for the devices tested averaged \$22,800, and Canon quoted us \$167 each for yellow, cyan and magenta toner cartridges, \$105 for black. The bright side is that enterprises that actively manage their document-output fleets can save 10 percent to 30 percent of their recurrent spending, according to Gartner. Usage stats regarding page-based leasing are available from every machine tested. If your organization prefers finer-grained accounting, make sure the model you want will provide it: HP's LaserJet 9500 lacks internal number-based accounting.

Each product performed reasonably well, but left us wanting in a few areas. For example, faxing has been supported on multifunction printers for a number of years, yet none of the devices tested have it down pat. Take the Xerox device: Although sending multiple page faxes from the document feeder on the device was straightforward, sending multipage faxes from the glass (physically putting each page down on the copier glass and sending them one at a time, rather than through the feeder) required a configuration option buried deep

Executive Summary

MULTIFUNCTION PRINTERS

We tested high-end multifunction printers from Canon, Hewlett-Packard, Ricoh, Sharp and Xerox in our University of Wisconsin-Madison Real-World Labs®. These are big machines—upward of 2 tons of gear crowded out our former human system recovery (nap) area. We focused on what IT should look for in a multifunction printer, namely security and management capabilities and ease of integrating the unit into your network. After evaluating these factors and considering feature sets, accounting and price, we awarded our Editor's Choice to the Xerox WorkCentre Pro C2636. It is an intuitive, well-designed printer with slick features.

within the system. We couldn't send multipage e-mail messages from the glass at all. The Sharp AR-BC320 shared this weakness: It let us send multipage faxes but not e-mail attachments. The HP LaserJet 9500 sent neither multipage faxes nor e-mail messages from the glass.

Red Alert

As we watched the vendor reps set up their devices, a scary thought occurred to us: Each multifunction printer has a secret code that would enable service technicians to bypass our security measures. The curse of an active imagination.

Speaking of security, one standout feature found in all the printers tested is the ability to print and hold jobs securely. Be careful, though: *Securely* means only that we could assign a secret number to a sensitive job at our desk before hitting "print." The job didn't print until we punched that code on the printer console. Managers who share a printer with their reports will appreciate this. Each copier also has hard-drive overwrite capabilities—for an additional cost.

Canon also provided us with its Canon's Copy Control Card System III. But it's, at best, as secure as a lock on a screen door. The access method to identify yourself and print secure jobs is a plastic punch card; we made working forgeries with a sheet of standard card stock, a copier and a razor blade. This method compares unfavorably with the standard, simpler, cheaper and stronger copy-number passwords.

Prince of Printers

Our Editor's Choice is the Xerox WorkCentre Pro C2636. It offered the best balance and integration among features, and we liked its simple drop-down menus and clear illustrations. The product sports slick features as well—for example, it can prevent one odd-ball job from becoming a bottleneck.

Let's suppose Fred orders a printout requiring paper

not loaded in the WorkCentre. Sue and Bill each print jobs on normal paper. The WorkCentre is the only printer we tested that will put Fred's job on hold and move Sue's and Bill's to print. As soon as Fred finishes his doughnut and loads his special paper, his job will proceed.

Xerox WorkCentre Pro C2636 The Xerox WorkCentre Pro was clearly built from the ground up as a



full-fledged multifunction printer, rather than just a printer or copier with extra features tacked on. We found the WorkCentre's console interface easy to use, thanks to flexible menus that Xerox calls "pathways." As mentioned, the provided driver was intuitive, offering a raft of complicated finishing options in a clear and consistent format.

Besides working around one-off print jobs, the product can natively authenticate to a variety of authentication servers, including NDS, SMB, Solaris Kerberos and Windows Kerberos. This let us apply strong authentication methods on the printers. However, we had to enter information on a small touch screen, which made typing passwords difficult.

Another, more serious limitation is that the authentication is good only for sending images over the network; it doesn't correlate to output accounting, which uses a separate database.



Like all the other devices except HP's LaserJet, the WorkCentre Pro performs standard numbers-based account management to track output per user; this is a must for organizations collecting usage metrics. Surprisingly, though, we couldn't manage this feature by way of the Web configuration pages. Creating accounts in bulk required a separate software tool (freely available from Xerox) to import and export accounting information over the device's USB port.

Faxing was straightforward and worked as expected.

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REPORT CARD

Multifunction Printers

	Xerox WorkCentre Pro C2636	Canon ImageRunner C3220	Sharp AR-BC320 Color Imager	Ricoh Aficio 2228C	Hewlett-Packard Color LaserJet 9500mfp
FEATURES (30%)	3.5	3.5	2.5	2.5	2
IT INTEGRATION (30%)	5	5	3.5	2.5	2.5
MANAGEMENT/EXTENDABILITY (30%)	4.5	2.5	4	3.5	2.5
PRICE (10%)	4	2	4	4	5
TOTAL SCORE (100%)	4.30	3.50	3.40	2.95	2.60
A≥4.3, B≥3.5, C≥2.5, D≥1.5, F<1.5 A-C GRADES INCLUDE + OR - IN THEIR RANGES. TOTAL SCORES AND WEIGHTED SCORES ARE BASED ON A SCALE OF 0-5.	A-	B-	C+	C	C-

IT INTEGRATION rates how well the printer assimilates into the network, interacting with standard databases and authenticating users, for example.

MANAGEMENT/EXTENDABILITY rates not only the ease of managing standard features, but also how easily IT can extend the device's capabilities by programming custom applications.

Customize the results of this report card using the Interactive Report Card®, a Java applet, at www.nwc.com.

We did miss some features found on rivals, including printing to fax directly from a Windows desktop and redirecting incoming faxes to an e-mail address.

In the image-sending area, all the products can query LDAP to find names and addresses, but the WorkCentre's touch-screen interface is by far the best and gave us plenty of information when multiple matches were returned. Searching LDAP is key to minimizing not only the amount of data entry required to get these products going initially, but also ongoing data maintenance.

WorkCentre Pro C2636, \$22,885. Xerox Corp., (800) 275-9376. www.xerox.com/office

Canon imageRunner C3220 The Canon ImageRunner, like multifunction printers from Ricoh and Sharp,

B has the air of an expensive copier supplemented with additional parts, all held together with software.

One feature we appreciated was being able to configure from one screen a default tray for any type of output job. We set our printouts to default to the top tray of the finisher; copies, to the tray beneath the scanner; and faxes, to the bottom tray of the finisher. Although the other printers also let you select the output tray for different printouts, such selections are typically broken out into subfeature options.

As mentioned, we tried and failed to get our hands on Canon's SDK. Fortunately, the \$3,955 third-party eCopy software loaded on our imageRunner was extremely flexible, providing three unique capabilities.

FYI

Photo Finish: The devices we tested came with multifunction finishers, remarkably useful devices that you won't find on most standard printers. Finishers let you staple, collate, fold, saddle stitch, hole punch and more. All the finishers tested will take a stack of printouts and rotate, assemble and staple them into booklets. If a multifunction printer is not in your budget, finishers are typically available separately for high-end standalone printers.

First, it let us preview documents before copying, faxing or e-mailing directly from the device's touch-screen interface. None of the other products offer this feature. Also, if we wanted to add, delete or replace a page, we could do so easily using a neat graphical display.

The second function we really liked was the ability to program buttons directly on the printer to do tasks. We could assemble a set of generic building blocks to perform complicated functions, then bind them to buttons; eCopy calls these "quick connects." We programmed our imageRunner to scan from itself to the laser printer in our lab. There are countless possibilities for these quick connects.

Finally, we like that eCopy lets outbound scans go through standard MAPI calls to an e-mail client, like Outlook. The scans then become part of the e-mail record, which is great for auditing requirements.

The system does have a number of drawbacks, however. As mentioned, security is lacking, and the printer as tested costs nearly \$8,500 more than the others we tested, not counting the eCopy application. On the bright side, as with all the multifunction printers we tested except HP's, pricing is à la carte. If you don't need analog faxing, you can save a few hundred bucks.

Finally, the imageRunner was the slowest to warm up. When you want to make your first printout or copy in the morning, send it before you grab a cup of coffee—it will take about six minutes for the device to awaken from deep power-save mode. The only other device that was nearly this slow was the LaserJet 9500, with a slightly better five-minute warm-up time from deep sleep. During the day, the imageRunner was ready within 30 seconds.

Canon imageRunner C3220, \$31,349; eCopy Share Scan, \$3,995. Canon USA, (800) OK-CANON, (516) 328-5000. www.usa.canon.com

Sharp AR-BC320 Color Imager The Sharp AR-BC320 is a decent multifunction printer with a good

C+ console interface and efficient client-side tools. The user interface clearly showed the machine. There are two "Go" buttons: one for color, the other for monochrome. The clear "Job Status" button quickly showed who was tying up resources and the print-fax and image-send queues. Finally, the system provides easy hooks to Sharpdesk, a Windows-based tool.

With Sharpdesk, we created several destination profiles on the AR-BC320. We entered items directly to the address book on the AR-BC320 for otherwise complicat-

WHEN IS A POUND NOT A POUND?

One thing to watch out for in the world of copiers and printers is the word *pound* in reference to paper. The pound rating—used predominately only in the United States, Canada and parts of Mexico—refers to the weight of 500 sheets, calculated on a standard basis size. For bond paper that basis is 17 inches by 22 inches. A standard 20-pound bond paper, cut into four sections of 8.5 by 11 inches, gives four, 500-page "letter"-size reams of 5 pounds each.

However, different types of paper—like cover, Bristol and index—have different basis sizes to determine the pound rating. For example, cover paper has a basis size of 20 inches by 26 inches. Therefore, a ream of cover paper with the same pound rating as bond paper will be lighter and flimsier.

To further complicate matters, each type of paper has several names. Bond paper is commonly called copier paper, cover stock is also known as card stock and Bristol is often called postcard stock.

The metric measurement, which we used in this article, uses a standard of GSM (grams per square meter) independent of the type of paper.

ed tasks. For example, one destination caused Sharpdesk to send out a scan through our local MAPI e-mail client. We also made destinations for PDF and TIFF image files and were able to OCR a document straight into Microsoft Word. One note about using OCR: We got much better results with a high resolution—the 200-dpi default resolution didn't work nearly as well as the 600-dpi high-resolution scan.

The AR-BC320 has the flattest physical print path of all the printers tested, and that lets it print on the heaviest paper—up to 300 gsm (equivalent to 170-pound

index paper; for more on paper weights see “When a Pound Isn't a Pound,” page 4). The Sharp AR-BC320 also offers the largest number of sheets—as many as 5,750 pages with a very large side-sheet feeder. Unfortunately, Sharp has dedicated an entire tray to an automatic duplexing unit, and that limits the number and types of non-Letter/A4 size sheets available.

Although we liked the device's touch screen, the on-console configuration menus are a hodgepodge—there's little to no organizational structure, and the menus are not consistent. For instance, on the key operator (super

Multifunction Printer Features

	Canon iR C3220	Hewlett-Packard Color LaserJet 9500mfp	Ricoh Aficio 2228C	Sharp AR-BC320 Color Imager	Xerox WorkCentre Pro C2636
Standard Features					
PPM BW/Color	32/32	24/24	28/20	32/26	36/26
Maximum resolution: copying	600x600 (1200x600 equivalent)	600x300	600x600	600x600	600x600
Maximum resolution: printing	600x600 (2400x600 equivalent)	600x600	1200x1200	600x600	1200x1200
Maximum resolution: scanning	600x600	600x600	600x600	600x600	600x600
Dual-size, one-pass scanning	N	Y	N	N	N
Standard input paper capacity (sheets)	1,200	3,100	1,100	750	1,140
Maximum input paper capacity (sheets)	5,000	3,100	3,100	5,750	3,140
First page out: BW/color	9.8/13.1	20/20	8.0/10	7.0/8.0	6.1/8.5
Maximum warm-up time from deep sleep (in minutes)	6	5	1:41	1:39	3
Internal number-based accounting	Y	N	Y	Y	Y
Touch screen	Y	Y	Y	Y	Y
Toner level monitored	Y	Y	Y	Y	Y
Hard drive overwrite option	Y	Y	Y	Y	Y
Log to syslog server	N	Y	Y	N	N
Runs NTP	N	Y	N	N	N
Energy Star compliance	N	Y	Y	Y	Y
Open architecture/available third-party apps	Y/Y	Y/Y	Y/Y	Y/Y	Y/N
IT integration					
LDAP & LDAP dynamic search	Y	Y	Y	Y	Y
MFP load LDAP into static address book	N	Y	N	N	N
Management					
On console/via HTTP/via Windows-only	Y/Y/Y	Y/Y/Y	Y/Y/Y	Y/Y/Y	Y/Y/Y
Via telnet	N	Y	Y	Y	N
SNMP support	Y	Y	Y	Y	Y
E-mail on error conditions	N	Y	N	Y	Y
Paper Handling					
Duty cycle	50,000	200,000	Vendor refused to disclose	48,000	100,000
Expected monthly print volume	5,000-30,000	6,000-8,000	8,000-50,000	40,000	8,000-30,000
Job queue	Y	N	Y	Y	Y
Queue accessible on front panel	Y	N	Y	Y	Y
Jobs requiring attention skipped	N	N	N	N	Y
Maximum image size	12x18	11.7x18.1	11x17	11x17	11.69x18.76
Maximum paper size	12.63x18	12.06x18.5	12x18	12x18	12x19
Paper trays autosense size	N	Y	Y	N	Y
Heaviest paper	266 gsm	220 gsm	163 gsm	300 gsm	220 gsm
Heaviest duplex	209 gsm	200 gsm	105 gsm	199 gsm	169 gsm

Y=Yes, N=No

user) menu, entries are not grouped logically, so we wasted a lot of time locating desired configuration items.

Sharp AR-BC320 Color Imager, \$22,540. Sharp Document Solutions Co. of America, (800) BE-SHARP, (201) 529-8200. www.sharppusa.com

Ricoh Aficio 2228C Of all the devices we tested, the Ricoh Aficio 2228C felt the most like a copier with additional features tacked on—in fact, many features felt barely connected. Even the Windows print driver seems underdeveloped.



The console interface was arranged in a logical man-

ner. One useful feature is the ability to choose from autocolour selection, full color, monochrome, single color or two-color copies. The single- and two-color copies are useful if you want only, say, black and yellow. Remember that printers work in CMYK (cyan, magenta, yellow and black), not RGB, so if you want red you'll be using two colors of toner even if you select "one-color" mode.

One of our major beefs with the Aficio is its Windows print driver. First, we had to install Ricoh's Smart-DeviceMonitor for Client, which installs a special TCP/IP printing port needed for the Windows driver to

Multifunction Printer Features (continued)

	Canon iR C3220	Hewlett-Packard Color LaserJet 9500mfp	Ricoh Aficio 2228C	Sharp AR-BC320 Color Imager	Xerox WorkCentre Pro C2636
Description Languages					
PostScript	PS3 (emulated, Adobe PS3 optional)	PS3 (emulated)	PS3 (optional)	PS3 (optional)	Y (emulated)
PCL5c	Y	Y	PCL5c (emulated)	PCL5c	Y (emulated)
PCL6	N	Y	N	N	N
PDF	Y	Y	N	N	Y
TIFF	N	N	N	N	Y
Printing Protocols					
Internet Printing Protocol	Y (1.1)	Y (1.0)	Y (1.1)	Y (1.0)	Y (1.0)
LPR/LPD	Y	Y	Y	Y	Y
Raw Socket (Port 9100)	Y	Y	Y	Y	Y
FTP	Y	Y	Y	Y	N
HTTP	Y	Y	N	N	Y
NetWare IPX/SPX	Y	Y	Y	N	Y
EtherTalk	Y	Y	Y	Y	Y
NetBEUI	Y	Y	Y	Y	Y
Print a URL	Y	N	N	N	N
Secure print	Y	Y	Y	Y	Y
Scanning					
To Windows desktop (direct)	Y	N	N	Y	Y
To e-mail/SMB/FTP	Y/Y/Y	Y/Y/Y	Y/Y/Y	Y/N/Y	Y/Y/Y
To document-management system	Y	Y	Y	Y	Y
PDF	Y	Y	Y	Y	Y
JPG/TIFF/MTIFF	Y/Y/Y	Y/Y/Y	Y/Y/Y	Y/Y/Y	Y/Y/Y
Maximum size	11x17	11x17	11x17	11x17	11.7x17
Copying N-UP copies	Y	Y	Y	Y	Y
Maximum number of copies	999	999	999	999	9,999
Administrator can set number of copies	N	N	Y	N	N
Stack of 8.5x11 -> 11x17 booklet	Y	Y	Y	Y	Y
Faxing					
Analog fax	Y	Y	Y	Y	Y
Internet fax (T.37)	Y (with Universal send kit)	Y	Y	N	Y
From PC	Y	N	Y	N	N
Forwarding	Y	Y	Y	N	N
Delayed sending	Y	N	Y	N	Y
Number of lines	1	1	1 (2 optional)	1	1 (2 optional)
Ports	Ethernet, USB	Bluetooth, 802.11b, Ethernet, IEEE 1284 (parallel)/1394 (FireWire), USB	Bluetooth, 802.11b, Ethernet, IEEE 1284 (parallel)/1394 (FireWire), USB	Ethernet, IEEE 1284 (parallel)/1394 (FireWire), USB	Ethernet, USB

Y=Yes, N=No

enable auto-updating features that other devices tested provide directly from their native drivers. If you have many Windows users, this could be a problem, depending on how you install your print drivers.

Also, by default the Aficio does not have its job queue enabled, meaning the device works exactly like a simple printer—it's online and potentially servicing a document, or offline so nothing can be submitted. If there is a fault in the Aficio, jobs cannot be submitted and may queue up on your users' workstations. With help from Ricoh, we managed to enable the queue through the telnet port.

Ricoh Aficio 2228C, \$20,775. Ricoh Corp., (973) 882-2000. www.ricoh-usa.com

Hewlett-Packard LaserJet 9500mfp Even though the HP LaserJet 9500mfp came in last



because of problems with its console interface and robustness, its color-image copies looked the best to us. We also liked the standard HP LaserJet functions, such as logging to a syslog server and running NTP, that are present on this platform. Although we found many of the on-console configuration menus difficult to operate, we configured the LaserJet 9500 through HP's freely available WebJet-Admin program.

HP is taking a different approach to multifunction

printers. The 9500mfp was reasonably priced—about half the price of the Canon imageRunner. In the right situation, it can provide tremendous bang for your buck.

HP only recently entered the multifunction printer space, and it shows. In copy mode, we disliked the on-screen display—features were hard to control, easy to reset to their defaults and tedious to re-enter. Furthermore, when copying from the glass, the 9500mfp doesn't indicate which copy it's working on. Also missing is internal accounting other than at the device level. With the 9500mfp, you'll live with device-level statistics or attach an external device to accomplish per-user accounting.

The 9500mfp can scan a two-sided document in one pass—it has a second scanner inside the document feeder. This makes the document feeder heavier, and we worry about the long-term reliability of a scanner inside a feeder that may be subject to significant jarring over time.

Hewlett-Packard Color LaserJet 9500mfp, \$16,516.50, with multifunction finisher and 2,000 sheet tray. Hewlett-Packard Co., (650) 857-1501. www.hp.com 

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