Summary Report

HP designjet 20ps Comparative Study:
vs. Epson Stylus Pro 5000, Epson Stylus Color 3000 *and* Epson Stylus Photo 1280

The *SpencerLab* Digital Color Laboratory has conducted independent comparative testing and evaluation of the **Hewlett-Packard designjet 20ps** color inkjet printer with server-based software RIP. The comparison evaluated *Throughput Speed Performance* and *Print Quality, including Pantone® color fidelity,* of the Hewlett-Packard designjet 20ps and the

- **Epson Stylus Pro 5000** with the EFI Fiery RIP Station 5000, the
- **Epson Stylus Color 3000** with the software Epson Stylus RIP, and the
- **Epson Stylus Photo 1280/1290**[1] with the software Epson Stylus RIP

Analyses utilized representative real-world documents from the *SpencerLab* Printer Test Suite[2], including graphic arts and professional office applications: desktop publishing, graphic design, proofing, and photographic reproduction. Pantone color fidelity analysis included the Hewlett-Packard designjet 20ps, the Epson Stylus Pro 5000, and the Epson Stylus Photo 1280. Analyses utilized proprietary files specially designed to measure Pantone accuracy.

Although this evaluation was sponsored by Hewlett-Packard, *SpencerLab* is an independent test laboratory with a broad base of industry clients and a well-earned reputation for the integrity of its test procedures and analyses. Results stated herein are based upon testing of actual products believed to be representative.

Summary

Based upon these tested documents, the Hewlett-Packard designjet 20ps provides graphic design professionals with *breakthrough graphics throughput speed at the top level of print quality and color accuracy.*

The Hewlett-Packard designjet 20ps was the fastest printer in nearly all of the tests. It outperformed the other printers on all graphic intensive documents. Among the six-color printers – including the Epson Stylus Pro 5000 and the Epson Stylus Photo 1280 – it was faster on all test documents.

Providing excellent print quality, including tints, blends, memory colors, flesh tones and unmatched Pantone color reproduction fidelity – the HP designjet 20ps *establishes a leadership position in the wide-format field for on-demand check prints, proofs and comps.*

Throughput Speed

Methodology

Four test document files were selected from the *SpencerLab* Printer Test Suite to represent an appropriate range of user applications for this comparative group of inkjet printers:

- *Castle* (Adobe Photoshop 6.0 TIFF, A3-size, 2 copies) – sRGB photograph
- *Catalog* (Adobe InDesign 1.5/Acrobat 5.0 PDF, B-size) – text, color graphics, proofing
- *Dragon* (Adobe Illustrator 9.0, B+-size) – computer-generated CMYK illustration
- *Newsletter* (QuarkXPress 4.11, A-size, 2 copies) – mixed text, color graphics and photo

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Mode selection was based upon their applicability to similar user scenarios and the content of each document file. Since there is a wide range of print quality among the tested printers, for meaningful throughput speed analyses it was deemed necessary to test the higher quality printers in the test – the HP designjet 20ps and the Epson Stylus Pro 5000 (SP5000) – in comparable print quality modes. Quality comparisons went well beyond the addressability ("resolution") specification, including evaluations of each type of document element: text, graphics, image, and color issues. While the four-color Epson Stylus Color 3000[3] (SC3000) throughput times may sometimes reflect quicker processing and printing, it is noted that the print quality of the six-color HP designjet 20ps, Epson SP5000 and even the Epson Stylus Photo 1280 (SP1280) were generally superior. To complete each scenario, representative media was chosen for each file according to estimated user preference or vendor recommendation[4], as shown below:

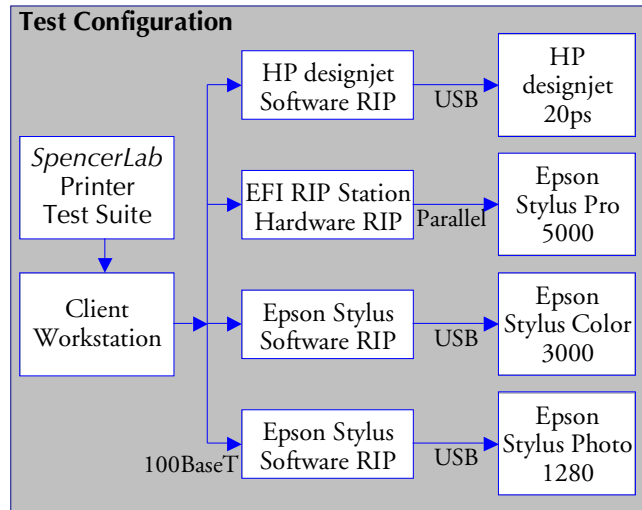|	HP designjet 20ps	Epson SP5000	Epson SC3000	Epson SP1280
Castle	**BEST** Proofing Gloss	**PHOTO QUALITY GLOSSY1440DPI** Photo Quality Glossy Paper		**PREMIUM GLOSSY PHOTO** Premium Glossy Photo Paper
Catalog	**PREMIUM** Proofing Semi-gloss	**PHOTO QUALITY GLOSSY 1440DPI** Matte Paper–Heavyweight		**HEAVYWEIGHT MATTE 1440DPI** Matte Paper–Heavyweight
Dragon	**BEST** Proofing Matte	**PHOTO QUALITY 1440DPI** Matte Paper–Heavyweight		**HEAVYWEIGHT MATTE 1440DPI** Matte Paper–Heavyweight
Newsletter	**NORMAL** Premium Inkjet		**INKJET 720DPI** High Quality Inkjet Paper	

All time measurements begin with the REQUEST-TO-PRINT. The measurement of LAST PAGE OUT, sometimes referred to as TOTAL PRINT TIME or "CLICK-TO-CLUNK", was augmented by measurements of APPLICATION and WORKSTATION RELEASE, SERVER ACQUISITION and RELEASE, ENGINE START, and FIRST PAGE OUT times. These times are shown graphically for each test document, as in the example below.
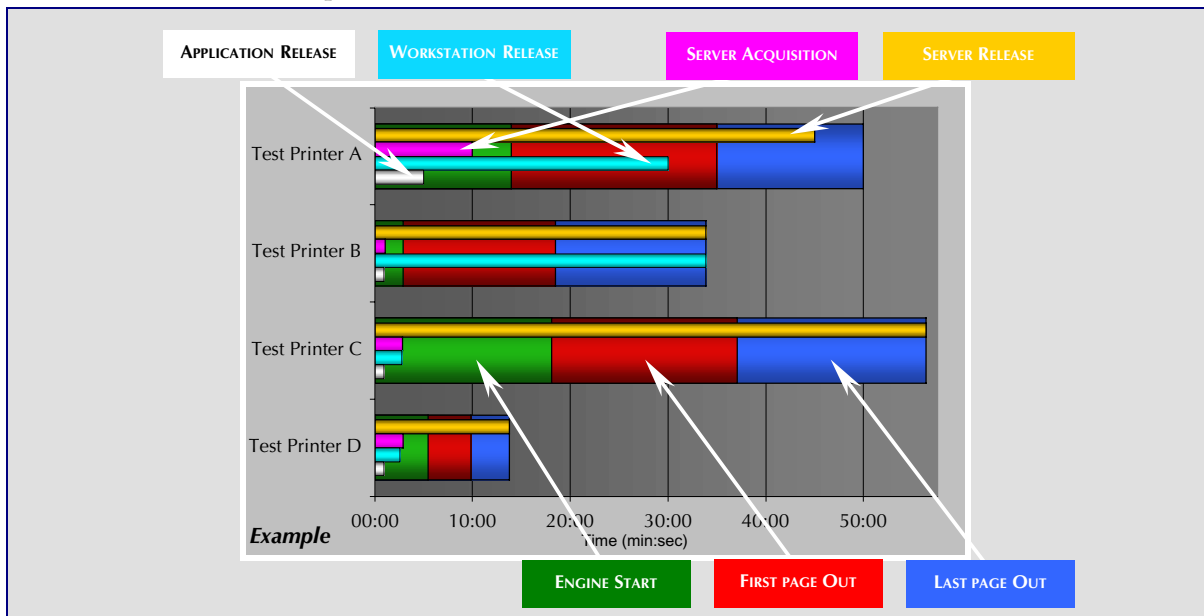
Directly impacting user workflow, APPLICATION and WORKSTATION RELEASE times allow the user to continue working and their workstation to return to full processing power, respectively. SERVER ACQUISITION and RELEASE mark the start and end of the RIP time. ENGINE START time (indicated by a mechanical action or perceptible sound) provides important feedback to the user – that the print request has begun physical printing. MECHANICAL PRINT TIME on multi-copy documents was calculated as the time between the FIRST and LAST PAGE OUT, divided by the
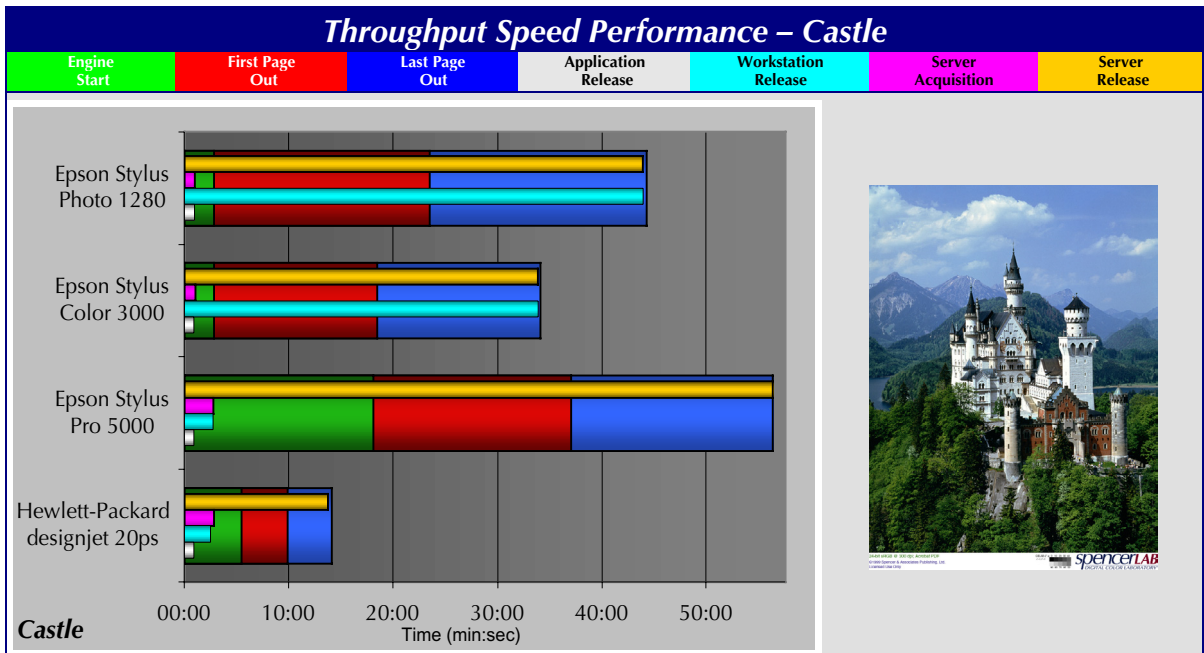
number of pages between them. All timings are recorded for each test document over several iterations to assure accurate results[5].

Testing was performed using a client/print server configuration. The client workstation was a 350MHz PowerMac G4 with 256 MB RAM running Mac OS 9.1; it was connected to the print servers via 100BaseT through a 10/100BaseT hub. The software RIPs were installed on a print server, a 733MHz PowerMac G4 with 128 MB RAM running Mac OS 9.2, which was connected one-at-a-time via USB to the HP designjet 20ps, Epson SC3000 and Epson SP1280. The hardware EFI RIP Station 5000 was connected via Parallel to the Epson SP5000.

Test Configuration

SpencerLab Printer Test Suite	HP designjet Software RIP → USB	HP designjet 20ps
Client Workstation	EFI RIP Station Hardware RIP → Parallel	Epson Stylus Pro 5000
	Epson Stylus Software RIP → USB	Epson Stylus Color 3000
100BaseT	Epson Stylus Software RIP → USB	Epson Stylus Photo 1280

Test Results

Throughput Speed Performance testing demonstrated a Hewlett-Packard designjet 20ps print speed advantage over the competition. The six-color HP designjet 20ps was faster than the other six-color printers, the Epson Stylus Pro 5000 and the Epson Stylus Photo 1280, in all documents tested. It was also faster than the four-color Epson Stylus Color 3000 in the three graphically intensive out of the four test documents. The SC3000 was the fastest printer in this test when printing the text-intensive *Newsletter* at comparable quality.

Throughput Speed Performance – Castle

| Engine Start | First Page Out | Last Page Out | Application Release | Workstation Release | Server Acquisition | Server Release |

Castle — Time (min:sec)

The Hewlett-Packard designjet 20ps processed and printed the *Castle* file in *approximately one-fourth the time* required by the Epson SP5000 printer. The HP designjet 20ps completed LAST PAGE OUT in 14:10[6], whereas all Epson printers tested considerably slower – the corresponding time of the Epson SP5000 was 56:24, almost four times slower (298% longer time), the Epson SC3000 was 34:06, more than 1.4 times slower (141% longer), and Epson

SP1280 was 44:17, more than three times slower (213% longer). The MECHANICAL PRINT TIME of the HP designjet 20ps was 4:17, as opposed to 19:23 on the Epson SP5000, 15:36 on the Epson SC3000, and 20:50 on the Epson SP1280.

Throughput Speed Performance – Catalog
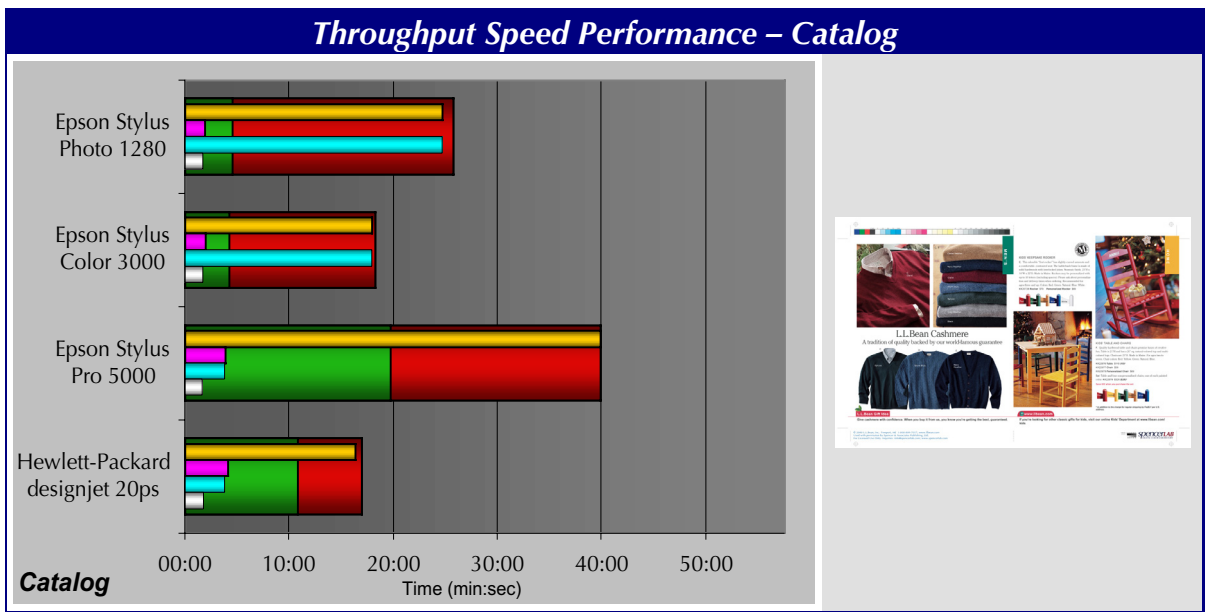
Catalog

On the *Catalog* file, the HP designjet 20ps completed LAST PAGE OUT in 17:01, while the Epson SP5000 took more than twice as long with a time of 39:56 (137% longer). The Epson SC3000 took 18:16 (7% longer), and the Epson SP1280 had a time of 25:51 (52% longer).

Throughput Speed Performance – Dragon

Asian Dragon
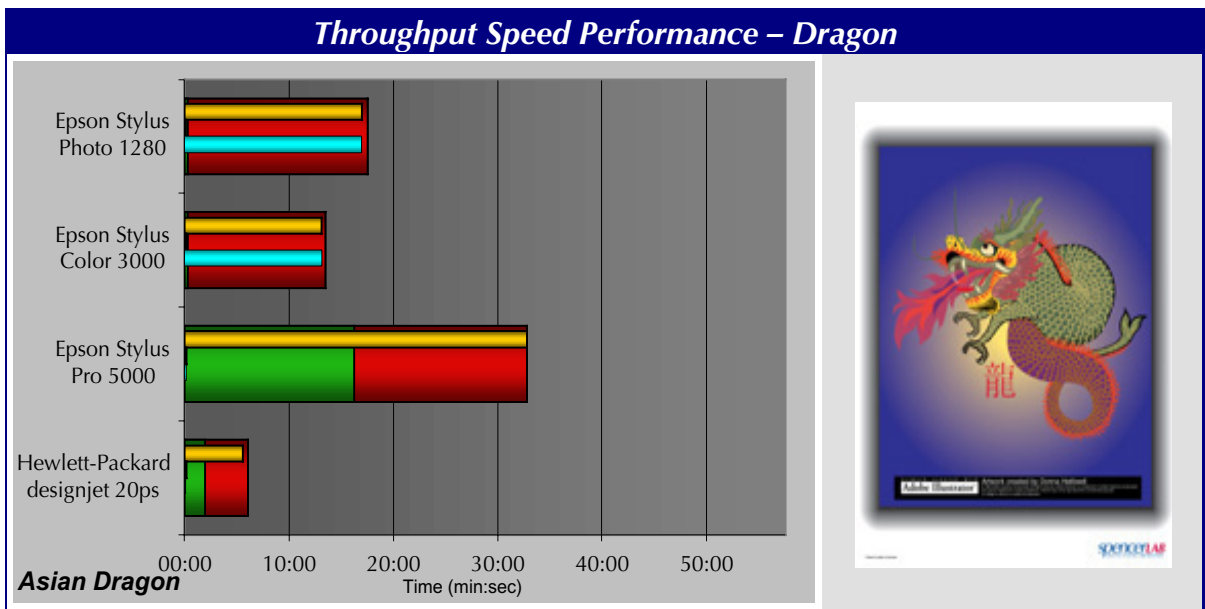
On the *Dragon* test file, the HP designjet 20ps at 6:01 was more than five times faster than the Epson SP5000, which completed printing in 32:50 (446% longer). It was over twice as fast as the closest Epson competitor, the SC3000, which completed printing in 13:26 (123% longer). The SP1280 at 17:31 took almost three times as long (191% longer).

Throughput Speed Performance – Newsletter
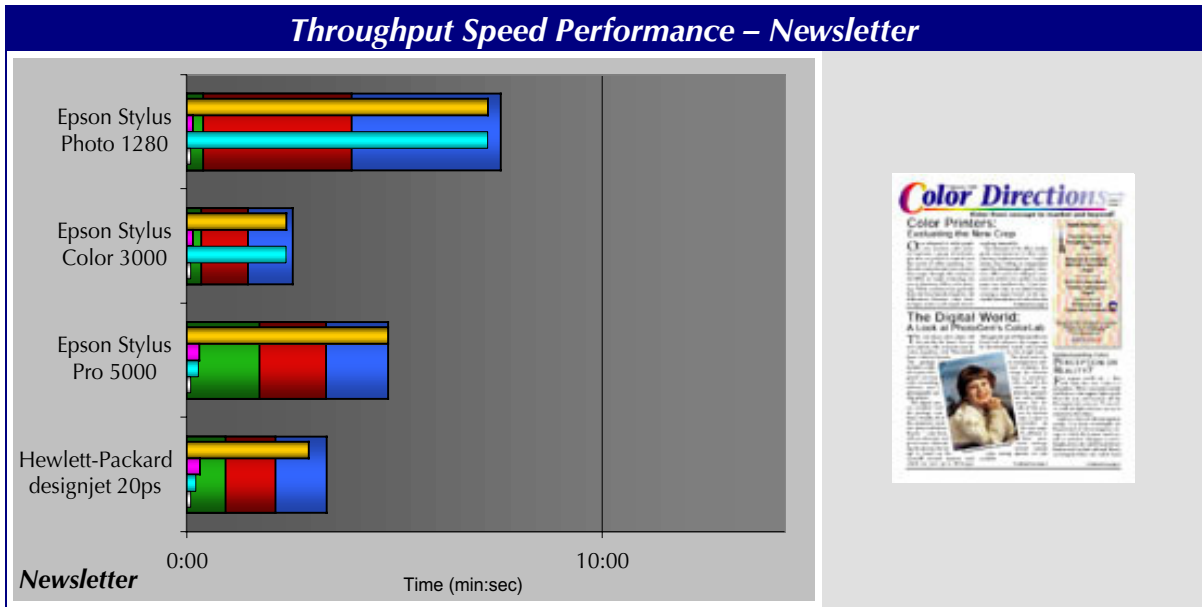
The HP designjet 20ps completed printing of the *Newsletter* file in 3:23. However, the four-color Epson SC3000 was the fastest printer in this test; at 2:33 it was fifty seconds (25%) faster than the designjet 20ps. At 4:50 the SP5000 was slower (43% longer) than the designjet 20ps, while at 7:35 the SP1280 took more than twice as long (124% longer) as the designjet 20ps. MECHANICAL PRINT TIME of the HP designjet 20ps was 1:14; while the SC3000 was correspondingly faster at 1:05, the SP5000 and SP1280 were slower at 1:30 and 3:36, respectively.

Print Quality Analysis

Methodology

A range of test documents from the *SpencerLab* Printer Test Suite was printed on each of the printers in a range of print modes, after printer setup and alignment. These test documents included current versions of the *Color Spectrum, Graphic,* and *Graphic RGB* PostScript programs, originally developed as part of the *Color Hardcopy Quality Factors* study series. Also included were images and application test documents from the suite, covering a range of printing appropriate for the graphic arts market. Print Quality was analyzed by element type (*e.g.*, color text, graphics, tints, blends, and images) across these test documents. The HP designjet 20ps was acquired from Hewlett-Packard prior to commercial release; a single printer of each competitive type was used in analysis and all printers are assumed to be representative of production units.

Pantone color fidelity analysis was performed using propriety *SpencerLab* test files, including over 940 Pantone coated spot colors. CIE $L\!*\!a\!*\!b\!*$ measurements (D50 illumination, 2° Observer) of actual printer output were compared with current Pantone data[7] and errors were calculated in deltaE (∂E) units – one ∂E is sometimes considered the minimum observable color difference, but there is some variation through the gamut and among observers. Both the HP designjet 20ps and the Epson Stylus Pro 5000 are Pantone-certified. All Pantone color fidelity testing was performed on media and modes recommended by each manufacturer; although the SP1280 is not certified, Epson recommends use of Stylus Photo 1270 settings.

Analysis Results

For the graphic arts market, the Hewlett-Packard designjet 20ps offers excellent print quality. In image reproduction, both the HP designjet 20ps and the Epson Stylus Pro 5000 produced

realistic flesh tones and memory colors, with very comparable overall quality. Shadow and highlight details rendered on both the HP designjet 20ps and the Epson SP5000 are of excellent quality. The SC3000 provided lower quality output; while it held detail well, its overall darker images caused some loss of shadow detail. The SP1280 rendered images with a greenish cast, which many users may find problematic; it held the least detail, rendering images with a relative lack of sharpness.

In tints and blends, the HP designjet 20ps rendered well-saturated colors, with only some minor contouring. Using process black[8], some tints rendered with a mottled appearance; however, mottling was more prevalent and visible on the SP5000, which also had less saturation of colors than the HP designjet 20ps. The SP1280 produced somewhat lower quality tints and blends. The SC3000 produced tints and blends with severe non-linearities and significant visible screening.

In text and lines, both the designjet 20ps and the SP5000 produced solid, sharp characters and lines with only minor bleed and splatter. On black text, the SP5000 produced more bleed and splatter, whereas the HP designjet 20ps exhibited some minor edge roughness and misregistration[9]. Even reverse text was rendered smooth and sharp on both printers, but the designjet 20ps' process black had less contrast. Both the Epson SC3000 and the SP1280 rendered black text comparably to the designjet 20ps, with the SP1280 also offering excellent fine line reproduction.

Color Fidelity. In Pantone color proofing accuracy, the Hewlett-Packard designjet 20ps can afford the graphic designer with a superior in-house tool. The designjet 20ps reproduced over 900 Pantone coated colors with a median error of only 4.70 ∂E; these errors include out-of-gamut colors as well as in-gamut colors that are not accurately reproduced. In comparison, the SP5000 had a median error of 7.38 ∂E, some 57% larger. The SP1280 (which is not certified) had a median error of 10.65 ∂E or 127% larger – more that twice that of the designjet 20ps.

Pantone Color Reproduction Fidelity
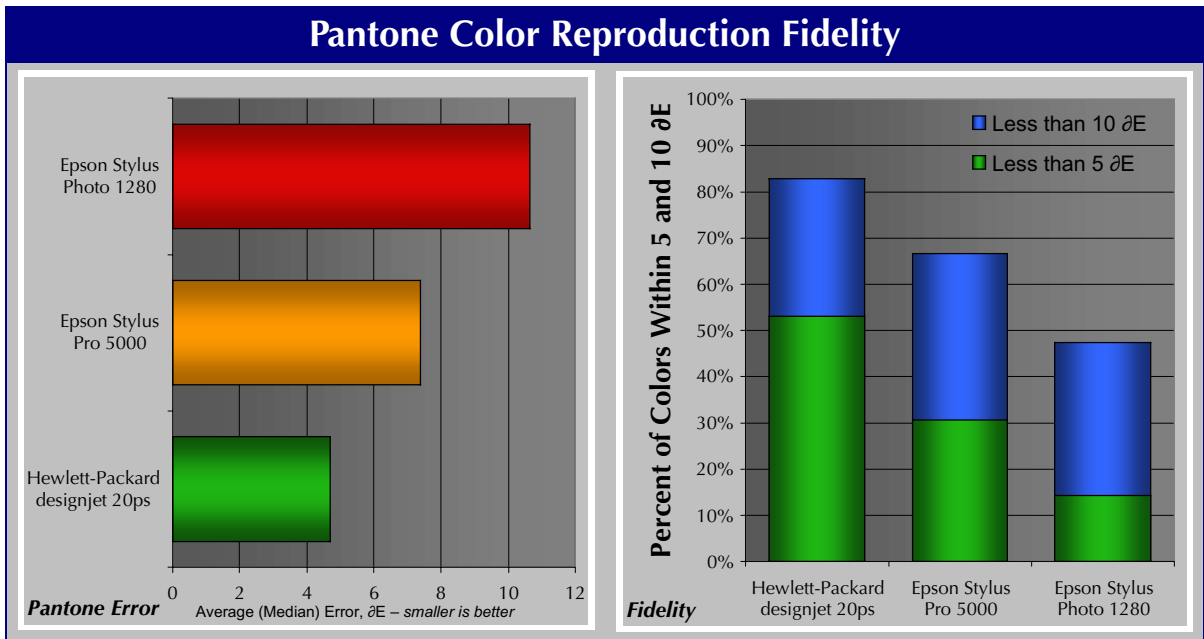
As can be seen from the graph, 53% of the Pantone coated spot colors were reproduced by the HP designjet 20ps within an accuracy of 5 ∂E, while only 31% of the SP5000 Pantone reproductions and only 14% of the SC1280's met this criterion. Correspondingly, 83% of the designjet 20ps spot color reproductions were within 10 ∂E, while only 67% of the SP5000's and

47% of the SP1280's met this objective. As noted above, these errors include out-of-gamut colors as well as in-gamut colors that are not accurately reproduced. These results imply that the designjet 20ps has better color fidelity and the largest useful gamut of the tested printers.

For applications heavy in graphics and image reproduction and proofing, in these tests the HP designjet 20ps provided top print quality as well as superior throughput performance.

About *spencerLAB*

The *SpencerLab* Digital Color Laboratory is an independent printer evaluation laboratory that provides services to vendors and corporations for whom color printing is mission-critical. The Laboratory follows strict guidelines in the integrity of both methodology and reporting; vendor-sponsored studies do not guarantee favorable results. *SpencerLab* has developed industry-standard test software, and performs print quality, throughput speed, cost-per-page and ink and toner cartridge yield, and ease-of-use analyses for color and monochrome printers in all technology classes, from inkjet and laser printers to digital color presses.

SpencerLab is operated by Spencer & Associates Publishing, Ltd., a premier information technology consulting boutique specializing in the application of Digital Color Technology to all aspects of color imaging. For over a dozen years Spencer & Associates has been providing strategic support to manufacturers in product planning, development, and launch. Color printing workflow analysis, print system selection, and usage optimization services are provided to corporate users.

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[1] The Epson Stylus Photo 1290, available outside the USA, is believed to be equivalent.
[2] The *SpencerLab* Printer Test Suite, now in ßeta, is an extension of Spencer & Associates' *Color Hardcopy Quality Factors* test suite, a de facto industry standard since 1990.
[3] The Epson Stylus Color 3000 was the only four-color printer included in this comparative testing; all other printers were six-color. Four-color printers may reflect a speed benefit at the expense of six-color print quality.
[4] Driver and media settings were confirmed as the correct combination of driver and media settings through Epson web-based support services.
[5] Repeatability is within one percent or one second.
[6] Minutes:seconds.
[7] This data was provided under non-disclosure, courtesy of Pantone.
[8] The pre-production test unit did not have full access to non-process black.
[9] These judgments were determined from individual sample printers, assumed to be representative.