ipa special report

IPA Color Proofing RoundUP Results- 2005

This special report includes analysis and results of the 3rd Annual IPA Color Proofing RoundUP, an independent, comprehensive and systematic analysis of twenty-seven unique color proofing systems, held in conjunction with the 2005 IPA Technical Conference.

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INTRODUCTION

The 3rd Annual IPA Color Proofing RoundUP for 2005 was conducted during the IPA Technical Conference, June 7-9, 2005, in Chicago, Illinois, USA. The objective of the Color Proofing RoundUP is to provide graphic solutions providers with a comprehensive understanding of available color proofing solutions and to identify key issues affecting color proofing. Twelve (12) RoundUP participants, constituting a "Who's Who" in the color proofing industry, submitted proofs from 27 systems for evaluation.

A team of experienced color managers evaluated the visual correlation of color proofs to GRACoL (General Requirements for Applications in Commercial Offset Lithography) press sheets. Colorimetric measurements were separately made to determine (Lab Delta E) correlation to press sheet reference characterization data.

In addition to color image quality, systems were tested for spot color support and PDF compliance (color management support and RIP performance). In-depth feature comparisons, including system pricing, maintenance and per proof consumable costs, are provided for each system.

The IPA Proofing objectives…..

- Provide a systematic and accurate method to compare color proofing systems.
- Provide a comprehensive, independent evaluation of today's color proofing systems.
- Allow industry members to make informed buying decisions about color proofing systems.

The Color Proofing RoundUP consisted of the following evaluation categories and this effort was led by the following persons:

- Colorimetric Delta E test - Abhay Sharma, Western Michigan University
- Visual tests – matching proofs to a press sheet - Tom Collins, Quad/Graphics
- Soft proofing – matching images on a monitor - Ray Cheydleur, X-Rite
- Spot color simulation - Steve Smiley, Vertis
- PDF/X-3 compliance – Florian Suessl, MetaDesign

NOTE: Every effort was made to conduct accurate assessments. The reader is cautioned to view these results in the context of the potential sources of variability in the testing process, including the subjective evaluations by judging personnel. We recommend you consult individual proofing suppliers with any specific system performance questions. No one proofing system is right for everyone; therefore, graphic solutions providers should examine their own workflow and customer needs when considering a proofing system.

OVERVIEW

For the 2005 Proofing RoundUP, 12 suppliers entered proofs for evaluation representing 27 separate proofing systems; 20 were hardcopy systems and 7 were softcopy systems. As shown in Figure 1, 3 systems (11%) were traditional proofing systems, 7 systems (26%) were soft proofing systems, while most (17) systems (63%) were based on inkjet technologies.

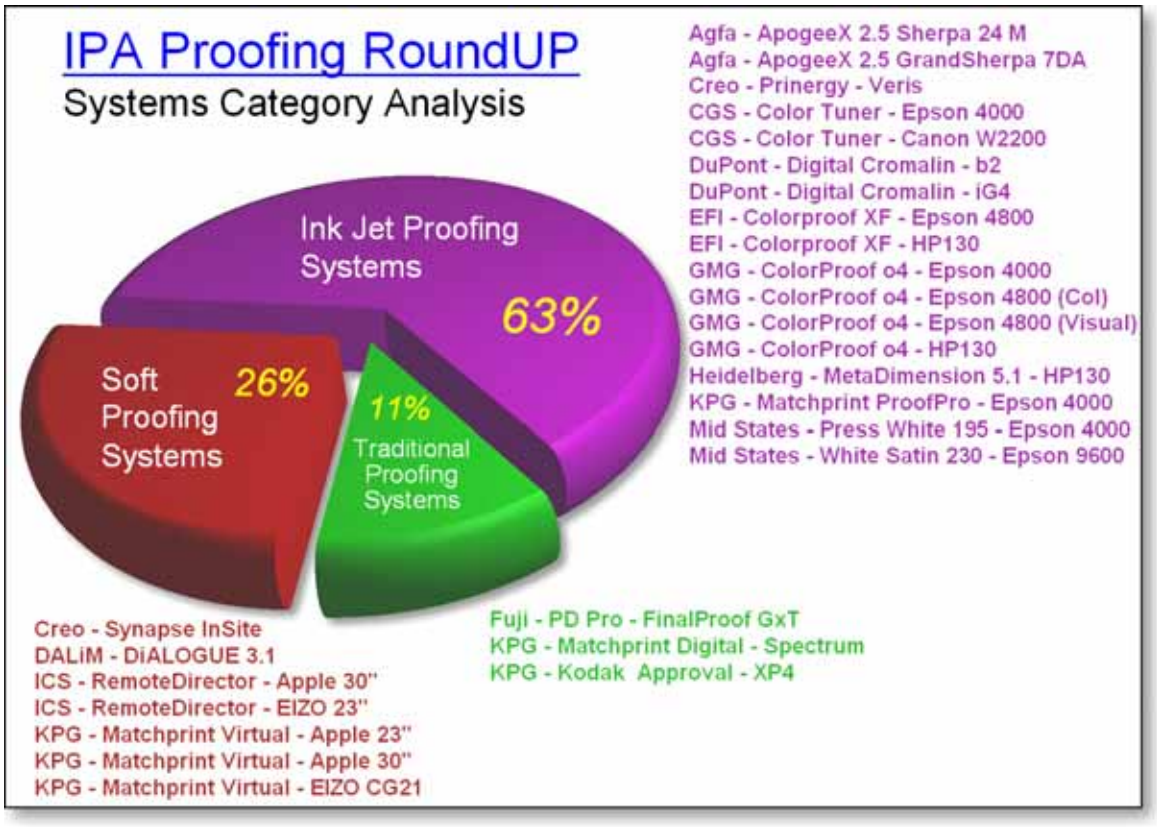


Figure 1: Analysis of the proofing entries in terms of traditional proofers, soft proofing and inkjet proofing shows traditional proofing is being edged out.

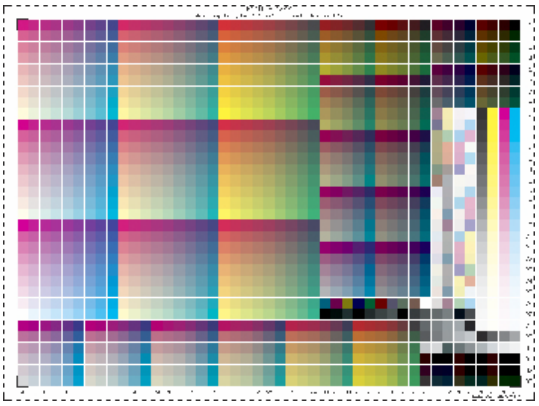
Colorimetric Tests

Participants in the RoundUP were provided with a GRACoL certified press sheet (see Figure 2) and were required to produce proofs that were a visual match to the press sheet images. Participants were also required to submit an ECI 2002 Visual target (see Figure 3) matching averaged measurements from a set of GRACoL press sheets. Participants were not allowed to optimize for each evaluation separately.

Measurements were made before the conference using two GretagMacbeth SpectroScan devices. CIE Lab Delta E was calculated between the proofs of the ECI 2002 image compared to the provided press sheet characterization data. The proofer sheets (and press sheets) were measured in two modes – unfiltered or UV filtered.

Figure 2: The IPA Color Proofing RoundUP tests were based on GRACoL press sheets printed at Integrity Graphics in January, 2005. Two copies of the press sheet were made available to each participant.

Figure 3: The colorimetric test was based on the ECI 2002 visual target. Suppliers were required to proof this target and submit it for measurement.



Visual Evaluation

At the conference, subjective visual match was assessed (0-10 rating scale) between proofs of Visual Image 1 and Visual Image 2, Figure 4, and a GRACoL certified press sheet. For soft proofs, a subjective visual match was assessed (0-10 rating scale) between soft proofs displayed on a monitor and the press sheet.

Visual Image 1

Visual Image 2

Figure 4: Visual Image 1 and Visual Image 2 contain images from the press sheet. These images were proofed by the suppliers and compared in a light booth to the press sheet.

Spot Color Simulation

The spot color test form contained 11 solid colors with defined CIE Lab values, tint values and a 4-channel spot color image. Colorimetric Lab measurements were made to assess the capability to simulate spot color solids. Subjective visual assessment of the test page was conducted to assess the ability to maintain tint hues consistent with the solids, highlights and the 4-color image.

Figure 5: The test file for the spot color evaluation was a PDF containing 11 solid spot color elements and tint values for those colors. A 4-channel image is also included in the test.

PDF/X-3 Support and Embedded Output Intent Support

Participants were asked to proof the Altona Visual and Altona Technical pages from the Altona Test Suite (Figure 6) to assess RIP (Raster Imaging Processor) capabilities, overprint correctness, spot-color and color management support.

The process tested the capability of the proofer RIP to automatically detect the output intent profile and use it for proofing. This feature is useful for both PDF/X-1a and PDF/X-3 workflow paths. Also, the test determined the capability of the RIP to apply all color conversions as defined in a PDF/X-3 file. The test file was published to the suppliers via the web site on Monday, June 6th, the day before the IPA Technical Conference commencement.

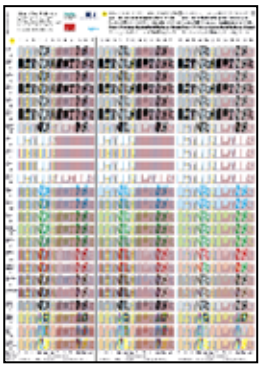


Figure 6: Participants were asked to proof the Altona Test Suite Visual and Technical pages to assess RIP capabilities, overprint correctness, spot-color and color management support.

Feature Comparison and Pricing

Proofing system features were identified in a checklist that includes imaging technology, RIP information, proofing speed, process control support, remote proofing support, media options, technical support, color stability, automatic calibration, duplex capability, and PDF/X and JDF support, plus features not included in the basic checklist give systems special value. Pricing for systems and consumable costs are also tabulated. Details of this tabulation are shown at the end of this report.

EXECUTIVE SUMMARY

Colorimetric Test

Comparison of ECI 2002 Visual Measurements to IPA Characterization Data

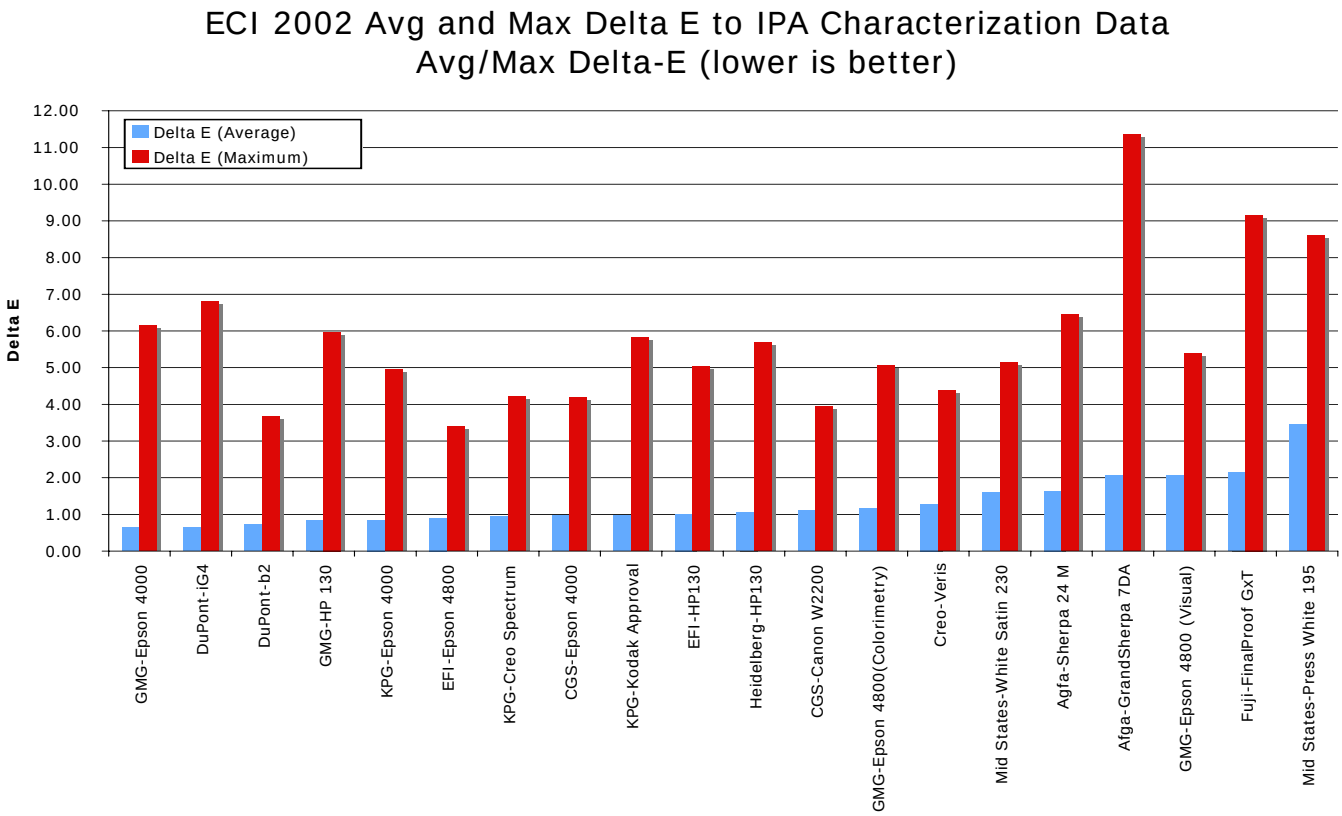


Figure 7: Delta E comparison of proofer ECI 2002 Visual Measurements to IPA Characterization Data

Comments / Observations:

1) Entries are ranked in order with the most accurate on the left.
2) Most systems are able to achieve a very good average Delta E < 2.0.
3) IPA Characterization data refer to the GRACoL averaged press sheet data.
4) Estimated overall measurement uncertainties are 0.3 Delta E average and 1.0 Delta E max due to issues of repeatability, inter-instrument agreement, UV influence, backing, and color stability.
5) Many systems are statistically equivalent considering the uncertainty interval of 0.3 Delta E.
6) Soft proofing systems were *not* measured for colorimetric match and are not included in this graph.
7) Rankings for Delta E max clearly do not always correlate with average Delta E.
8) Multiple metrics (different Delta E equations) are provided in other parts of this document.
9) It may appear entries are now at the limit of Delta E. There is little room for further improvement as the results are at the limit of instrument repeatability, inkjet and press stability and the Delta E numbers are at the limit of human vision discernability.
10) See supplementary documentation for details on procedures and other issues.

Visual Color Matching

Visual Match to GRACoL Press Sheet

Note: Higher score is better

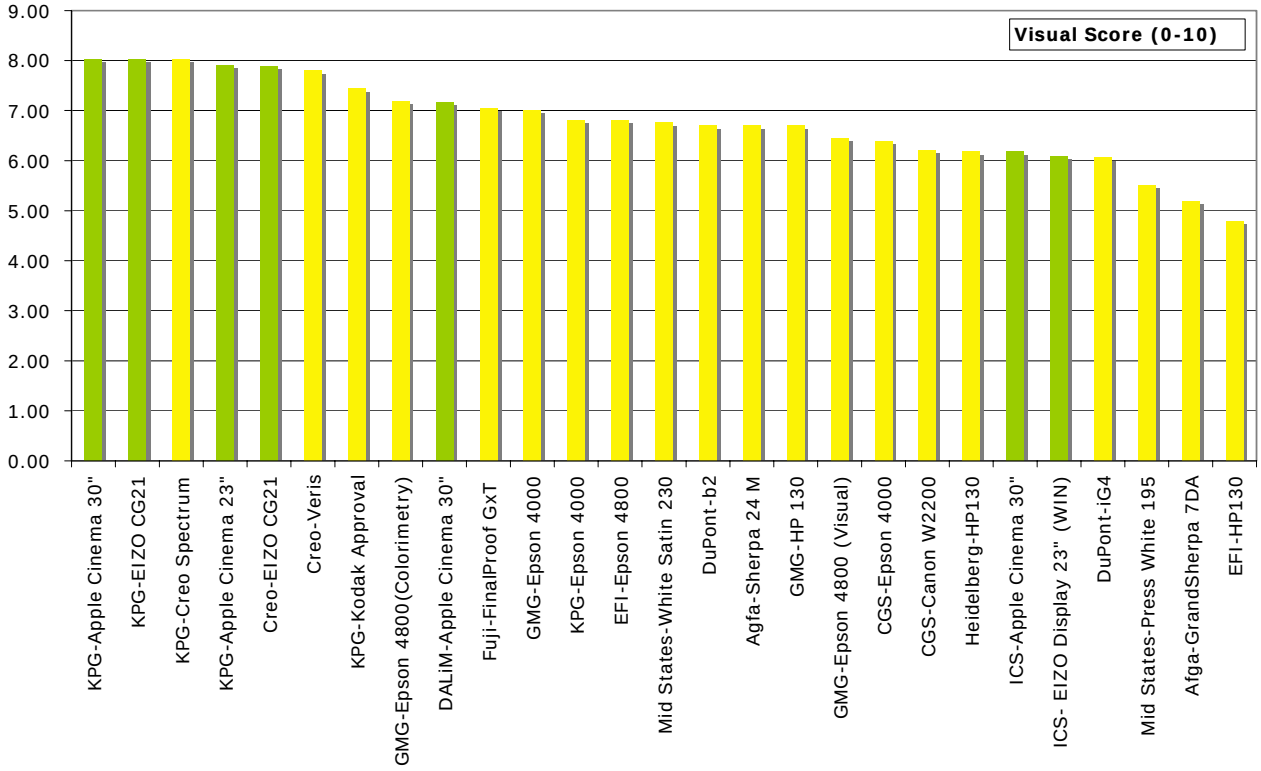


Figure 8 Judges' Visual score when comparing proofs to GRACoL press sheet. Soft proofing systems are shown in green.

Comments / Observations:

1) The graph shows the subjective evaluation of seven categories by twelve viewers experienced in color evaluation.
2) Soft proofing and hard copy systems were subject to the same evaluation procedures.
3) Soft copy and hard copy proofs were compared to a press sheet in a viewing booth.
4) Graphs of results in individual categories correlated well to overall average, see further details in later sections.
5) Note 4 of the 5 of the top preferred proofing systems are soft copy systems.
6) Visual results correlated moderately, with colorimetric results.

Spot Color Measurement

Solid Spot Measurements Compared to Target Lab Values

Delta E between Pantone® Target Lab values and measured values
Avg Delta-E (lower is better)

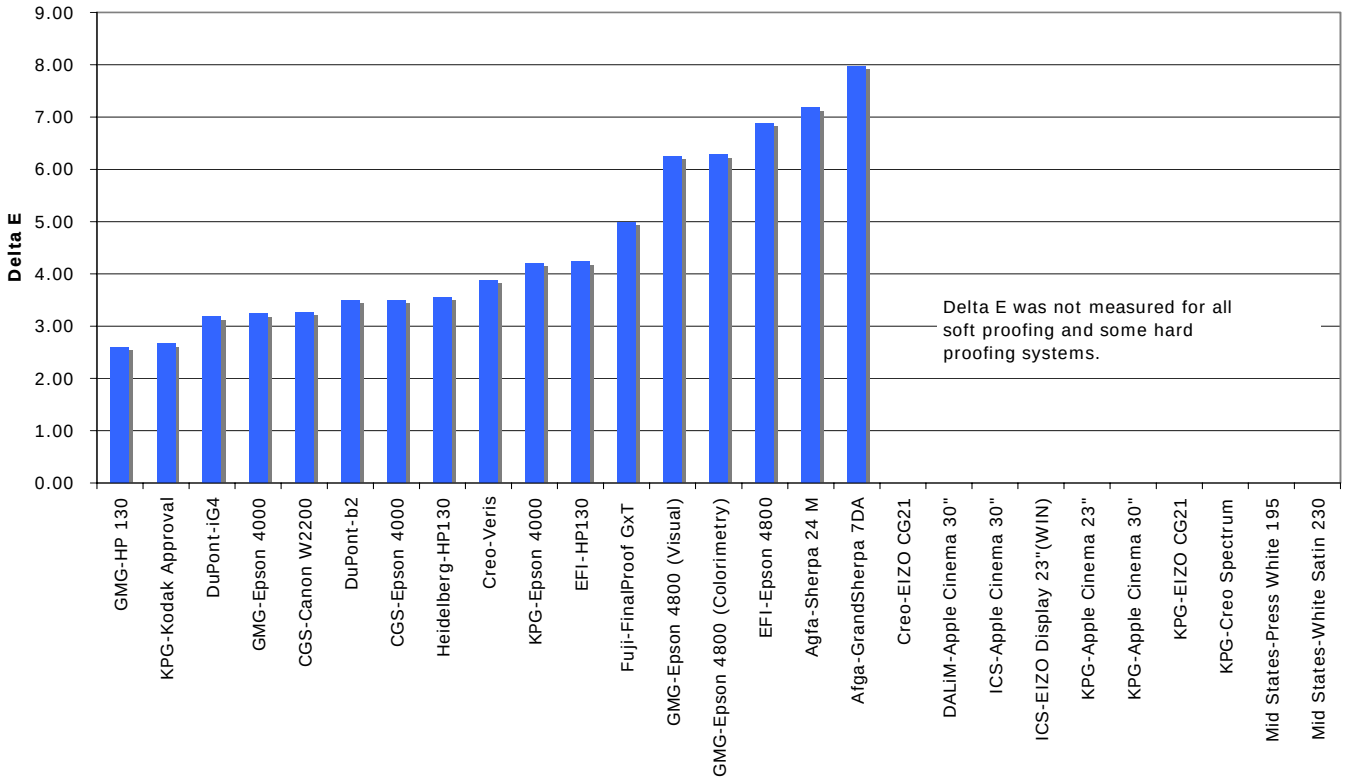


Figure 9: Delta E between Pantone Target Lab values and measured values Average Delta-E (lower is better).

Comments / Observations:

1) Illustrates colorimetric challenge of various spot colors, some of which were not within the gamut of typical proofing systems or typical press characterizations.
2) Average Delta E measure not adequate to determine specific spot capabilities. Future tests need more comprehensive evaluation procedures.
3) Results depend on color management as well as gamut of the particular ink/paper used.

Spot Color Visual

Visual Evaluation to Pantone Spot Color Books

Visual evaluation comparing solids and tints to Pantone Color Books
Average of judges visual rating (Higher score is better)

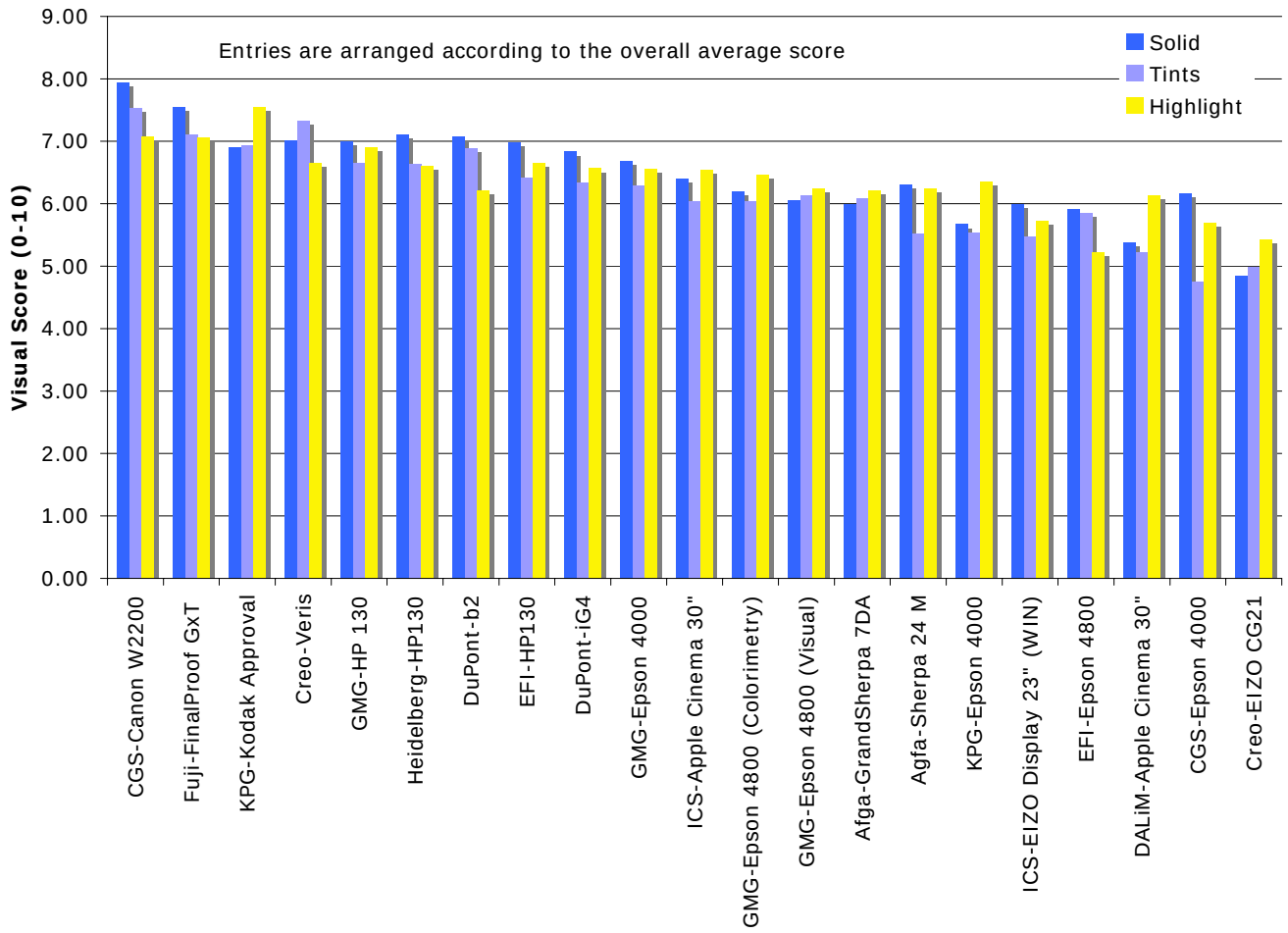


Figure 10: Visual evaluation comparing solids and tints to Pantone Color Books average of judges' visual rating (Higher score is better).

Comments / Observations:

1) Score is average of expert visual comparison (0-10) to Pantone color book.
2) Soft proofing systems were included.
3) While there is a general correlation to measured colorimetric evaluations, there are notable exceptions where visual assessment fared much better. Solids, tints and highlights generally showed the same pattern for each supplier.

Altona Test Suite Evaluations

Technical and Visual Pages from the Altona Suite
Evaluated for Conformance to PDF/X Standards

System	Supplier	RIP	Output Device	Color Management	CMYK Process Color Definitions	Spot Color	Smooth Shades	Font Errors	Overprinting Errors
A1	Agfa	ApogeeX 2.5	Sherpa 24 M					0	0
A2	Agfa	ApogeeX 2.5	Grand Sherpa 7DA					0	0
C1	Creo	Prinergy	Creo Veris					0	0
C2	CGS	Color Tuner	Epson 4000						
C3	CGS	Color Tuner	Canon W2200					0	0
C4	Creo	Synapse InSite	Eizo CG21					0	0
D1	DuPont		Digital Cromalin-B2					0	0
D2	DuPont		Digital Cromalin-iG4					0	0
D3	DALiM	DiALOGUE 3.1	Apple Cinema 30"					0	18 errors
E1	EFI	Colorproof XF	EPSON 4800					0	0
E2	EFI	Colorproof XF	HP130					0	0
F1	Fuji	PD Pro	FinalProof GxT					0	0

Figure 11: (continued on next page)

Color Key for Figure 11:

Softproof

passed

failed

no submission

same RIP - other output device

System	Supplier	RIP	Output Device	Color Management	CMYK-Process Color Definitions	Spot Color	Smooth Shades	Font Errors	Overprinting Errors
G1	GMG	ColorProof 04	Epson 4000					0	0
G2	GMG	ColorProof 04 (colorimetry)	Epson 4800						
G3	GMG	ColorProof 04 (visual)	Epson 4800						
G4	GMG	ColorProof 04	HP 130						
H1	Heidelberg	Meta Dimension 5.1	HP 130					0	0
I1	ICS	Remote Director 3.0.1 (MAC)	Apple Cinema 30"						
I2	ICS	Remote Director 3.0.1 (WIN)	Eizo Display						
K1	KPG	Matchprint Virtual	Apple Cinema 23"						
K2	KPG	Matchprint Virtual	Apple Cinema 30"						
K3	KPG	Matchprint Virtual	EIZO CG21						
K4	KPG		Matchprint Digital						
K5	KPG	MPPP 1.0	Epson 4000						
K6	KPG		Approval						
M1	Mid States	Press White 195	Epson 4000					0	0
M2	Mid States	White Satin 230	Epson 9600					0	0

Figure 11: (continued from previous page)

Comments / Observations:

1) Altona Test Suite and documentation available at www.eci.org.
2) Results show significant improvement from last year with several systems having perfect scores.
3) Pass/Fail (P/F) recorded for entire Technical Page and elements 24, 26-38 on Visual Page.
4) Errors in Visual elements 34-38 correspond to ICC Rendering Intent support.

DETAILED ANALYSIS

IPA Characterization Data

One objective of the IPA Proofing RoundUP for 2005 was to use and evaluate the GRACoL reference printing conditions. Many of the tests in the RoundUP are based on the GRACoL-like, Grade 1, gloss coated press sheet printed at Integrity Graphics, CT, in January 2005 (see Figure 2). Sheets were printed according to GRACoL 6.0 solid ink densities. The sheet contains SCID and other images, SID patches, the IT8.7/4 target and the Hutch205204aR target. Larry Steele (RGB Metrology) measured more than 100 press sheets using an X-Rite 530 with status T densitometry and determined the following characteristics for this press run, Figure 12.

GRACoL 6.0	Cyan	Magenta	Yellow	Black
SID aim values	1.40	1.50	1.05	1.70
Press sheet average	1.53	1.54	1.01	1.85
Allowed variation ± 0.10				
TVI aim values	20	20	18	22
Press sheet average	18	19	17	19
Allowed variation ± 3%				

Figure 12: Analysis of more than 100 press sheets showed the press run was within GRACoL 6.0 guidelines.

A subset of 35 sheets (closest to the GRACoL aim values) was identified. A GretagMacbeth SpectroScan was then used to measure the IT8.7/4 target from each of these press sheets. The spectra of each IT8.7/4 patch was measured from which CIE XYZ was calculated, averaged and then converted to CIE L*a*b* (D50/2˚).

Data from the 35 sheets were averaged. From this averaged data, the patches corresponding to the ECI 2002 target were extracted. The extracted ECI 2002 data are called the "IPA RoundUP Characterization Data Set". The above procedure was completed twice, once in unfiltered mode (GretagMacbeth U filter) and once with a UV filter (GretagMacbeth UV filter); see Figure 13. Therefore we have the following two data sets

IPA RoundUP Characterization Data Set – unfiltered (IPA05Gracol-NoFilt.txt)
IPA RoundUP Characterization Data Set – UV filter (IPA05Gracol-UVFilt.txt)

These data sets were used to judge the colorimetric accuracy of the supplier provided proofing systems.

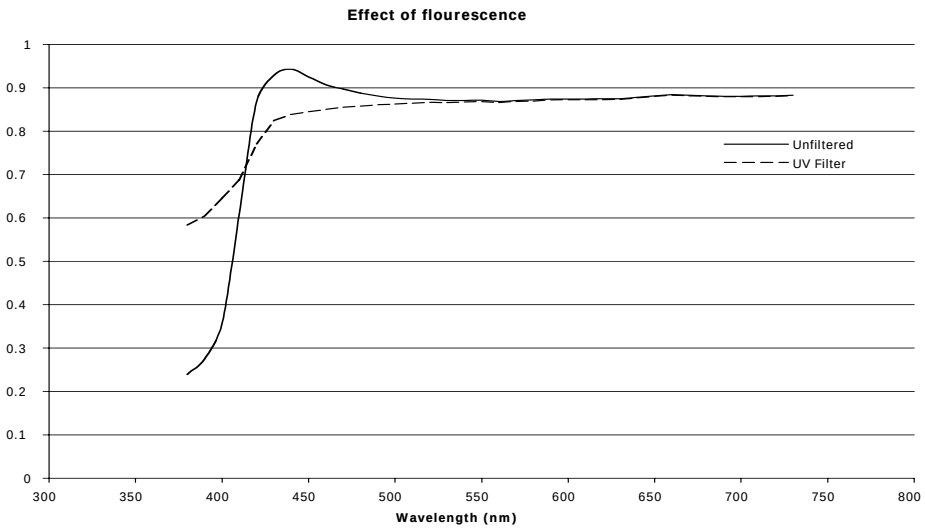


Figure 13: Analysis of the Integrity Graphics press sheet with and without UV excitation in the measurement system.
Thanks to William Li, Creo for suggesting this graph.

UV radiation causes excitation of optical brighteners in paper and emission of this energy in the visible (blue) part of the spectrum serves to brighten the paper. This effect changes the measured paper color, as shown below:

Press sheet L*a*b* with unfiltered measurement	94.6, +0.8, -1.6
Press sheet L*a*b* measured with UV filter	94.6, -0.2, +2.2

Analyses of the data are from the 35 press sheets show very little variation within the press run. For reference see Figure 14.

	Average Delta E between a press sheet and the average of the 35 press sheets was in the following range	***Maximum*** Delta E between a press sheet and the average of the 35 press sheets was in the following range
Unfiltered measurement set	0.28 – 0.47	0.97 – 2.02
UV filter measurement set	0.27 – 0.47	1.09 – 2.12

Figure 14: The average and maximum Delta E of each press sheet is compared to the average of the 35 press sheets. Data based on the IT8.7/4 target.

What is the correlation between the measurement system used at RGB Metrology and an instrument at Western Michigan University? The same press sample was measured at both sites on different SpectroScan devices. The data in Figure 15 suggests the instrumental differences are within expected tolerances.

	Average DE between a measurement at RGB Metrology and WMU	**Maximum** DE between a measurement at RGB Metrology and WMU
Unfiltered measurement set	0.34 (0.30)	1.08 (0.80)

Figure 15: Correlation between instrument at RGB Metrology and WMU.
Figure in parenthesis is supplier's quoted Delta E for inter-instrument agreement on BCRA tiles.
Data is based on the IT8.7/4 press sheet target.

The differences in Figure 15 incorporate instrument repeatability, inter-instrument agreement, differences between older SpectroScan and new (purple) device, and differences in how LAB is calculated. Differences in how LAB is calculated arise because RGB Metrology calculates LAB from spectral data while WMU uses GretagMacbeth MeasureTool.

In further "process control," the instruments were monitored prior to measuring each participant's samples. Six printed patches were measured at the start of the process and again prior to measuring each participant's samples. Figure 16 shows the Delta E stability of the instruments to the test patches. An X-Rite 530 spectrodensitometer was used to measure the spot color entries.

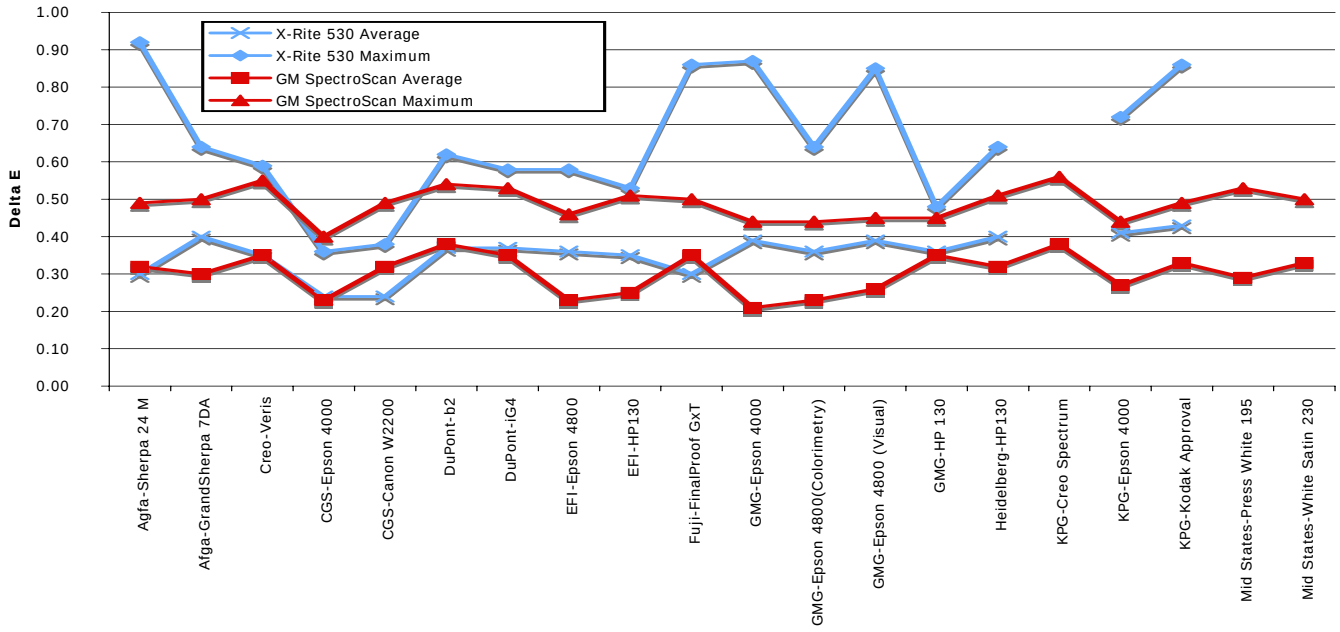


Figure 16: Stability of the system was monitored by measuring six printed patches at the start and then prior to measuring each participant's sample.

Colorimetric Tests

Results of the "Colorimetric Tests" part of the IPA Proofing RoundUP are based on a colorimetric (CIE L*a*b* DE) correlation of the supplier entry (proofer sheet) to the IPA RoundUP Characterization Data Set (press sheet). Suppliers print the ECI 2002 target on their proofing system, submit the target, the target is measured and compared to the IPA RoundUP Characterization Data Set. Suppliers are only allowed to use the ECI 2002 visual layout. Suppliers are free to choose between unfiltered or UV filtered measurement.

To create their entry, suppliers downloaded from the web site an unprofiled, CMYK TIFF image of the ECI 2002 Visual test target, (see Figure 3). The supplier configured their proofing system to match the press, represented by the IPA RoundUP Characterization Data Set. The supplier printed the ECI 2002 target to the specified physical dimensions and sent the hardcopy proof to Western Michigan University (WMU) by the stipulated date for measurement. The physical printed size of the ECI 2002 target was specified at the top of the chart image.

WMU measured the target on a GretagMacbeth SpectroScan with no filter (U) or UV filter (UV), white backing, no polarizing filter, and no paper backing. The supplier specified - no filter (U) or UV filter (UV). WMU measured CIE L*a*b* (D50/2˚) values for each patch using GretagMacbeth MeasureTool. The measured supplier data were compared to the relevant CIE L*a*b* values of the IPA RoundUP Characterization Data Set to determine average DE and maximum DE. Additional DE metrics, such as DE (cmc) were also computed (see Figure 17).

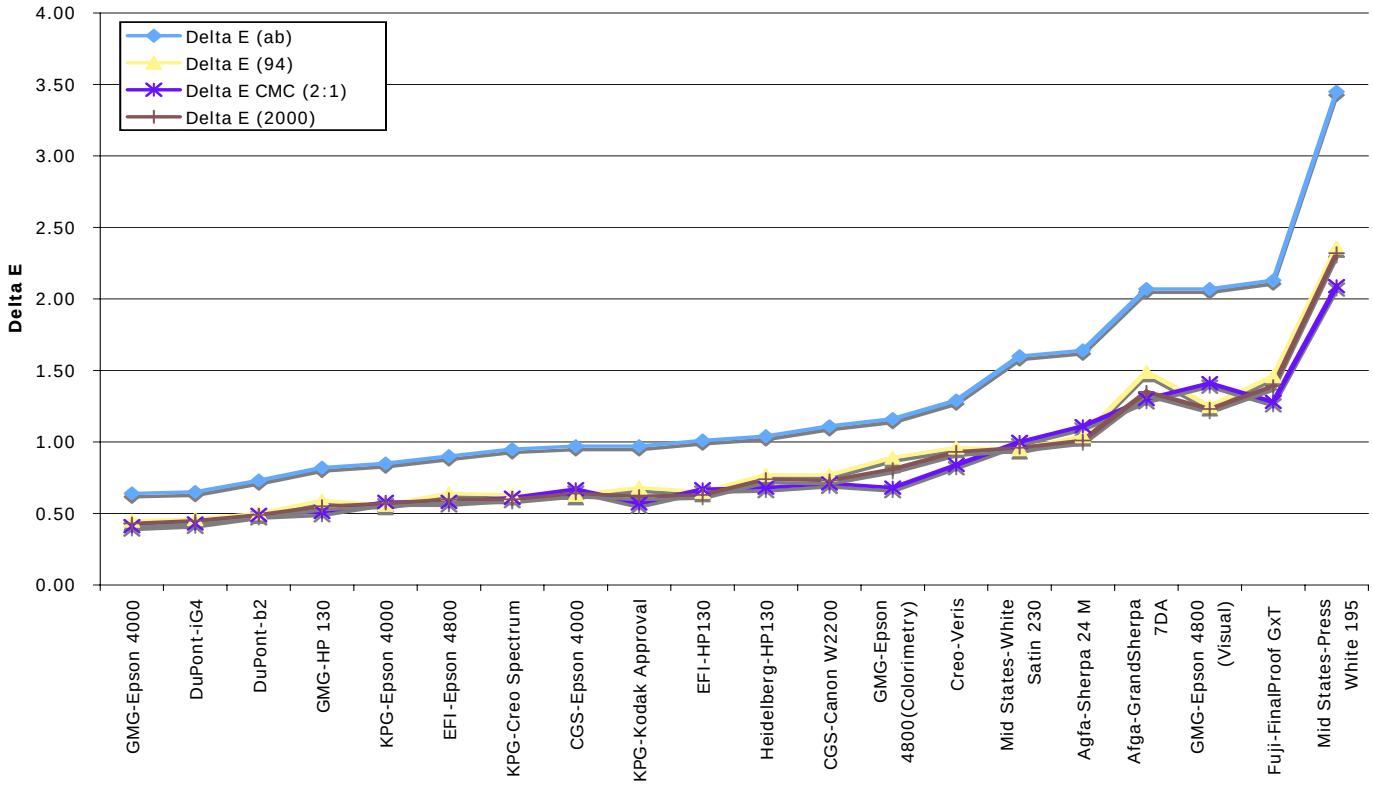


Figure 17: Different Delta E metrics are compared to traditional Delta E(ab). We see all "newer" metrics are about 50% of Delta E(ab).

While individual GRACoL certified press sheets also can be used to produce characterization data, it should be noted the IPA Characterization Data is an averaged set of data from 35 press sheets and is expected to be (slightly) different from any individual GRACoL press sheet measurement. To avoid confusion in this work we used the IPA Characterization Data and not any individual GRACoL press sheet measurements.

The average Delta E of all the suppliers was Delta E of 1.30. In last year's 2004 RoundUP, the average Delta E was 2.67. Please keep in mind, 1.0 Delta E is defined as a just noticeable visual difference. In conjunction with the simple average Delta E other metrics should also be considered. In particular, it is important to look at the maximum Delta E. So the best systems should exhibit a low mean Delta E and also a low max Delta E (see Figure 7).

Visual Evaluation

Suppliers should prepare their systems to provide a colorimetric match to the IPA RoundUP Characterization Data Set as well as a visual match to the imagery on the press sheets. Proofing stock or paper simulation should match press sheets as closely as possible. Suppliers are instructed to use the same setup for both types of data. In other words, suppliers are to produce the ECI 2002 target and the visual pages, without changing their printer configuration. The IPA team may choose to measure test patches on the visual image to verify the visual images and the test targets were indeed printed using the same configuration. Figure 18 shows the Delta E difference between some test patches measured on the visual sheets and the same color patches on the ECI 2002 target to ensure participants did not change their set up between printing the ECI test target and the visual images.

In most cases there was little difference which suggests suppliers obeyed the rules and used the conditions as requested by IPA. Only DuPont's Digital Chromalin b2 had an issue. Thanks to Dick Presley, KPG for suggesting this test.

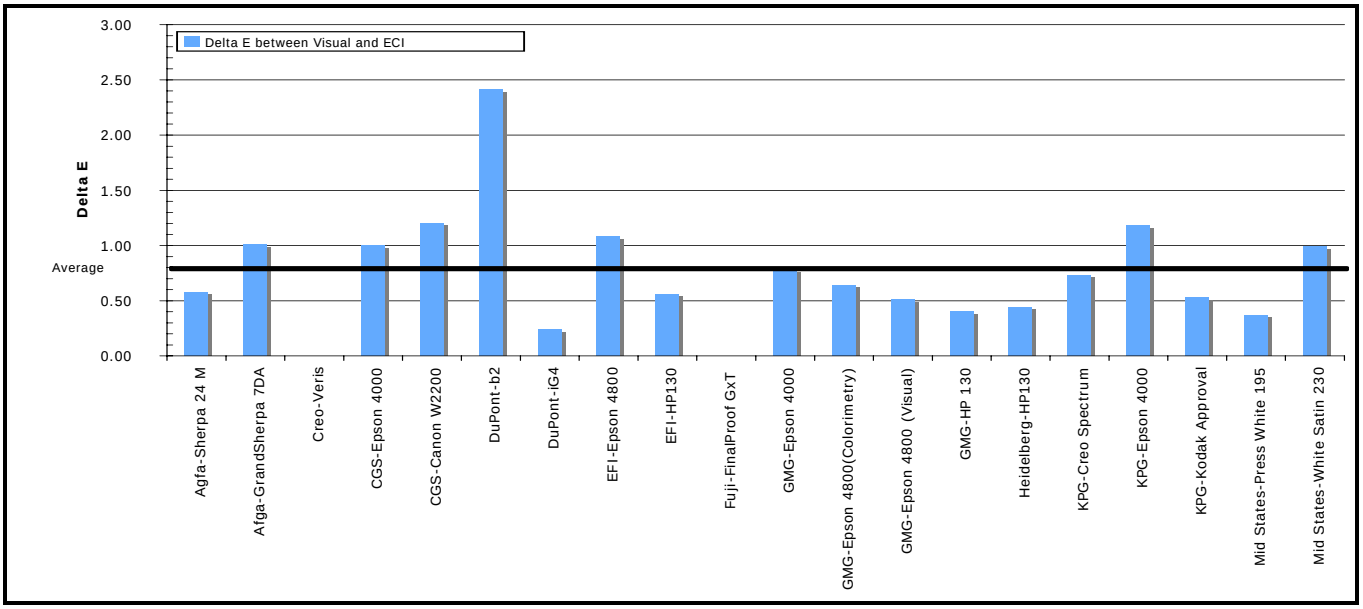


Figure 18: The Delta E difference between some test patches measured on the visual sheets and the same color patches on the ECI 2002 target to ensure participants did not change their set up.

To proof the images, suppliers were expected to download Visual Image 1 and Visual Image 2 (see Figure 4) from the web site. These TIFF image files had been constructed from the press images. The images were to be printed according to the given physical dimensions. The proofs were to be sent to WMU by the stipulated date but were to be assessed at the Technical Conference in Chicago, Illinois.

This part of the RoundUP focused on the traditional method of evaluating proof quality: subjective visual impression of match to a set of reference images.

Visual evaluation of proofing systems was conducted in a manner meant to control, as much as possible, the purely subjective nature of the process. In addition to calculating an overall visual score, an attempt was made to see if any correlation could be found between visual score and colorimetric rating. The visual target consisted of a selection of images taken from the full GRACoL sheet.

For each system, visual match (0-10 rating scale) between proofs of Visual Image 1 and 2, and the IPA RoundUP Press Sheet images was assessed by both expert and attendee groups. The questions the judges used are provided in the Appendix to this report. A separate sheet was used by each judge. The judge's data were averaged. The proofs were numbered anonymously, and any supplier-specific data in the proofed sheet was trimmed from the print.

The supplier's own press sheet was not used. Suppliers were invited to bring their specific press sheet to the conference in instances where they believe there may be a significant difference between their press sheet and the press sheet being used by IPA.

The comparison between proofed Visual Image 1 and 2, and the IPA RoundUP Press Sheet was conducted in a light booth. A press sheet was placed in the viewing booth and samples were placed along side. The GTI EVS-2540/FS light booth was used provided a 25" x 40" viewing area on a floor stand. The booth contained standard, GTI supplied, fluorescent T8 slim lamps with a high CRI (93-95) D50 illuminant. The lighting may be described as "low UV." In the colorimetric test section, suppliers may have requested measurement with unfiltered or UV filter configuration; *however during evaluation of the visual proofs there was only one viewing booth configuration as described above. There were no sleeves or filters used on the light source.* It was necessary to consider room lighting conditions so room lights were dimmed during this evaluation.

The results of this test are shown in a simple bar chart (see Figure 8) with the suppliers ranked according to the average score awarded by the judges.

The judging form asked the judge to evaluate the proof on seven different criteria, on a scale of 1 to 10, with 1 representing serious imbalances of color, and 10 being a virtually perfect proof.

The proofs were judged on the following categories:

- Gray balance
- Saturation
- Contrast and weight
- Flesh tones
- Accuracy of vignettes
- Visible artifacts
- Other (paper color, glossiness, sensitivity to angle)

Note the first three factors on the subjective form relate directly to the familiar colorimetric units of L*C*H*.

The next two factors (flesh tones and vignettes) attempt to evaluate areas not directly expressed in colorimetry. The visible artifacts question addresses visible flaws and artifacts, and the last question addresses the "intangibles" fit into no other category. The final question is changed in cases where a soft proofing station is being judged.

Three GRACoL sheets were placed into the viewing areas of the three GTI viewing booths, and, in the case of soft proof systems, into their respective viewing booths. For the smaller soft proofing viewing booths the participants were allowed to cut the press sheets into smaller pieces.

The 12 judges were broken into groups of three, with equal numbers placed within each viewing booth. Each group of three judges went to work scoring the proofs in their booth. When finished, they returned the proofs to the package and selected the next supplier packet. Each group started at a different "first" packet which introduced a desired level of randomness to the order of judging. The nature of soft proofing systems prevented anonymity; however, random order was maintained by rotating groups of judges as in the hard proof evaluations.

Judges were allowed to talk among themselves and compare notes; however, a panel consensus was not voted on but was calculated from combined scores.

Judges were selected from the roster of event attendees, based on their job descriptions as hands-on color experts. All judges work in the field of graphic arts production. Persons affiliated with proofing manufacturers were excluded.

Results from all judges were averaged. The final scores ranged from a high of 8.02 to a low of 6.09. The relatively narrow range of scores seems to reflect the overall closeness of color match among most of the entries.

In Figure 19, the performance of each proofing system has been graphed for the "color" categories, showing clearly the tight clustering around the overall trend. It was thought some systems would excel in particular areas, such as gray balance, but fare poorly in others, such as flesh tones. In reality, while this did happen in some cases, the stronger pattern was for all five categories of "color" judging to cluster closely along a common trend.

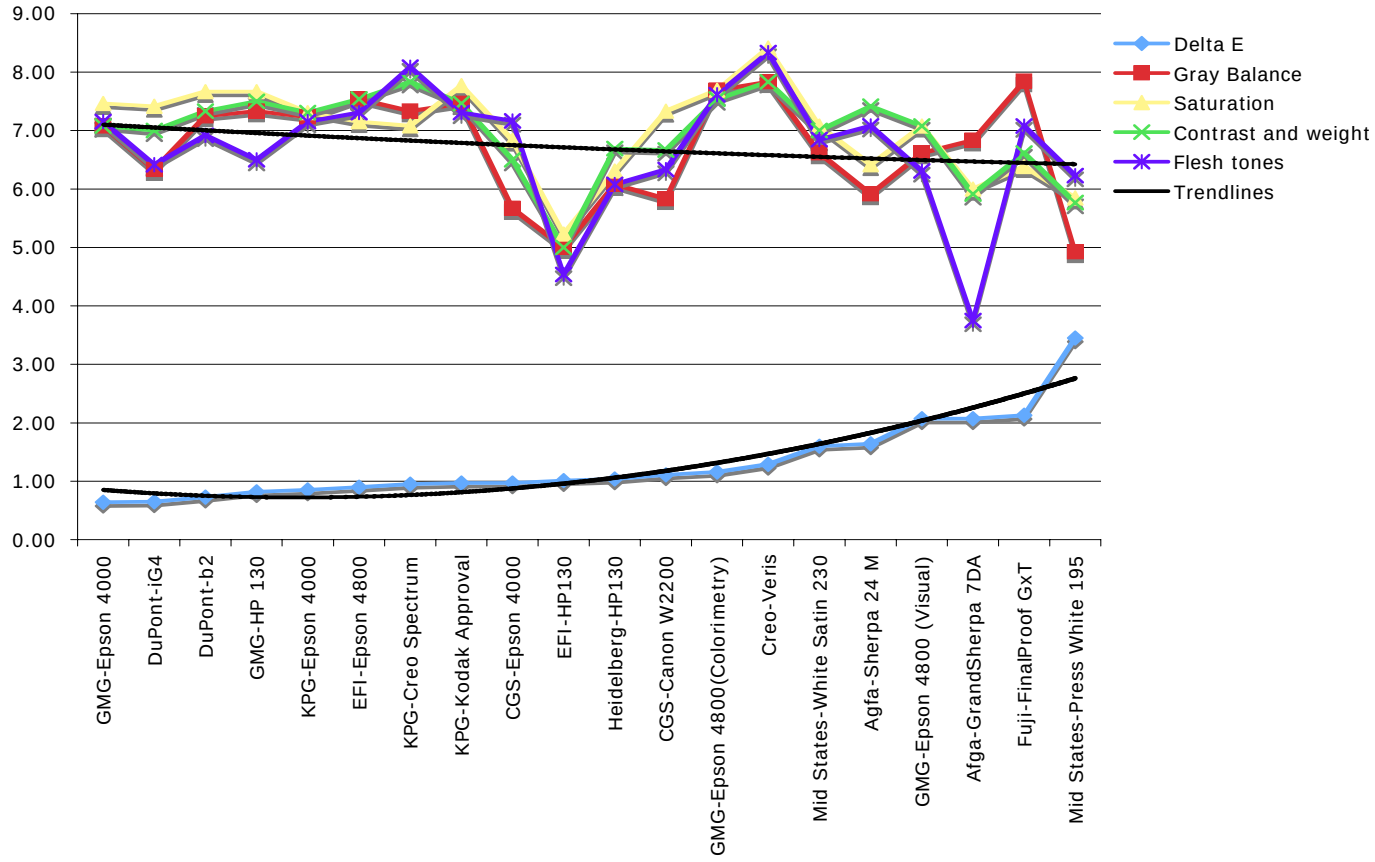


Figure 19: The trend line shows as Delta E increased the samples were less preferred – as predicted by theory.

One of the questions brought into the testing process was: "Will visual evaluations correlate with measured data?" Since Delta E is a measure of error, an inverse relation would be expected between DE and visual scores: low DE should correlate with high visual scoring and high DE should correlate with low visual scoring.

An initial comparison of mean Delta E versus visual scoring seems to show only a weak relation between the two: the visual scores seem to meander widely even as average Delta E rises from less than 1 to 2 (see Figure 20). The trend is also somewhat obscured by the relatively narrow range of visual scoring. However, in most cases the visual score does move down as the average Delta E moves up.

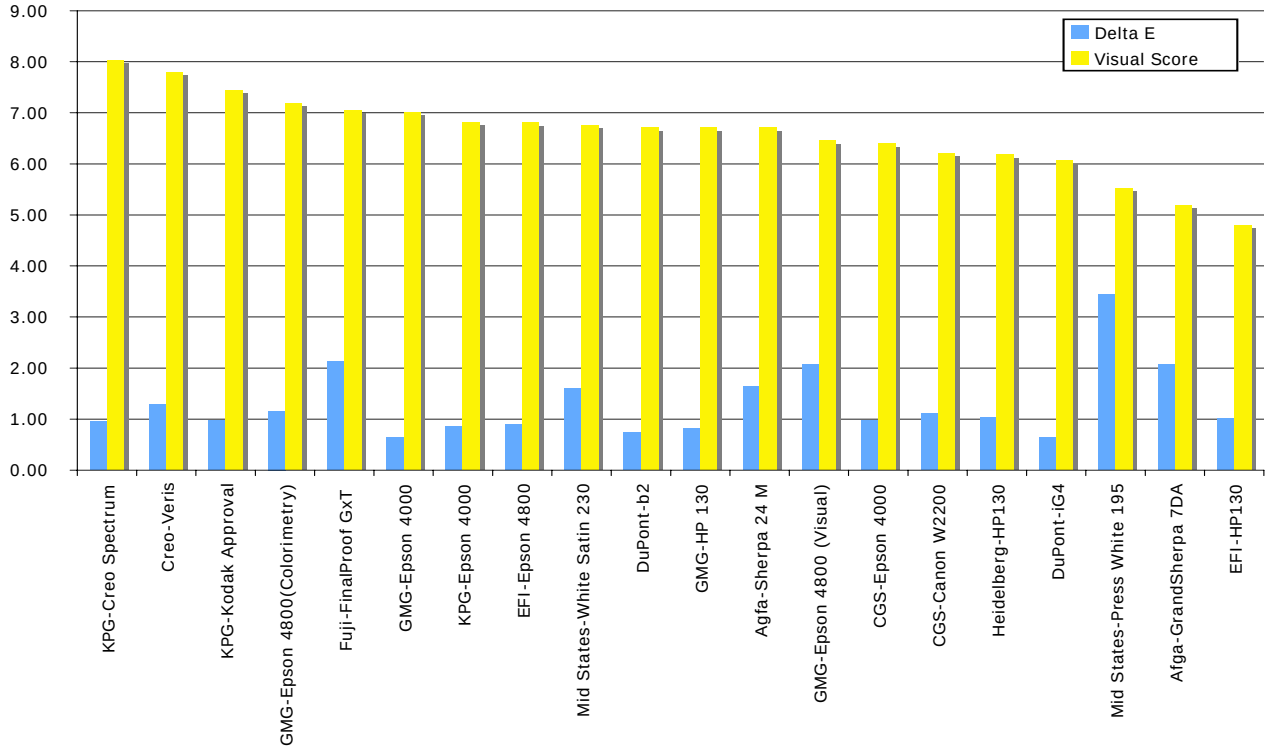


Figure 20: It is not easy to see a direct correlation between total visual score and Delta E, however it is possible to discern a reduction in visual score and a gradual (though erratic) increase in Delta E from right to left.

A strong inverse relation between Delta E and visual score becomes clear only where the average overall Delta E begins to exceed 3.0.

When overall visual scores are compared to maximum Delta E, the expected inverse relation appears to be somewhat stronger (see Figure 21).

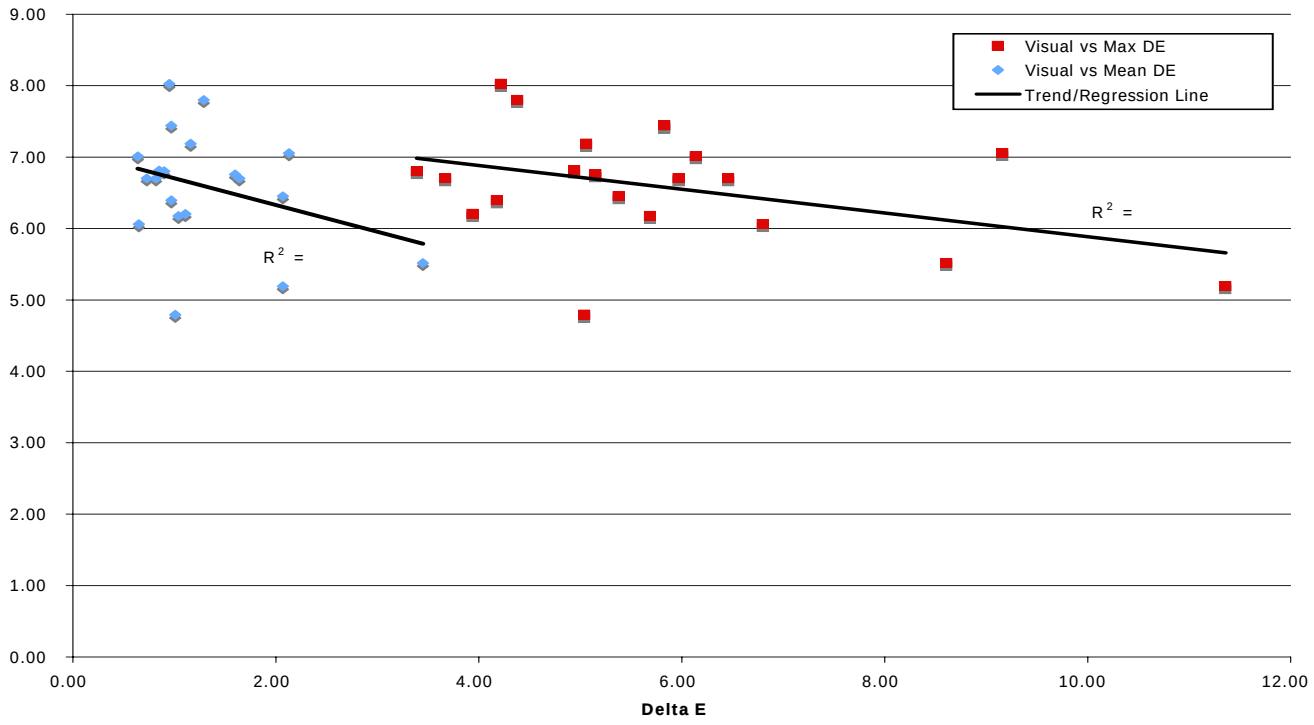


Figure 21: When visual scores are compared to maximum Delta E, the expected inverse relation appears to be somewhat stronger than comparison with mean Delta E.

Spot Color Evaluation

IPA created a PDF file to determine a system's ability to recreate Spot Color on the proofing systems evaluated in the RoundUP. The key test was to assess Delta E between the Pantone Coated Solid values and the proofing systems. The file was also used for a visual comparison for solids and tints; tints were compared to the PMS Tint Book. Additionally, a 4-color SCID image with the CMYK colors replaced by Pantone colors was used to determine if the system could overprint spot colors correctly.

Spot Color File

The test file for the spot color evaluation was a PDF containing 11 solid spot color elements and tint values for 7 of those colors along with a 4-color SCID image. Lab values, taken directly from the Pantone Solid Coated library, were associated with each of the sold colors to ensure common aim points.

Spot Color Numerical

Numerical evaluation was made by Western Michigan University. Each spot color was measured and the Delta E was calculated in comparison to Pantone Digital Library L*a*b* values. Results were plotted for each system from the average of the 11 Delta E measurements. It was discovered Pantone provided incorrect L*a*b* values for two colors, 287C and 639C. These values were measured under a D65 light source, while values for the other nine colors were provided for a D50 light source. All numerical measurements were made with an X-Rite 530 using a D50 light source.

Spot Color Visual

Solid colors were evaluated by a team of color experts on a scale of 1-10 (10 best) by comparing them to solid swatches from the Pantone Coated Solid book.

Spot Color Tint Evaluation

Spot color tints were evaluated on scale of 1-10 (10 best). Judges were instructed to compare the tint values for a best match to the Pantone Tint Book and to ensure there were uniform color steps between patches.

Spot Color Highlights with Tints

Highlights were evaluated to determine if the background was included in the Pantone color. It was agreed in advance of the Proofing RoundUP this would be a good test, however, ink jet suppliers were given the option of using no paper simulation. All suppliers used paper simulation.

Spot Color Image

A 4-color CMYK image was converted to use 4 PMS colors in place of CMYK. Judges were instructed to evaluate if the proofing system was able to reproduce this image using spot colors. For some systems, judges were not in agreement on whether the system used CMYK or PMS colors to reproduce the image. A proof was provided to all suppliers but was found to be inaccurate, so a match was not required. Systems were simply judged on their ability to simulate the spot colors in the image. The main judging factor was that if purple and magenta were in the image, the system was using CMYK to reproduce the image and therefore did not use any spot colors.

Grading System:

Used for all visual judging.

9-10 points	Excellent Match
7-8 points	Just Noticeable Match
5-6 points	Visible Shift
3-4 points	Large Shift
1-2 points	Very Large Shift

Bonus Question:

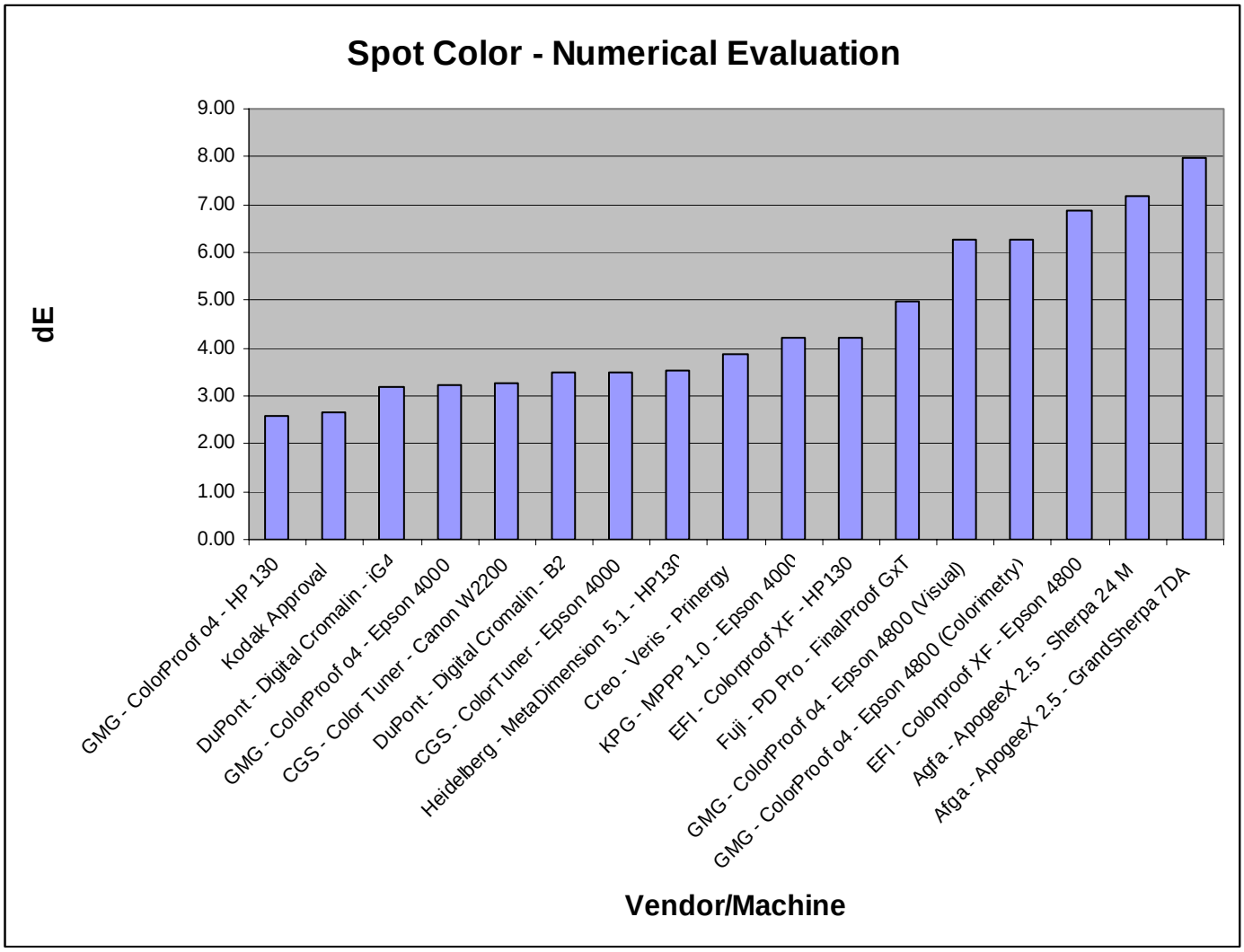
Used for the overall feel of the soft proofing systems only.

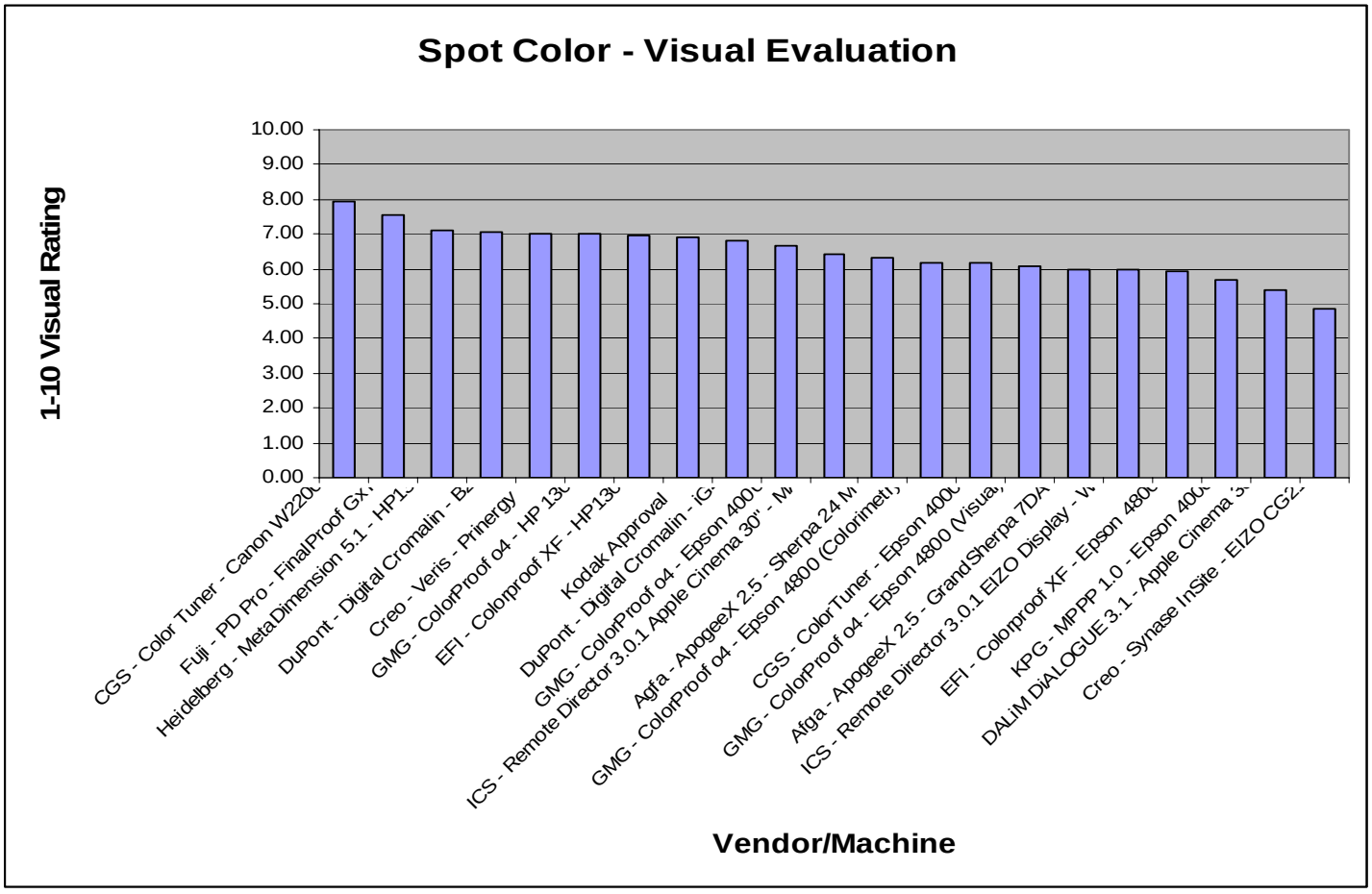
9-10 points	Excellent Match (Good or better than best hard proof)
7-8 points	nearly as good as best hard proof
5-6 points	Compares to average hard proof
3-4 points	Reasonable Match, but not comparable to hard proofs
1-2 points	Poor Match

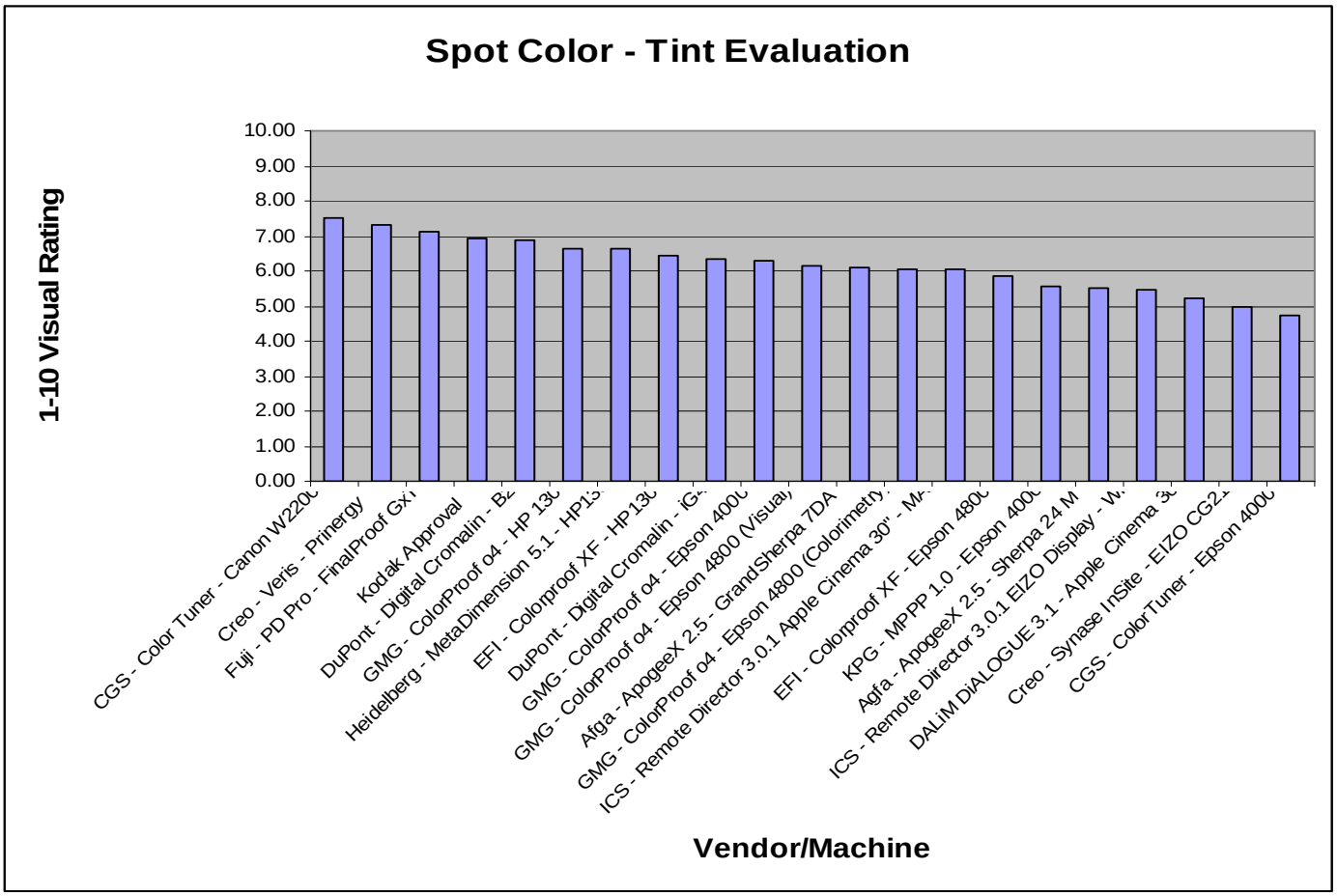
CM = Lab Delta E
VIS = 1-10 visual rating of solids to Pantone Coated Solid Books
T (tints) and H (highlights) = 1-10 visual rating of tints/highlights to Pantone Tint Books
Bonus = 1-10 visual rating for soft proofing systems only
Image = yes/no (was system able to reproduce the image with spot colors)

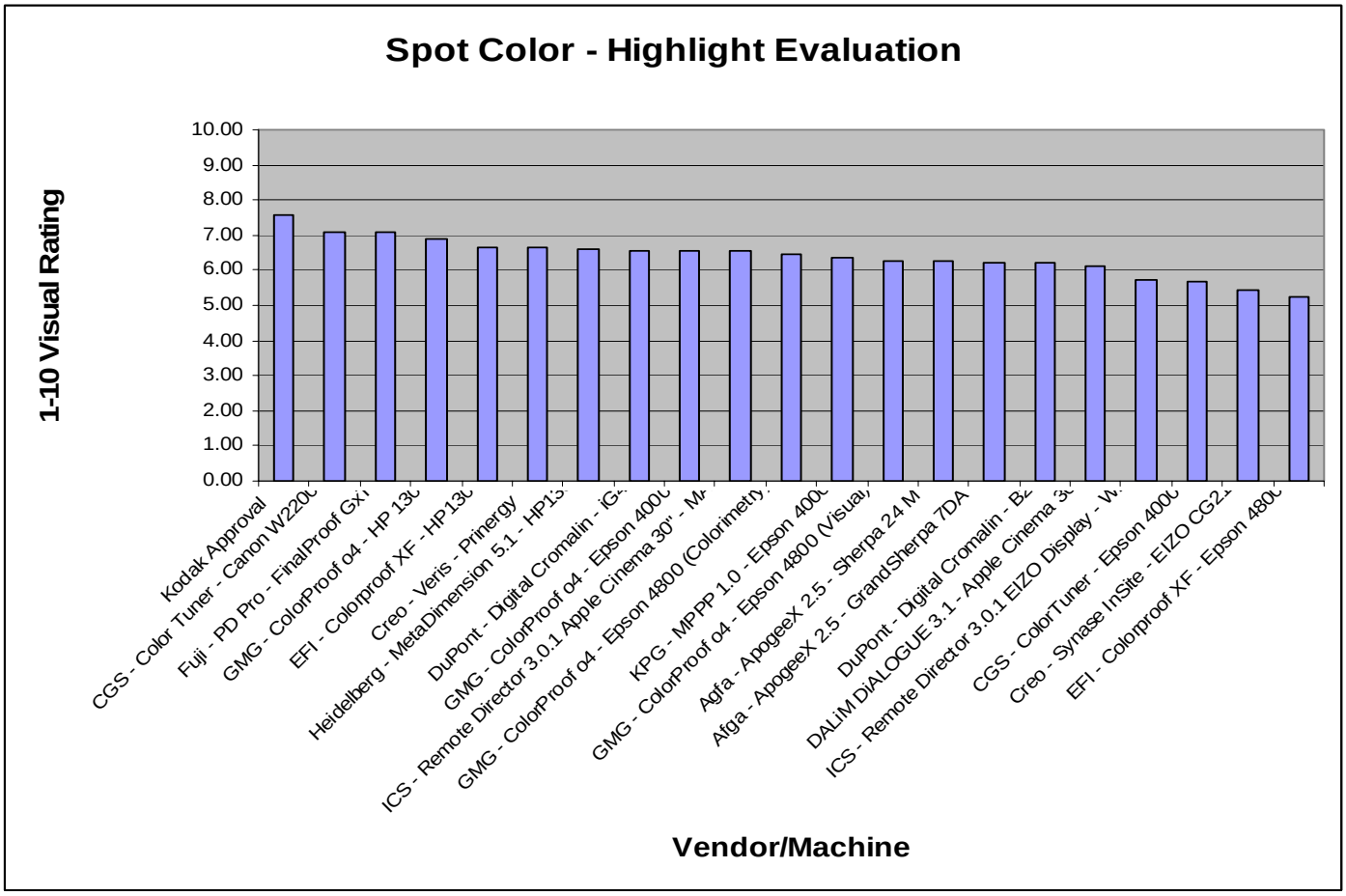
Name	CM	VIS	T	H	Bonus	Image
GMG - ColorProof o4 - HP 130	2.60	7.00	6.65	6.90	n/a	Yes
Kodak Approval	2.66	6.91	6.94	7.55	n/a	Yes/No
DuPont - Digital Cromalin - iG4	3.18	6.84	6.33	6.57	n/a	Yes
GMG - ColorProof o4 - Epson 4000	3.24	6.69	6.28	6.55	n/a	Yes/No
CGS - Color Tuner - Canon W2200	3.26	7.95	7.53	7.07	n/a	Yes
DuPont - Digital Cromalin - B2	3.49	7.07	6.88	6.21	n/a	Yes
CGS - ColorTuner - Epson 4000	3.50	6.16	4.75	5.70	n/a	Yes
Heidelberg - MetaDimension 5.1 - HP130	3.55	7.11	6.64	6.61	n/a	Yes
Creo - Veris - Prinergy	3.88	7.02	7.33	6.65	n/a	Yes/No
KPG - MPPP 1.0 - Epson 4000	4.21	5.67	5.55	6.36	n/a	Yes
EFI - Colorproof XF - HP130	4.23	6.98	6.42	6.66	n/a	Yes/No
Fuji - PD Pro - FinalProof GxT	4.99	7.55	7.12	7.06	n/a	Yes/No
GMG - ColorProof o4 - Epson 4800 (Visual)	6.25	6.05	6.14	6.25	n/a	Yes
GMG - ColorProof o4 - Epson 4800 (Colorimetry)	6.28	6.20	6.04	6.46	n/a	Yes
EFI - Colorproof XF - Epson 4800	6.88	5.91	5.86	5.23	n/a	Yes/No
Agfa - ApogeeX 2.5 - Sherpa 24 M	7.18	6.31	5.53	6.25	n/a	Yes
Afga - ApogeeX 2.5 - GrandSherpa 7DA	7.97	6.00	6.08	6.22	n/a	Yes
Creo - Synase InSite - EIZO CG21	-	4.85	4.99	5.43	3.25	Yes
DALiM DiALOGUE 3.1 - Apple Cinema 30"	-	5.38	5.23	6.14	4.25	Yes
ICS - Remote Director 3.0.1 EIZO Display - WIN	-	6.00	5.48	5.72	5.00	No
ICS - Remote Director 3.0.1 Apple Cinema 30" - MAC	-	6.40	6.03	6.54	2.00	No
KPG - Matchprint Virtual - Apple Cinema 23"	-	*	*	*	*	*
KPG - Matchprint Virtual - Apple Cinema 30"	-	*	*	*	*	*
KPG - Matchprint Virtual - EIZO ColorEdge CG21	-	*	*	*	*	*
KPG - Matchprint Digital	-	*	*	*	*	*
Mid States - Press White 195 - Epson 4000	-	^	^	^	^	^
Mid States - White Satin 230 - Epson 9600	-	^	^	^	^	^
Monitors were not measured numerically						

* Kodak chose to not include these systems in the spot color portion of the RoundUP.
^ Mid States did not include their systems in the spot color portion of the RoundUP.


Spot Color - Numerical Evaluation
dE
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
GMG - ColorProof o4 - HP 130
Kodak Approval
DuPont - Digital Cromalin - iG4
GMG - ColorProof o4 - Epson 4000
CGS - Color Tuner - Canon W2200
DuPont - Digital Cromalin - B2
CGS - ColorTuner - Epson 4000
Heidelberg - MetaDimension 5.1 - HP130
Creo - Veris - Prinergy
KPG - MPPP 1.0 - Epson 4000
EFI - Colorproof XF - HP130
Fuji - PD Pro - FinalProof GxT
GMG - ColorProof o4 - Epson 4800 (Visual)
GMG - ColorProof o4 - Epson 4800 (Colorimetry)
EFI - Colorproof XF - Epson 4800
Agfa - ApogeeX 2.5 - Sherpa 24 M
Afga - ApogeeX 2.5 - GrandSherpa 7DA
Vendor/Machine


Spot Color - Visual Evaluation
1-10 Visual Rating
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
CGS - Color Tuner - Canon W220
Fuji - PD Pro - FinalProof GX
Heidelberg - MetaDimension 5.1 - HP1
DuPont - Digital Cromalin - B
Creo - Veris - Prinergy
GMG - ColorProof o4 - HP 13
EFI - Colorproof XF - HP13
Kodak Approval
DuPont - Digital Cromalin - iG
GMG - ColorProof o4 - Epson 400
Agfa - ApogeeX 2.5 - Sherpa 24 M
ICS - Remote Director 3.0.1 Apple Cinema 30" - M
GMG - ColorProof o4 - Epson 4800 (Colorimet
CGS - ColorTuner - Epson 400
GMG - ColorProof o4 - Epson 4800 (Visua
Afga - ApogeeX 2.5 - GrandSherpa 7DA
ICS - Remote Director 3.0.1 EIZO Display - V
EFI - Colorproof XF - Epson 480
KPG - MPPP 1.0 - Epson 40
DALiM DiALOGUE 3.1 - Apple Cinema 3
Creo - Synase InSite - EIZO CG2
Vendor/Machine


Spot Color - Tint Evaluation
1-10 Visual Rating
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
CGS - Color Tuner - Canon W220
Creo - Veris - Prinergy
Fuji - PD Pro - FinalProof Gx
Kodak Approval
DuPont - Digital Cromalin - B
GMG - ColorProof o4 - HP 13
Heidelberg - MetaDimension 5.1 - HP13
EFI - Colorproof XF - HP13
DuPont - Digital Cromalin - iG
GMG - ColorProof o4 - Epson 400
Afga - ApogeeX 2.5 - GrandSherpa 7DA
GMG - ColorProof o4 - Epson 4800 (Visual
ICS - Remote Director 3.0.1 Apple Cinema 30" - Mr
EFI - Colorproof XF - Epson 480
KPG - MPPP 1.0 - Epson 400
Agfa - ApogeeX 2.5 - Sherpa 24 M
ICS - Remote Director 3.0.1 EIZO Display - W
DALiM DiALOGUE 3.1 - Apple Cinema 3
Creo - Synase InSite - EIZO CG2
CGS - ColorTuner - Epson 400
Vendor/Machine



PDF and RIP Performance

Participants were asked to proof specialized test pages from the Altona Test Suite (see Figure 6) to assess RIP capabilities, overprint correctness, spot-color and color management support.

This part of the RoundUP focused on two aspects:

- RIP and output intent profile. To test the capability of the proofer RIP to automatically detect the output intent profile and use it for proofing. This feature is useful for both workflow paths including PDF/X-1a and PDF/X-3.
- Correct color conversions - capability of the RIP to apply all color conversions as defined in a PDF/X-3 file.

Test Process:

Suppliers were supplied with the Altona Visual page with an output intent profile new to all suppliers (none of the standard profiles such as ISO Coated etc.) The test file was published to the suppliers via the web site on Monday, June 6th, the day before the IPA Technical Conference. Suppliers who did not have their systems at the event were asked to output at their location and FedEx to Chicago. All others provided output of the files at

the Conference. Suppliers were solely responsible for assuring the proofs arrive by (or were created by) 12.00 noon on Tuesday, June 7th. Proofs not in the hands of IPA by Wednesday June 8th were not considered.

Evaluation of the printed output (and the soft proof systems) was based on visual evaluation. *This evaluation did not check the quality of the colorimetric match.* We compared the correct rendering in the color management patches #34 through #38 and the two images #22 and #24. Reference prints of The Altona Test Suite Application Kit and the documentation (available from www.eci.org) were used as reference for the judgment.

With the increasing use of PDF and PDF/X as an exchange format and all of the new design application features get introduced, questions that arose include:

1) How is one sure what he sees on the proof accurately represents the file contents and the intent of the author?
2) How is one able to determine which proofing solution will address specific needs for cost and speed, once it is determined it is capable of accurately processing the files and reproducing the color?

At the IPA Color Proofing RoundUP we addressed these questions with a variety of tests and with lots of information gathering.

Task 'PDF/X-3' For Monday June 6th

1) Procedure: Preferred procedure is (as in all 'bvdm/ECI Digital Proof Forum' events) the test files will be given to the suppliers on site. For suppliers who do not have their systems at the IPA event, the printed output should be sent to Chicago for evaluation.

2) Task: Files will be output as 'AltonaVisual_1v2_IPA_x3.pdf' and 'Altona_Technical_1v2_x3.pdf' and printed samples were provided to the Dearborn room at Westin O'Hare, Chicago.

3) Evaluation: Output evaluation was based on the complete Altona Technical page and selected elements of the Altona Visual page. Purpose of this test is for PDF/X-3 compatibility. Color accuracy was evaluated in a separate part of the RoundUP. Reference for correct output can be found in the documentation of the Altona Test Suite. A PDF named 'AltonaTestSuite_Documentation_ENG.pdf' with all relevant information is available in the download section at www.eci.org.

Altona Test Suite

The Altona test suite was provided as 3 separate PDF/X-3 files: a measurement page has an ECI 2002 target, a visual page with an assortment of sample images and color instruction handling tests, and a technical page addresses 864 different overprint combinations. For IPA Proofing RoundUP in 2004 (last year) purposes we used only a part of the visual test page and the technical page since the other issues that were addressed using other tests that were performed. A complete description of each of the tests in the Altona test suite is explained in the Altona test documentation available for free at: http://www.eci.org/eci/en/060_downloads.php.

The ability to pass these tests is controlled by a number of factors. These include: the core RIP's ability to process the instructions; the supplier's implementation of the core RIP; and, finally, the settings used at the time

of processing. Having run these files in the past, we have seen errors caused by all 3 factors. Since all the suppliers should have had experience in running the Altona Test Suite, it is recommended you ask your proofing solution supplier for an application data sheet defines the correct settings to ensure you are processing the files correctly. If they are able to process these files, they will probably have these instructions; if they don't have instructions, they probably won't be able to correctly process the files.

Visual Page

The specific tests used on the visual page were items 22 and 24 and 34-38. Each of these individual tests was valued on a pass/fail system in all printed samples and on screen of evaluated soft proofing systems. In case of errors we analyzed the respective patches in order to figure out the supposed reason.

All systems perfectly passed the tests of rendering smooth shades and spot colors. Except for three systems (DuPont, KPG and MidWest) all tested solutions passed the color management capabilities test without any error.

Based on the analysis of the patches 34 – 38 the DuPont and KPG systems seem to ignore individual profiles and rendering intents assigned to these page objects. The rendering intent is either set to "relative colorimetric" by a system setting or completely ignored so the PDF default rendering intent "relative colorimetric" is used.

MidWest provided two samples with different results, both wrong. In addition to ignored rendering intents, the MidWest system treats pixel and vector elements not identically. The first sample provided by Creo showed errors caused by inadvertent, yet incorrect, system settings (i.e. predefined profiles and rendering intents overwriting the respective object settings of the test file). A second observed test run with correct system settings was error free.

Except for one system (MidWest) all solutions perfectly handled the technical aspects CMYK-process color definitions. Test element 39 tests whether a system renders two CMYK patches (100 percent black and 100 percent black plus 50 percent Cyan) with a distinct color difference as in the reference print. Surprisingly one of the two MidWest samples showed the opposite effect of what we expected: The black only patch was darker than the patch with additional Cyan.

Technical Page

While there are 896 individual tests, we elected to value compliance to each individual patch of the entire page and noted the supposed reason for the failure. As one limitation typically affects several patches, the comparison between systems based on the number of detected error patches is not applicable. However, except for one system all tested solutions processed the Altona Technical without any error. The DALiM soft proofing system 'DIALOGUE 3.1' caused problems with overprinting of image mask objects. As indicated by yellow patches in figure 11 some suppliers (ICS and KPG) decided not to participate.

IT8.7/4 and ECI 2002 Targets

The press sheet used in the IPA Proofing RoundUP is part of ongoing GRACoL committee work to produce certified press sheets and characterization data. The press sheets contain the IT8.7/4 target. The problem with this target is:

- It has been changed a number of times, *thus*
- It is not commonly supported by measuring systems, *and*
- The relationship between Patch ID and CMYK ink values is covered by copyright – it is not "open source" which prevents the widespread development of a measurement reference file and use in color management systems.

The ECI 2002 target contains 1485 patches. The IT8.7/4 is formed from the ECI 2002 basic set with two extra sets. Thus the IT8.7/4 contains, 1485 + 125 + 6 = 1616 patches. Because the IT8.7/4 target contains the ECI 2002 target, the data for the ECI 2002 target can be extracted from the measurement file of the IT8.7/4. Using the SpectroScan, any rectangular target including the IT8.7/4 can be measured. From the measurement file of the IT8.7/4 the ECI 2002 measurements can be extracted. Mike Rodriguez has made available a spreadsheet for this purpose.

ACKNOWLEDGEMENTS

The RoundUP would not have been possible without the loan of hardware and support from the following companies – GretagMacbeth, GTI, Apple Computer, and X-Rite.

We are pleased to acknowledge the help of the following Western Michigan University students – Swaroop MJ, Erika Hrehorova, Laura Kraft, Steve DiLullo and Ben Starr. The IPA "connection" has allowed Steve to intern with Vertis this summer and for graduate Ben Starr to accept a position with one of the participating companies.

We acknowledge the support of Diane Kennedy and the GRACoL Committee and IDEAlliance for press sheet material and measurement data.

It is a pleasure to acknowledge the continued support and guidance of Dr. Mike Rodriguez, RR Donnelley in this work.

Last but not least, we are of course grateful to the suppliers who tirelessly subject themselves to this evaluation process.

APPENDIX

Participating Suppliers

Supplier Code	Supplier Name	Number of Systems	System details	Abbreviated system details as shown on graphs
A1	Agfa	1	Agfa-ApogeeX 2.5-Sherpa 24 M	Agfa-Sherpa 24 M
A2	Agfa	2	Afga - ApogeeX 2.5 - GrandSherpa 7DA	Afga-GrandSherpa 7DA
C1	Creo	3	Creo - Prinergy - Veris	Creo-Veris
C2	CGS	4	CGS - Color Tuner - Epson 4000	CGS-Epson 4000
C3	CGS	5	CGS - Color Tuner - Canon W2200	CGS-Canon W2200
C4	**Creo**	**6**	**Creo - Synapse InSite - EIZO CG21**	**Creo-EIZO CG21**
D1	DuPont	7	DuPont - Digital Cromalin - b2	DuPont-b2
D2	DuPont	8	DuPont - Digital Cromalin - iG4	DuPont-iG4
D3	**DALiM**	**9**	**DALiM DiALOGUE 3.1 - Apple Cinema 30"**	**DALiM-Apple Cinema 30"**
E1	EFI	10	EFI - Colorproof XF - Epson 4800	EFI-Epson 4800
E2	EFI	11	EFI - Colorproof XF - HP130	EFI-HP130
F1	Fuji	12	Fuji - PD Pro - FinalProof GxT	Fuji-FinalProof GxT
G1	GMG	13	GMG - ColorProof o4- Epson 4000	GMG-Epson 4000
G2	GMG	14	GMG - ColorProof o4 - Epson 4800 (Colorimetry)	GMG-Epson 4800(Colorimetry)
G3	GMG	15	GMG - ColorProof o4- Epson 4800 (Visual)	GMG-Epson 4800 (Visual)
G4	GMG	16	GMG - ColorProof o4 - HP 130	GMG-HP 130
H1	Heidelberg	17	Heidelberg-MetaDimension 5.1 - HP130	Heidelberg-HP130
I1	**ICS**	**18**	**ICS- Remote Director 3.0.1 Apple Cinema 30" - MAC**	**ICS-Apple Cinema 30"**
I2	**ICS**	**19**	**ICS- Remote Director 3.0.1 EIZO 23" Display - WIN**	**ICS- EIZO Display 23" (WIN)**
K1	**KPG**	**20**	**KPG-Matchprint Virtual - Apple Cinema 23"**	**KPG-Apple Cinema 23"**
K2	**KPG**	**21**	**KPG-Matchprint Virtual - Apple Cinema 30"**	**KPG-Apple Cinema 30"**
K3	**KPG**	**22**	**KPG-Matchprint Virtual - EIZO ColorEdge CG21**	**KPG-EIZO CG21**
K4	KPG	23	KPG - Matchprint Digital Halftone - Creo Spectrum	KPG-Creo Spectrum
K5	KPG	24	KPG- Matchprint ProofPro 1.0 - Epson 4000	KPG-Epson 4000
K6	KPG	25	KPG - Kodak Approval - XP4	KPG-Kodak Approval
M1	Mid States	26	Mid States - Press White 195 - Epson 4000	Mid States-Press White 195
M2	Mid States	27	Mid States - White Satin 230 - Epson 9600	Mid States-White Satin 230

Suppliers shown in **bold blue type** submitted soft proofing systems for evaluation.

List of Participating Judges

Judges - Hard and Soft Proofing

David Rohe	Schawk
Dan Martinez	Repro-Media
Ron Sheffield	Doner
Ken Pecca	Hearst Magazines
Mike Cox	NEC
John Jasinski	Hearst Magazines
Ty Kang	LAgraphico
Randy Noble	RR Donnelley
Steve Rankin	X-Rite
Brian Pfeil	Monarch Imaging
Brian Binotto	Discover Color
Mike Lippeth	Color 4

Judges - Spot Color

John King	JC Penney Direct
Gary Bernier	Southern Graphic Systems
Garret Long	Southern Graphic Systems
Wayne Peachey	Southern Graphic Systems
Mike McGinnis	Banta Digital Menasha

Supplier Code_____ **Judge**_____

VISUAL EVALUATION OF PROOFING SYSTEMS

1. Gray Balance: Accurate rendering of neutral and grayscale images.

9-10 points. Excellent rendering of neutrals.
7-8 points. Just noticeable shift from neutral.
5-6 points. Visible shift from neutral. Easy to match on press.
3-4 points. Visible shift from neutral. Difficult to match on press.
1-2 points. Large shift from neutral. Very difficult to match on press.

2. Saturation: Correct rendering of "colorfulness" of images.

9-10 points. Excellent rendering of target colors.
7-8 points. Just noticeable shift of target colors.
5-6 points. Visible shift from target colors. Easy to match on press.
3-4 points. Visible shift from target colors. Difficult to match on press.
1-2 points. Large shift from target colors. Very difficult to match on press.

3. Contrast and Weight. Correct rendering of tonal values. Correct rendering of highlight & shadow detail.

9-10 points. Excellent rendering of weight and contrast.
7-8 points. Slight shift in weight and contrast.
5-6 points. Visible shift in weight or contrast. Easy to match on press.
3-4 points. Visible shift in weight or contrast. Difficult to match on press.
1-2 points. Large shift in weight or contrast. Very difficult to match on press.

4. **Flesh Tone Reproduction. Correct rendering of flesh tone color and smoothness.**

9-10 points. Excellent rendering of flesh tones.
7-8 points. Very good rendering of flesh tones.
5-6 points. Good rendering of flesh tones. Easy to match on press.
3-4 points. Questionable rendering of flesh tones. Difficult to match on press.
1-2 points. Poor rendering of flesh tones. Very difficult to match on press.

5. Accuracy of Vignettes and Tonal Transitions. Freedom from banding and flat spots. Consistent hue and saturation within transitions.

9-10 points. Excellent rendering of vignettes and tonal transitions.
7-8 points. Very good rendering of vignettes and tonal transitions.
5-6 points. Average rendering of vignettes and tonal transitions.
3-4 points. Below average rendering of vignettes and tonal transitions.
1-2 points. Unacceptable quality in tonal transitions.

6. Visible Artifacts. Patterning, banding, streaking, mottling, puddling, speckling, fuzziness, over sharpening, outlining, other (list).

9-10 points. Free from visible artifacts.
7-8 points. Barely noticeable visible artifacts.
5-6 points. Acceptable level of visible artifacts.
3-4 points. Distracting level of visible artifacts.
1-2 points. Unacceptable level of visible artifacts.

7. Other (Paper color, glossiness, "look and feel," weight, sensitivity to angled light).

9-10 points. Excellent overall simulation of "look and feel" of printed sheet.
7-8 points. Good overall simulation of "look and feel" of printed sheet.
5-6 points. Average overall simulation of "look and feel" of printed sheet.
3-4 points. Below-average overall simulation of "look and feel" of printed sheet.
1-2 points. Poor overall simulation of "look and feel" of printed sheet.

8. Monitor proofing stations

9-10 points. Excellent accuracy, as good as or better than the best hard proofs.
7-8 points. Nearly as good the best hard proofs.
5-6 points. Comparable to average quality hard proofs.
3-4 points. Reasonable accuracy but not comparable to hard proofs.
1-2 points. Poor overall accuracy. Not suitable for contract proofing.

Comments:

Judge's Total:

---

technical conference

Supplier Code#_____ **Judge**_____

Visual Evaluation of Proofing System - Spot Colors

Spot Colors Solid - Visual solid match PMS book (1-10)
Spot Colors Tint - Visual Tint match using PMS tint book (1-10)
Highlights w/ tint - Tint match in highlight including background (1-10)

9-10 points Excellent Match
7-8 points Slight noticeable match
5-6 points Visible Shift
3-4 points Large Shift
1-2 points Very Large Shift

	Solid	Tints	Highlights
1) Pantone 639 C			
2) Pantone 109 C			
3) Pantone 526 C			
4) Pantone 485 C			
5) Pantone Hex C			
6) Pantone Hex M			
7) Pantone Hex Y			
8) Pantone 287 C			
9) Pantone 165 C			
10) Pantone Hex G			
11) Pantone 469 C			

Judge's Comments:

Spot Color Image: Yes or No

PMS Color Substitution

Bonus Question: (Monitor Proofing Stations only)

9-10 points Excellent Match (good or better than best hard proof)
7-8 points Nearly as good as best hard proof
5-6 points Compares to average hard proof
3-4 points Reasonable Match, but not comparable to hard proofs
1-2 points Poor Match

Bonus Question

SUPPLIER COMMENTS

Creo - William Li

"Creo would like to commend IPA for building upon last year's Proofing RoundUp with an even more successful and well-run event this year. This year's Proofing RoundUP was quite educational for everyone in the industry. The lack of correlation between the simple delta-E statistics and the visual judging results clearly shows that there is still some more research which has to be invested into coming up with good, usable, and simple numeric metrics for color matching, however it is encouraging that the industry as a whole seems to be moving forward towards objective, numerically-based metrics. Apart from the spot color SCID image test, which was marred by not having a correct reference sample distributed to the vendors, this year's IPA Proofing RoundUP was very well-run and succeeded in its goal of advancing the state of color knowledge in the industry."

DuPont - Mark Rauscher,

"DuPont congratulates the IPA on another outstanding event! The excellent results associated with our 2 RoundUP entries (DuPont Cromalin® iG4 and Cromalin b2, both using DuPont Cromanet™ Color Technology) demonstrate the power of Cromanet - the software "heart" of our digital proofing systems. Cromanet offers an easy, powerful method to create and manage color-accurate contract-quality CMYK and special color inkjet proofs - without complex "tweaking" or time-consuming, repetitive re-reading of color patches. Two notes:

1) Altona Visual - Cromanet's color management module deliberately suppresses embedded rendering intents in favor of Cromanet color match data. This is reflected in reported results for "color management" on the Altona test. We are considering support for embedded color workflows in future Cromanet products.
2) The noted shipping damage possibly caused the appearance of a setup discrepancy for our Cromalin b2 Visual proofs. The measured difference between the Visual and Colorimetric proof submissions were not the result of any attempt to create an alternate Visual setup. We invite IPA members to request certified Cromalin b2 sample proofs from DuPont match the RoundUP data set/press sheets, along with documentation describing the Cromanet technology used in producing them. Please email ipasample@ei.dupont.com with your contact information."

EFI - Bernard LaRoche

"EFI Colorproof XF completed the Proofing RoundUP as the industry's most consistent proofing solution (all technologies included), achieving the best combination of Average Delta E (0.7) and Maximum Delta E (3.2) measured. This performance was achieved using Epson 4800 and EFI Proofing Paper. With constant changes in the print engines, paper and ink quality, users require an easy to use solution to quickly reproduce such results. EFI's IPA RoundUP contract proof results were achieved simply, using the Wizard-based ICC profile linearization and calibration system, something entry level prepress operators can quickly deliver on their own. No need for highly paid prepress experts and expensive proprietary technology. Most manufacturers and the IPA organizers recognize achieving good Visual and Measurement results with the same proof is extremely"

SUPPLIER COMMENTS (continued)

difficult, which is why some companies submitted one print sample optimized for measurement and another optimized for visual - consequently, some samples achieved good measurement but lower visual scores and vice versa. For the Visual test, EFI submitted one single proof, the same was used for Delta E Measurements, and again, the EFI-Epson 4800 combination topped the Visual ranking chart for ink jet systems, trumping many other proofing solutions.
EFI successfully passed the PDF/X-3 compliancy test as well as the Spot Color Test, despite testing conditions. Many manufacturers questioned this test as the rules changed after manufacturers submitted samples and many of the testing parameters were unclear (measuring device, Pantone Swatch book, screening preferences, etc.). EFI Colorproof XF is the industry's easiest to use, most consistent ICC-based color proofing solution, at the most economical price."

GMG - James Summers

GMG is pleased with the 2005 IPA shootout. The results reinforce GMG's consistent, winning performance at this and other worldwide proofing shootout forums. We offer the following commentary to the results.

New GMG Media: All Epson 4000 and 4800 submissions utilized a new, exclusive GMG semi matte 250gsm proofing media. While GMG ColorProof works with any paper, the IPA results demonstrate the synergistic benefits of using both superior software and media. Characteristics of the new media, available in July, include:

- higher sharpness
- No over-inking
- White point similar to ISO paperclass 1, 2

Spotcolor Test: GMG erred in scaling the Spotcolor image size. Irrespective, we disagree with the SCID image results, since this was judged visually without a valid target print for comparison.

Colorimetric vs. Visual Adjustment: GMG included two submissions with the new Epson 4800 printer and GMG semi matte proofing media based on initial testing and development. The IPA results helped identify changes made within the new printer and areas for improvement. The current, released versions of GMG software for the Epson 4800 now produce even better results than the winning performance achieved the older Epson 4000 at this year's IPA event.

Heidelberg USA - Mark Tonkovich

"This year, the IPA Color Proofing RoundUP shows the state-of-the-art of Color Proofing has reached a point of excellence from most suppliers. Eleven of the suppliers had a Delta E average of around 1, with the lowest being approximately .65. With an instrumentation repeatability specification of .29, the measurement differences are almost unperceivable. If you remove the results of the proprietary systems, the lowest value is around .90. Compare this to last year, only two suppliers had a Delta E around 1. Measurement has almost become a given with other points to be evaluated such as does the rip drives the proofer also drive the CTP? What is the price/performance factor?"

SUPPLIER COMMENTS (continued)

Mid-States Graphics - Troy Buccini

Mid-States Graphics supplied two proofs on two different proofing systems with two of our ProofLine Media's. The "White Satin 230" media was printed on an Epson 9600 with a resolution of 1440x720 unidirectional using ICC profiles created with GMB ProfileMaker 503. A custom chart containing 5076 patches was used; not an ECI2002 or a IT8.74, along with an ICColor 211UV Spectrophotometer, not a Spectrolino like the one used to measure the numeric results. A EFI ColorProofXF RIP was used to drive the Epson. The ProofLine "Press White 195" media was submitted using the same RIP and resolution on an Epson 4000 with a print head that went out during production of the submitted proofs. Admittedly the proofs suffered pronounced banding, however due to time constraints we decided to submit the proofs to meet the submission cutoff date. Our initial internal testing actually indicated that this media would yield better results than the already high scoring "White Satin 230." with its' "look and Feel" of an actual press sheet that also reduces pigmented bronzing and has the lowest metamerism in its class. We were quite happy with results that prove a great consistent color-match with ProofLine media can be achieved without focusing on the "less than 1 Delta E game" and printing using a realistic production resolution.

FEATURE COMPARISON

Not all proofers are created equal. In fact, your individual requirements might make one proofer more suitable to you than to someone else. In an effort to make the identification process easier, we collaborated with the suppliers to pull together much of the information you might find useful to find a proofer that fits all of your needs. Once the questions were defined, we asked each of the suppliers to fill out a form answering each question to the best of their ability. In some cases, a proofer may only work when connected to a 3rd party's workflow solution. In these cases, the supplier didn't include RIP information since it could vary and was out of their control. It should be noted we didn't verify this information, so we suggest you use it as a base from which to have a conversation.

Features Comparison

Supplier Code	Company	Product Name	Product Version	Core RIP Manufacturer	Core RIP Software Version	RIP Platform
CONVENTIONAL PROOFING SYSTEMS						
A1	Agfa-Gevaert	Sherpa 24m Pigment	7 Color Pigment	Agfa	Apogee X v2.5	Apogee X v2.5
A2	Agfa-Gevaert	Grandsherpa	7 Color Dye	Apogee X	Apogee X v2.5	Apogee X v2.5
C1	Creo	Prinergy	3	Adobe	CPSI 3016	PC
C2	CGS	ORIS Color Tuner	5.1	CGS	4.2.6	Windows
C3	CGS	ORIS Color Tuner	5.1	CGS	4.2.6	Windows
D1	Dupont	Cromalin b2	v 5.5.9	Adobe	3016	Windows 2000 Pro
D2	Dupont	Cromalin Digital iG4	v 5.5.9	Adobe	3016	Windows 2000 Pro
E1	EFI	Color Proof XF	2.5	Adobe CPSI	3016 . 103	Windows XP Pro
E2	EFI	Color Proof XF	2.5	Adobe CPSI	3016 . 103	Windows XP Pro
F1	Fuji/Enovation	Fuji FinalProof GXT	PD-PRO v 3	Apago PDF Enhanser	v 3.0	PC
G1	GMG Americas	GMG ColorProof 04	4	Jaws	4	PC
G2	GMG Americas	ColorProof 04	4	Jaws	4	Jaws
G3	GMG Americas	ColorProof 04	4	Jaws	4	PC
G4	GMG Americas	ColorProof 04	4	Jaws	4	PC
H1	Heidelberg	Meta Dimension	5.1	Adobe	3016	PC
K4	KPG	Matchprint ProofPro Rip /Epson 4000	v1.0	n/a	n/a	PC
K5	KPG	Matchprint Digital Halftone	n/a	n/a	n/a	PC
K6	KPG	Kodak Approval XP4 NX	n/a	n/a	v 5.5	PC
M1	Mid States	Press White 195	n/a	EFI	2.5.4	Efi ColorProof XF
M2	Mid States	White Satin 230	n/a	EFI	2.5.4	Efi ColorProof XF
SOFT PROOFING SYSTEMS						
C4	Creo	Synapse Insite	4.2	Adobe	CPSI 3016	Windows 2000
D3	Dalim Software	Dalim Dialogue	v 3.1	Dalim Software	v 5.1	Linux/OS X
I1	ICS	Remote Director	3.0.1	Apago	n/a	Macintosh
I2	ICS	Remote Director	3.0.1	Apago	n/a	Windows
K1	KPG	Matchprint Virtual Proofing Apple Cinema 20"	v3.2	Harlequin	n/a	PC
K2	KPG	Matchprint Virtual Proofing Apple Cinema 30"	v3.2	Harlequin	n/a	PC
K3	KPG	Matchprint Virtual Proofing E120 C621	v3.2	Harlequin	n/a	PC

Features Comparison

Supplier Code	Company	Product Name	Output Device	Imaging Technology	Calibration Controls	Self Calibration
CONVENTIONAL PROOFING SYSTEMS						
A1	Agfa-Gevaert	Sherpa 24m Pigment	Sherpa 24m Pigment	Inkjet (Piezo)	Yes	No
A2	Agfa-Gevaert	Grandsherpa	GrandSherpa 7-Color	Inkjet (Piezo)	Yes	No
C1	Creo	Prinergy	Veris	MDA-Multi Drop Array	Yes	No
C2	CGS	ORIS Color Tuner	Epson 4000	Inkjet	Yes	Yes
C3	CGS	ORIS Color Tuner	Canon W2200	Inkjet	Yes	Yes
D1	Dupont	Cromalin b2	Cromalin b2	DOD	Yes	Yes
D2	Dupont	Cromalin Digital iG4	Cromalin Digital iG4	CFIJ	Yes	No
E1	EFI	Color Proof XF	Epson 4800	Ultrachrome K3	Yes	Yes
E2	EFI	Color Proof XF	HP 130 NR	Photo Dye	Yes	Yes
F1	Fuji/Enovation	Fuji FinalProof GXT	FinalProof GXT	Thermal Laser	Yes	Yes
G1	GMG Americas	GMG ColorProof 04	Epson 4000	Inkjet	Yes	Yes
G2	GMG Americas	ColorProof 04	Epson 4800	Inkjet	Yes	Yes
G3	GMG Americas	ColorProof 04	Epson Stylus Pro 4800	Inkjet	Yes	Yes
G4	GMG Americas	ColorProof 04	Hewlett-Packard HP130	Inkjet	Yes	Yes
H1	Heidelberg	Meta Dimension	HP 130	Inkjet	Yes	Yes
K4	KPG	Matchprint ProofPro Rip /Epson 4000	Kodak XP4 NX	Inkjet(DOD)	Yes	No
K5	KPG	Matchprint Digital Halftone	Kodak XP4 NX	Thermal Laser Halftone	Yes	No
K6	KPG	Kodak Approval XP4 NX	Kodak XP4 NX	Thermal Laser Halftone	Yes	No
M1	Mid States	Press White 195	Epson 4000	Inkjet	Yes	No
M2	Mid States	White Satin 230	Epson 9600 UC	Inkjet	Yes	No
SOFT PROOFING SYSTEMS						
C4	Creo	Synapse Insite	Eizo C621	LCD	Yes	No
D3	Dalim Software	Dalim Dialogue	Apple Cinema Display 30"	LCD	Yes	No
I1	ICS	Remote Director	Display	LCD	Yes	Yes
I2	ICS	Remote Director	Eizo 23"	LCD	Yes	Yes
K1	KPG	Matchprint Virtual Proofing Apple Cinema 20"	Apple Cinema Display 23"	Real Time Imaging	Yes	Yes
K2	KPG	Matchprint Virtual Proofing Apple Cinema 30"	Apple Cinema Display 30"	Real Time Imaging	Yes	Yes
K3	KPG	Matchprint Virtual Proofing E120 C621	Eizo C621	Real Time Imaging	Yes	Yes

Features Comparison

Supplier Code	Company	Product Name	Tone Curve Adjustment	Halftone Capabilities	Embedded Output Intent Support	Device Independent to CMYK via Output Intent
CONVENTIONAL PROOFING SYSTEMS						
A1	Agfa-Gevaert	Sherpa 24m Pigment	Yes	Yes	Yes	Yes
A2	Agfa-Gevaert	Grandsherpa	Yes	Yes	Yes	Yes
C1	Creo	Prinergy	No	No	Yes	Yes
C2	CGS	ORIS Color Tuner	Yes	Yes	Yes	Yes
C3	CGS	ORIS Color Tuner	Yes	Yes	Yes	Yes
D1	Dupont	Cromalin b2	Yes	Yes	Yes	Yes
D2	Dupont	Cromalin Digital iG4	Yes	Yes	Yes	Yes
E1	EFI	Color Proof XF	Yes	Yes	Yes	Yes
E2	EFI	Color Proof XF	Yes	Yes	Yes	Yes
F1	Fuji/Enovation	Fuji FinalProof GXT	Yes	Yes	Yes	Yes
G1	GMG Americas	GMG ColorProof 04	Yes	Yes	Yes	Yes
G2	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes
G3	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes
G4	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes
H1	Heidelberg	Meta Dimension	Yes	No	Yes	Yes
K4	KPG	Matchprint ProofPro Rip /Epson 4000	Yes	No	Yes	Yes
K5	KPG	Matchprint Digital Halftone	Yes	Yes	Yes	Yes
K6	KPG	Kodak Approval XP4 NX	Yes	Yes	Yes	Yes
M1	Mid States	Press White 195	Yes	Yes	n/a (see entry E1)	n/a (see entry E1)
M2	Mid States	White Satin 230	Yes	Yes	n/a (see entry E1)	n/a (see entry E1)
SOFT PROOFING SYSTEMS						
C4	Creo	Synapse Insite	No	No	Yes	Yes
D3	Dalim Software	Dalim Dialogue	No	Yes	Yes	Yes
I1	ICS	Remote Director	No	No	Yes	Yes
I2	ICS	Remote Director	No	No	Yes	Yes
K1	KPG	Matchprint Virtual Proofing Apple Cinema 20"	No	No	Yes	No
K2	KPG	Matchprint Virtual Proofing Apple Cinema 30"	No	No	Yes	No
K3	KPG	Matchprint Virtual Proofing E120 C621	No	No	Yes	No

Features Comparison

Supplier Code	Company	Product Name	Spot Color Support	Paper Simulation	Device Link Support	Available Media Options	Available Colorant Options
CONVENTIONAL PROOFING SYSTEMS							
A1	Agfa-Gevaert	Sherpa 24m Pigment	Yes	Yes	Yes	Yes	Yes
A2	Agfa-Gevaert	Grandsherpa	Yes	Yes	Yes	Yes	Yes
C1	Creo	Prinergy	Yes	Yes	Yes	Yes	Yes (CMYK)
C2	CGS	ORIS Color Tuner	Yes	Yes	Yes	Yes	Yes
C3	CGS	ORIS Color Tuner	Yes	Yes	Yes	Yes	Yes
D1	Dupont	Cromalin b2	Yes	Yes	No	Yes	No
D2	Dupont	Cromalin Digital iG4	Yes	Yes	No	Yes	Yes
E1	EFI	Color Proof XF	Yes	Yes	Yes	Yes	
E2	EFI	Color Proof XF	Yes	Yes	Yes	Yes	Yes
F1	Fuji/Enovation	Fuji FinalProof GXT	Yes	No	Yes	Yes	Yes
G1	GMG Americas	GMG ColorProof 04	Yes	Yes	Yes	Yes	No
G2	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes	No
G3	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes	No
G4	GMG Americas	ColorProof 04	Yes	Yes	Yes	Yes	No
H1	Heidelberg	Meta Dimension	Yes	Yes	Yes	Yes	No
K4	KPG	Matchprint ProofPro Rip /Epson 4000	Yes	Yes	Yes	Yes	No
K5	KPG	Matchprint Digital Halftone	Yes	Yes	Yes	Yes	Yes
K6	KPG	Kodak Approval XP4 NX	Yes	Yes	Yes	Yes	Yes
M1	Mid States	Press White 195	Yes	Yes	Yes	Yes	Yes
M2	Mid States	White Satin 230	Yes	Yes	Yes	Yes	Yes
SOFT PROOFING SYSTEMS							
C4	Creo	Synapse Insite	Yes	Yes	Yes	Yes	No
D3	Dalim Software	Dalim Dialogue	Yes	Yes	No	No	No
I1	ICS	Remote Director	Yes	Yes	No	No	Yes
I2	ICS	Remote Director	Yes	Yes	No	No	Yes
K1	KPG	Matchprint Virtual Proofing Apple Cinema 20"	No	Yes	Yes	No	No
K2	KPG	Matchprint Virtual Proofing Apple Cinema 30"	No	Yes	Yes	No	No
K3	KPG	Matchprint Virtual Proofing E120 C621	No	Yes	Yes	No	No

Features Comparison

Supplier Code	Company	Product Name	Tested Configuration	List Price at Tested Configuration
CONVENTIONAL PROOFING SYSTEMS				
A1	Agfa-Gevaert	Sherpa 24m Pigment	Sherpa 24m Pigment	$5,500
A2	Agfa-Gevaert	Grandsherpa	GrandSherpa 7-Color	$21,000
C1	Creo	Prinergy	Prinergy+Veris	$37,000
C2	CGS	ORIS Color Tuner	ORIS Color Tuner Pro	$4,250
C3	CGS	ORIS Color Tuner	ORIS Color Tuner Light	$2,250
D1	Dupont	Cromalin b2	Standard Cromalin PC Proof Server + b2	$25,995
D2	Dupont	Cromalin Digital iG4	iG4 system upgraded with PC Proof Server	$39,995 + $4,995
E1	EFI	Color Proof XF	XF, Spotcolor option, HP 130 NR	software $2,000
E2	EFI	Color Proof XF	XF, Spotcolor option, HP 130 NR	software $2,000
F1	Fuji/Enovation	Fuji FinalProof GXT	Yes	$150,000
G1	GMG Americas	GMG ColorProof 04	ColorProof 04/Epson 4000	software $2,750
G2	GMG Americas	ColorProof 04	ColorProof 04/Epson 4800	software $2,750
G3	GMG Americas	ColorProof 04	ColorProof 04/Epson 4800	software $2,750
G4	GMG Americas	ColorProof 04	ColorProof 04/HP 130	software $4,750
H1	Heidelberg	Meta Dimension	Meta Dimension ProofStation/ HP 130	$10,995
K4	KPG	Matchprint ProofPro Rip /Epson 4000	ProofPro Rip /Epson 4000	$5,000
K5	KPG	Matchprint Digital Halftone	Creo Trendsetter Spectrum	$140,000
K6	KPG	Kodak Approval XP4 NX	Approval	$150,000
M1	Mid States	Press White 195	n/a	$1.30/ 11X17 proof +ink
M2	Mid States	White Satin 230	n/a	$1.50/ 11X17 proof + ink
SOFT PROOFING SYSTEMS				
C4	Creo	Synapse Insite	Insite + Prinergy	$25,000
D3	Dalim Software	Dalim Dialogue	Dalin Dialogue v 3.1	$5,000
I1	ICS	Remote Director	LCD 30"	$22,800/seat/year (unlimited use)
I2	ICS	Remote Director	Eizo Display	$22,800/seat/year (unlimited use)
K1	KPG	Matchprint Virtual Proofing Apple Cinema 20"	Apple Cinema 20"	Monitor + $1,000
K2	KPG	Matchprint Virtual Proofing Apple Cinema 30"	Apple Cinema 30"	Monitor + $1,000
K3	KPG	Matchprint Virtual Proofing E120 C621	EIZO CG21	Monitor + $1,000