

# IPA Digital Print Forum 2009 - Procedures & protocols v4

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<http://www.ipa.org/knowledge/conferences/2009-digital-print-forum>

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**Author** Abhay Sharma  
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**Document name** Digital\_Print\_2009\_v2.pdf  
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**Author** Abhay Sharma  
**Revision history** Version 2  
**Changes** Received and incorporated written comments from – HP, Kodak, Konica-Minolta, Xeikon.  
Introduced costing for the project - \$5000 project costs + \$3000 Graphic Arts Monthly advertisement + \$374 Resometer  
Introduced common paper type - NewPage Futura Laser Gloss  
Forum now open to DI offset press technologies  
Introduced tolerances based on ISO 12647-7.2  
Introduced concept of a certificate for “contract proof” or “validation print”  
Introduced test for measurement of productivity at customer sites  
Special features topic inserted  
De-inking according to INGEDE protocol arranged with FOGRA  
Test for visual ranking of images removed  
Carbon footprint topic removed  
Established a web site for this project

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**Author** Abhay Sharma  
**Revision history** Version 3  
**Changes** Changes from Version 2 to Version 3 are shown in red  
Section 1 Included reference to review of 2008 Forum in Seybold Report  
Section 5 Budget - Removed the proposal to have a paid advertisement in GAM  
Section 6 – Timeline - Introduced February 13, 2009 deadline to confirm supplier configuration  
Section 16 Duplex Printing- proposed a test image  
Section 21 Pantone - Described the use of Pantone GoeGuide™  
Section 24 Match to GRACoL - Added L\*a\*b\* values of NewPage paper  
Section 25 Clarified items relating to ISO validation  
Section 27 Clarified the Taber rub resistance and the question of a protective finish, w.r.t Xeikon  
Section 31 Clarification on press speed test

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**Author** Abhay Sharma  
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**Changes** Changes from Version 3 to Version 4 are shown in red

# 1. Introduction

In 2008, the IPA conducted the first Digital Print Forum where we reviewed digital production devices from HP, Kodak, Konica-Minolta, Xeikon and Xerox, and compared these to the same images printed on a Heidelberg XL 105 offset press. The results were provided in a 46-page booklet that included actual print samples from each device in the study.

The 2008 Digital Print Forum was a huge success, many suppliers and end users are using the report. The report was published in April, 2008 and since that time, the results have been publicly discussed at the following events.

*Digital Print Forum: A Landmark Study of Digital Print*, A Sharma, IPA Technical Conference, Chicago, April 21-24, 2008

*2008 IPA Digital Print Forum Results – Webinar*, A Sharma, M Habekost, J Walter, C Hura, Presented May 21, 2008 and available as a recording from [www.ipa.org](http://www.ipa.org)

*IPA Testing Shifts to Production-Level Digital Color Printing*, J Parsons, Vol 8, Number 9, The Seybold Report, 2008

*Digital Presses: See How They Run*, A Sharma and M Habekost, Graphic Arts Monthly, May 2008, p 64 – 65 in print and also online at <http://www.graphicartsonline.com/article/CA6560228.html>

*Digital Press Certification*, A Sharma and M Habekost, IDEAlliance Print Properties Meeting, Nov 10-11, 2008, Rochester, NY

*Toner Based Technologies*, A Sharma and P Crean, Digital Imaging Association Meeting, Nov 19, 2008, Toronto

*IPA Digital Press Research Study*, A Sharma, PIA/GATF Color Management Conference, presented at the Pre-conference Session: Color Management and Digital Printing, Dec 7-9, 2008, Phoenix, AZ



An online video summary of the 2009 program has been published at [http://www.ipa.org/DPF\\_Review](http://www.ipa.org/DPF_Review)

Discussions with end users are taking place at PrintPlanet <http://printplanet.com/forums/digital-printing/>

Digital color printing is the topic at many international events, consider for example a special ICC Digital Print day on March 4, 2009, organized by the ICC with the École Nationale Supérieure des Télécommunications and London College of Communication, and sponsored by Océ. <http://www.color.org/digitalprint09.html>

An exciting development for 2009 is that the procedures and data gathered from the IPA Digital Print Forum will form the basis for the development and implementation of a related IDEAlliance Digital Print Certification process that will be similar in nature to the existing IDEAlliance SWOP/GRACoL certifications for inkjet and monitor soft proofing.

We salute the bravery of the suppliers that entered the initial 2008 survey. The outcome and the results were not known beforehand, and the format and presentation of the data was also unknown. In this environment we applaud the bravery of those suppliers that participated. Reviews of this nature improve our technologies and thus grow the opportunities for everybody in digital production printing. We are

now beginning to plan for 2009. We intend to have an expanded Digital Print Forum with more entrants, more tests and systems from new suppliers. *Please participate and become involved in the industry's most important study of digital production printing.*

## 2. List of Supplier Systems 2008

A list will summarize the details of each system studied in the Forum. The table will include the supplier name and the device/hardware name. The suppliers will be asked to provide an indicative list price for a standard, base configuration including RIP. If greatly different, the price of the device used to produce the data in the report should also be provided. The digital front end (DFE) that was driving the device will be listed, the paper used will be listed, and any relevant configuration options will be described.

The systems studied in 2008 are shown below.

#	Supplier	Hardware	List Price US\$	Digital Front End (DFE)	Printed at	Substrate
1	Heidelberg	XL 105	2,900,000	N/A	-	Sappi Hannoart Gloss 80 lb Text
2	HP	indigo 3050	259,000*	indigo RIP 5.2	Cober Printing	Spicers Supreme Gloss 80lb Digital
3	HP	indigo 5000	349,000*	HP Press Production Manager 2.5.16	North American Color	Sappi Hannoart Gloss 80 lb Text
4	HP	indigo 5500	415,000*	HP Press Production Manager 2.6.1	Cober Printing	Spicers Supreme Gloss 80lb Digital
5	KODAK	NEXPRESS S3000	542,000	NexPress V Front End with System Software v10	-	NewPage Sterling UltraGloss 80lb Text
6	Konica-Minolta	bizhub PRO C6500	75,000	Fiery IC-303 version 1.1	-	Gloss Print 80 lb IT Digital
7	Punch Graphix	Xeikon 6000	795,000	X800 version 1.8	-	130 gsm Arctic Gloss 4DI 500mm
8	Punch Graphix	Xeikon 8000	TBA	X800 version 2.0	-	130 gsm Arctic Gloss 4DI 500mm
9	Xerox	iGen3 110	580,000	Xerox FreeFlow Print Server	-	Xerox Digital Color Elite Gloss Text 120 gsm

\* Based on 4-color configuration

## 3. Digital Presses, DI Presses, Production Inkjet?

The Forum is aimed primarily at toner based, xerographic type, color, digital production presses. For comparison purposes, the forms will also be run on a Heidelberg offset press. In 2009 we expand the Forum to include DI press technology where the plates are imaged on the press (e.g. Presstek 34 DI, Ryobi 3404 DI, Screen TruePress 344, KBA 74 Karat and Heidelberg QM DI) and also where appropriate to inkjet technologies (e.g. production inkjet and large-format inkjet).

The protocols were developed for toner-based technologies, thus the procedures and protocols are often couched in “toner terminology”, however it is very appropriate for other technology areas that serve this market segment to be included in the study.

#### **4. List of Supplier Systems 2009**

Nobody is excluded from the Forum, everybody is welcome to participate. In 2009, we invite the following suppliers to participate.

- **Digital Presses**
  - Canon
  - HP
  - Kodak
  - Konica-Minolta
  - Océ
  - Ricoh (IKON)
  - Toshiba
  - Xeikon (Punch Graphix)
  - Xerox
  
- **DI Presses**
  - Presstek
  - Screen
  - KBA
  
- **Offset Press**
  - Heidelberg

Due to the changes in our procedures from 2008 to 2009, and the complexity of comparing digital to offset, Heidelberg will no longer be producing samples using the XL 105. Offset will continue to be represented by Presstek and Screen.

The following suppliers have confirmed their entry (current March 23, 2009).

Supplier	Hardware	Software
Canon	imagePRESS C7000VP	-
Heidelberg Canada	Speedmaster XL 105-10P	-
HP	HP Indigo 7000	HP SmartStream Production Pro Print Server
Kodak	NexPress S3000	NexPress V
Océ	CS665 Pro	-
Presstek	Presstek 52DI	-
Screen	Truepress 344	-
Toshiba	e-STUDIO6530c	EFI Fiery
PunchGraphix	Xeikon 8000	X800
PunchGraphix	Xeikon 3300	X800
Xerox	Xerox iGen4	Free Flow Print Server, CGS/Oris PressMatcher

## 5. Cost to Supplier - US\$ 5000 per System

There are numerous costs involved in the Forum. There are external costs for the many tests we plan to conduct. There are labor costs – to pay for measuring the press sheets and collating the data, and there are costs involved in producing the final report. The pilot project in 2008 made a huge loss to the organization and was not a viable funding model. The IPA does not seek to make a profit from the Digital Print Forum, the charges being made are intended to cover the costs incurred in this project.

The following is the cost for each system, based on a good faith estimate of our underlying costs.

### BASE FEE

Full test protocol, analysis of data, detailed entry in the final report (includes rub tests, cracking test, fading test, productivity survey, colorimetry, Pantone test, INGEDE Method 11, etc.)	IPA Member	\$5000*
	Non-Member	\$7000*

\*First system only. Additional systems \$4000.

NOTE: (i) Each participating supplier will receive 50 copies of the published report for internal distribution or for clients and customers. (ii) The non-member rate then gives the supplier one year membership of the IPA and all benefits (iii) Non-members pay \$7000 for the first system, but member's rate after that (iv) The cost of entry will enable "member's rate" at the subsequent IDEAlliance Digital Press Certification process.

Henry Freedman's Resometer™

\$374

It is essential that all participants own their own copy of this product before they submit their entry. Suppliers may already own this software tool.

Do you have an uptight manager or director of marketing who only counts pennies and does not see the depth and real value of this work? Are they complaining about their budget? Remind them that SWOP Certification, for non-members costs \$6500, and is valid for 2 years, while Fogra certification for non-members is \$8500 (€6000). If it helps, we are happy to FedEx them a free copy of the full 2008 report with print samples. We will also send them a copy of the article in Graphic Arts Monthly, May, 2008 issue, that was seen by 70,000 subscribers in the US. Just send me their address and we will overnight this material to them. If all else fails, get down on your knees and beg..... try it, I use it all the time, it works!

\*\* For a free copy of the 2008 report send me an e-mail with your manager's mailing address. Abhay. E-mail: [sharma@ryerson.ca](mailto:sharma@ryerson.ca) \*\*

A contract is provided in Appendix A, and suppliers will be invoiced by IPA on confirmation of entry.

## 6. Timeline (Revised from v1 of this document)

### 2008

October 10 – *Procedures & Protocols* version 1 document to be published

October 17 – Conference call with all participants to review the draft document

October 29 – Face-to-face meeting at Graph Expo

November 10-11 - Print Properties Meeting, RIT, Rochester – discuss IDEAlliance certification

### 2009

January 5 - *Procedures & Protocols* version 2 document to be published

January 15 - Conference call with all participants to review version 2 document

January 31 – Final - version 3 of *Procedures & Protocols* document to be published

February 13 – Deadline to confirm supplier systems

February – Work with suppliers to confirm systems for testing, production of print samples

March 9, 2009 – All digital files to be released, NewPage paper ordered.

March 16, 2009 – paper to arrive with all participants

April 13 – absolute latest to receive your print samples, must receive all samples this week

April - May – testing and evaluation to be completed, final report compiled

June 8-10 – IPA Technical Conference, Chicago

## 7. I am not ready to go public.....

Some suppliers may not be ready to participate in the Forum this year but may have a device that is in development and/or testing phase. There is no ability to use an anonymous code system, such as Supplier A1, Supplier A2, etc. Instead there is the ability to do the tests “offline”. In this format, suppliers provide their samples according to the mainstream test procedures, and their samples are measured and evaluated at the same time as all other entrants. The data from these tests, however, will only be provided to the supplier and will not appear in the official published data. The process allows suppliers to be measured and evaluated independently by a third-party and to have exactly the same equipment and test procedures applied to their samples. The cost to do this “offline” evaluation will be the same as the “public” testing. Those systems submitted for "offline" testing are not eligible to be re-categorized as "online" and cannot be submitted for testing in the main Forum this year, but we hope that the data will encourage the supplier to participate in future studies. **Deadline to decide between private/public testing is April 13, 2009.**

A condition of the Digital Print Forum is that each system entered must be shipping and commercially available — R&D, beta devices or development software and products are not permitted, except for the situation of “offline” testing as described here.

## **8. Do I have to enter all the tests?**

If your device can perform a test, then yes, in the spirit of the Digital Print Forum it is required that you submit entries for all tests. Any given device cannot perform best in all categories and there are some categories in which there may be less than stellar results. This can be easily explained by, “we are not aiming for that market segment and have therefore not prioritized our functionality in that area.” When dealing with complex technologies this is an understandable and acceptable position.

If a supplier has a device that can perform a particular test, e.g. light fading, and the supplier refuses to produce the appropriate image for this test, then this will be reported in the published document. Wording that may be used could be “Supplier chose not to enter”, or “Data not provided by supplier – contact your local representative for further information.” It is the intentions of the Forum, that all the submission components will be done on a single device. Suppliers should review all the tests to ensure that the chosen device configuration can create all the required print samples.

## **9. Which Press is Best?**

The report aims to present the findings of the Digital Print Forum 2009, it is not appropriate for us to make recommendations or draw conclusions from the data. The report will, however summarize and consolidate the data for each device. The results for each device will be strewn throughout the report, it will be helpful to put in a single paragraph an overview for each device to paint a general picture for the reader.

The results are intended to allow users to make informed buying decisions about digital printing systems. It is left up to the end-user/future customer to review the data and make purchasing decisions that are relevant to their own printing requirements and priorities.

It would be impossible to declare the “#1 car” in the world. What criterion would be used to arrive at that statement? What is the most important issue - gas consumption, safety rating, pulling power, acceleration from 0-60 mph? Everybody will weigh these parameters differently, in the same way it is difficult to declare the “#1 digital press”, it is however possible to help the user identify the “#1 digital press for you”.

This report provides information so that users can identify the right press for them and begin to ask the right questions as they understand the challenges and opportunities of short-medium run print production and sales.

## **10. Delta E**

Throughout the Forum report, traditional  $\Delta E^*_{ab}$  will be used, in order to provide a benchmark for backward comparisons. In recognition of the newer equations and to provide compatibility with the other IDEAlliance certification procedures, data will also be expressed in  $\Delta E^*_{00}$ .

## 11. Substrate

It is possible to source a common paper for all participants. In fact, that approach was used when similar studies were conducted by PIA/GATF in 1999 [1] and 2003 [2]. In those studies the same paper was provided to all suppliers. In the IPA Digital Print Forum 2008, all suppliers were instructed to use a coated, gloss finish, 80lb/120 g/m<sup>2</sup> text stock for all tests, but we *did not* supply a common stock to all participants. To eliminate a major variable (paper) from the evaluation, in 2009, *we will* supply a common stock to all participants. We have been approached by NewPage who are able to provide the following stock to all participants:

NewPage Futura Laser gloss, 100lb text, gloss coated, 12 x 18”



The paper is available in different sizes – 8.5 x 11”, 11 x 17”, 12 x 18”, and 14.3 x 20.5”. For all sheet-fed devices we will attempt to use a single size – 12 x 18”. For our friends at Xeikon, and others, we will source a roll from the same batch. ~~Due to time constraints it is not possible to derive all paper from a single mill source. Participants will use NewPage Futura Laser gloss, 100 lb text, from commercial “off the shelf” sources and not converted from a single roll of mill paper.~~ Through the help of Dennis Essary, NewPage, the paper has been converted from a single mill source. Futura Laser gloss has been sheeted and shipped to all participants in early March, 2009. If appropriate this stock may be used by offset and DI technologies, otherwise an alternative product may be used by those suppliers.

Suppliers can sometimes prefer paper types that work best with their machines. In addition to the NewPage paper type described above, suppliers at their own discretion may seek to submit the tests on a substrate of their choosing. This is allowed and is considered another “system”, which will incur another system fee.

We thank NewPage for their generosity in providing paper for this test. The order for paper will be coordinated centrally by the IPA, suppliers are requested to not contact NewPage directly. Specific questions can be addressed to Dennis Essary. Contact: Dennis Essary, Director, Digital Business Development, NewPage Corporation, 23 Quaker Lane, Trumbull, CT 06611. E-Mail: [Dennis.Essary@newpagecorp.com](mailto:Dennis.Essary@newpagecorp.com)

## 12. Visual Images

Each supplier will be required to print visual images chosen for the usual characteristics of flesh tones, memory colors, etc. The reproduction style will not be specified, suppliers will be asked to produce good output quality as if for a typical customer job. The size of the images will be considered. The book is to be produced 8.5 x 11”, but attempts should be made to include images with large detail to better enable color comparisons.

In version 1 of this document there was a proposal to rank visual imagery. To do this properly, there are enormous logistical challenges, so after discussions with all parties, the visual ranking experiment has been dropped from the Forum.

## 13. Sheet to Sheet Variability

In this test we will measure the sheet-to-sheet variation over a press run. Suppliers will submit 1000 printed sheets. From these sheets, # 1, 100, 200, 300, .....1000 will be pulled. The density value of the C, M, Y, K solid will be measured for these 11 sheets using an X-Rite 530 or 939 spectrophotometer. The

experiment seeks to measure any variation of the print process over 1000 sheets. After measurement, the remaining sheets will be used to produce the sample booklets.

The X-Rite 939 will be used in measurement of sheet to sheet variability. (The 939 is a higher end device compared to the X-Rite 530.) The large solid patches from the lower left area of page 2 will be measured to determine variability. The print run is increased to a run length of 2500 copies. Variability will be measured over the whole press run. For information purposes this parameter will also be computed for variability over 1000 sheets (as done in 2008), and the data made available to interested parties. The official reporting will consider 2500 copies. The increase to measuring the variability over 2500 copies provides better statistical data, and could represent a typical production scenario, but does raise the bar for supplier entries.

## 14. Variability from Day to Day

Suppliers will be asked to provide a print sample from two consecutive days. The date and time stamp should be in a “slug line”, imprinted via the machine/RIP. Solids and mid-tone patches will be measured to quantify the repeatability of the device. Target values are in accordance with ISO 12647-7.2 and are summarized in Section 25

## 15. Sheet Variability within a Page

In this test we will have a target repeated at different positions on a page. We will measure the value of the same patch at different positions on a page and determine the uniformity of printing within a page. This is considered in Section 25.

## 16. Sheet Variability with Duplex Printing



*Figure: These two pages when printed duplex will each have a white backing.*

In this test the same digital original will be printed on the front and back of a sheet. The difference between the same image printed on different sides will be measured. The image may be printed against a white background.

## 17. Variation of a Tint

This test seeks to quantify a well known issue in digital printing. Can the digital production press reproduce a tint evenly across a page? Does digital printing have more variability than an offset press? An image will be specially constructed, with two areas of constant CMYK pixel values; 50, 40, 40, 0 and 0, 0, 0, 50. We will visually judge any distortion or patterning across these large near-neutral image blocks. We may also use Roy Rosenberger’s Verity IA, scanner based technology, to quantify the mottle or perturbation across the image area by scanning the sample and using digital image analysis to



quantify the variation.

Printing uniformity is also evaluated in the certification process, Section 25.

## **18. Measurement of gloss**

We seek to measure the gloss of the print in solid ink areas. We will use a Novo-Gloss glossmeter at 75<sup>0</sup> incident angle and 75<sup>0</sup> measurement angle to report the gloss for informational purposes. We aim to measure the gloss vs. dot area coverage on the print.

There is debate on the use of matt or gloss paper for this test. It is not logistically possible to provide matching matt paper to all participants, Following recent conference calls and general discussion we have removed this test this year, and may re-visit this concept in future Digital Print Forums.

## **19. Color of the Colorants**

ISO 12647-2 is an international standard that describes conditions for offset printing, including the color of the printing inks [3]. The color of the digital press colorants (toner, liquid ink) will be compared to ISO standard inks as specified in ISO 12647-2. From the standard we chose the color of the printing inks based on paper type 1, gloss-coated, measured with white backing - this best represents the configuration used in the Forum.

It is not necessary that the colorants of a digital print process correspond to offset printing inks. It is interesting to see if the suppliers attempted to match offset inks in their choice of colorant. If there happens to be a good correlation between digital toner and offset inks, then the work of a color management system is made easier, any pixel value, for example, 70% cyan on the digital press will look similar to 70% cyan on an offset press. It would be possible to obtain a good color match, for example, using only the GRACoL G7 calibration process, if the digital colorants are similar in color to offset inks. (It is necessary to ensure that the patch being measured is 100% pure solid and not, for example, 100% Cyan + 10% Magenta, due to color management and RIP parameters.)

It is widely accepted that the color of the colorants is NOT a requirement for a good color match, nevertheless with DI presses in the review, it is relevant to evaluate this parameter, as it requires no extra printing or tests.

This test is for informational purposes only, and therefore will be reported in the Appendix, and not in the main body of the report, in order not to give the reader the impression that this test is an important requirement for accurate color reproduction.

## **20. Darkest Patch**

In digital printing the darkest patch may or may not be 100% K. A “black” color on paper can be made from black toner only, i.e. a single-color black or the printing system may decide to create black from black and other colors. Rich black or 4-color black may consist of C, M, Y and K. In digital printing a black overprint may improve uniformity and mask any unevenness in print quality. The addition of CMY to K can either make the black patch darker or it can introduce a tint and appear lighter, so that CMYK black may produce a black that is less dense than 100% K.

In this study, data from measurement of the IT8.7/4 target (Section 23) will be examined to determine the patch with the lowest L\* and least color (minimum a\* and b\*). We also seek to record the L\* of 100 K.

## 21. Pantone® Colors – Test I

Special colors are a necessary part of many print jobs today. The Pantone® system may be used to specify special colors in a design or page. In Pantone Colors - Test I, it is useful to confirm that the RIP in a digital print system is able to detect spot color objects (either as L\*a\*b\* values or Pantone names) and produce a good match to the Pantone Formula Guide. The supplier is free to use the Pantone name, digital library or any other internal iteration system they chose to reproduce the color.

A digital file will be made available, containing 10 Pantone Goe colors. These specially chosen colors are expected to be in-gamut of a commercial offset print process, as represented by GRACoL 2006 characterization data. Each press supplier will be asked to print these colors so that they match the Pantone Formula Guide. All participating suppliers will be provided with a formula guide. The printed samples and the Pantone book will be measured using CIE L\*a\*b\*, D50/2°, black backing and an X-Rite 530-~~or~~ 939 device. UV will be included in the measurement and a number of measurements will be taken and averaged. The difference will be expressed as Average and Maximum Delta E. I will compare my Swatch book and your printed patches directly to each other in terms of L\*a\*b\* values and Delta E. We have all been sent a new Pantone Goe book from the same batch.

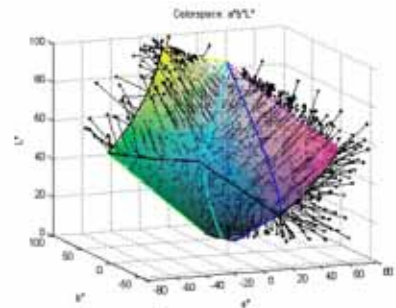
In 2008 we specified conventional Pantone colors, in 2009 we will specify colors according to the new Pantone Goe system. The IPA will coordinate with Pantone, who will send to each supplier the Pantone GoeGuide™ coated swatchbook. With each guide, Pantone will include the Goe digital library CD that installs the coated, uncoated and GoeBridge digital libraries in Adobe CS3/4. Should you want to download and install them immediately for testing, just go to:

[http://www.pantone.com/pages/MYP\\_mypanone/mypanInfo.aspx?pg=20576&ca=75](http://www.pantone.com/pages/MYP_mypanone/mypanInfo.aspx?pg=20576&ca=75)

2500 copies of the “Pantone Sheet” are to be printed. Which one will be used in the measurement? We have created very exacting testing conditions and I want to give all suppliers a comfort level, so each supplier, may at their discretion, select a particular sheet and mark this as “The Pantone sheet”? There should be little difference between the “selected” sheet and the 2500 sheets.

## 22. Pantone® Colors – Test II

How many Pantone colors can a digital press reproduce? A percentage of Pantone colors are likely to be outside the gamut of a digital print device. In general, most digital print systems will be able to reproduce a useful number of Pantone colors via CMYK simulation. In Pantone Colors - Test II we will use the Pantone Digital Library from Adobe Photoshop CS3 and test to see how many of these colors are within the gamut of each device.



We will make an ICC output profile for each device from a “full gamut” IT8.7/4 target printed by the supplier. Next using Graeme Gill’s Argyll color management library and CMM [4], we will use command line instructions to determine how many L\*a\*b\* values would be clipped and thus outside the color gamut of the device. It may be useful to introduce a Delta E tolerance to the experimental results to better match what we see in real-life. We will compare this data with data provided in sales literature, where available. A better way of doing this analysis using BabelColor software is being tested. BabelColor can provide a cumulative distribution of Delta E values.

If a supplier offers extended gamut technology using hardware or software tools, then the supplier is allowed and encouraged to utilize that system, and have it measured and reported.

## 23. Digital Characterization Data – Printing the IT8.7/4



We request IT8.7/4 targets for each entry. We request targets that are printed with “full-device gamut”, described here, and separately printed again to meet a reference printing condition, see Section 24.

An untagged, CMYK tiff image will be provided. Suppliers are required to print this image with substrate calibration and ink limiting, but no color management. The form has the words "FULL GAMUT" on it to distinguish it from the test in Section 24. Suppliers are requested to submit 2 targets at 0° and 2 further targets printed by rotating 180°. Do not remove crop marks. The printed size of each patch should measure 6 x 6 mm. This form will be measured on an X-Rite Eye-One iSis XL, UV excluded.

All IT8.7/4 targets (described in this section and other sections) will be measured with UV excluded from measurement (i.e. A UV cut filter will be used).

All other spot measurements (described throughout this document) will be done with a handheld device – the X-Rite 939, with UV included (i.e. No UV cut filter).

All targets that will be measured with the X-Rite iSis XL will use white backing, because the device has only this option! Any target that has the “diamond tractor lines” will be measured with white backing. Everything else using the stand alone X-Rite 939 will be measured using black backing, the NewPage paper and the Pantone book are so thick this will be OK.

The print density of the pure CMYK patches is not specified, each supplier should choose an optimum setting that creates the largest gamut for their device. The supplier can use CMYKOVG or CMYKcm if available, to increase their color gamut. The characterization data gathered from measurement of this target will be used to determine the blackest black and also to create an ICC profile and thus to compute color gamut, reproducible Pantone colors, etc.

A long-term goal of this work is to develop a digital reference printing condition. The data gathered here provides data for that initiative.

## 24. Matching a Printing Condition – GRACoL and SWOP



It is interesting to know if suppliers have a process to achieve a colorimetric match to a given characterization data set, and how well they can achieve it. It is not generally necessary that a digital press match an offset press, however there are many commercial situations where digital may be placed alongside offset printing. In general it is useful to know if the supplier is able to create any required “look and feel” on their press. We choose as our “targets”, three well known printing conditions, and ask the suppliers to match these conditions on their digital device. This test will be based on a colorimetric (CIE L\*a\*b\* Delta E) correlation of the supplier’s print to a chosen characterization data set. There will be three reference printing conditions

- GRACoL 2006, Coated #1
- SWOP #3 coated paper
- SWOP #5 coated paper

We will supply an untagged, CMYK tiff image. Suppliers are required to print this image with substrate calibration and color management. When measured, the supplier's target should match as closely as possible the GRACoL (or other) characterization data set. The form will have the words "GRACoL", "SWOP #3", "SWOP #5" on it to distinguish from other tests. Should you need them, characterization data and ICC profiles are available, for free, from [www.idealliance.org](http://www.idealliance.org).

We request IT8.7/4 targets for each entry. For each printing condition, the supplier will submit 2 targets at 0° and 2 further targets printed by rotating 180°. The measuring instrument will be the iSis XL, UV excluded. Do not remove crop marks. The printed size of each patch should measure 6 x 6 mm.

If you look in the reference file header of the GRACoL, SWOP characterization data files, it says, no filter, which means UV included. After the January 15, 2009 conference call, the majority of participants would like UV excluded, the vote was 11 UV excluded to 5 UV included. So the characterization data was measured with UV included, but we will measure with UV excluded. Of course if the paper being measured has no OBAs then UV included = UV excluded!

The test for matching a printing condition will be determined using an X-Rite iSis XL with "UV excluded".

The white point of the chosen paper type (NewPage Futura Laser) is compared to reference printing condition white points in the following table. WE NEED TO ACKNOWLEDGE THE DIFFICULTY IN HITTING GRACoL #1 PAPER WHITE POINT WITH THE CHOSEN NEWPAGE STOCK.

	NewPage Futura Laser (UV incl)	NewPage Futura Laser (UV excl)	GRACoL #1	SWOP #3	SWOP #5
L*	95.20	95.01	95	93	90
a*	1.14	-0.74	0	0	0
b*	-7.45	-1.53	-2	0	4

## 25. Certifying a Press

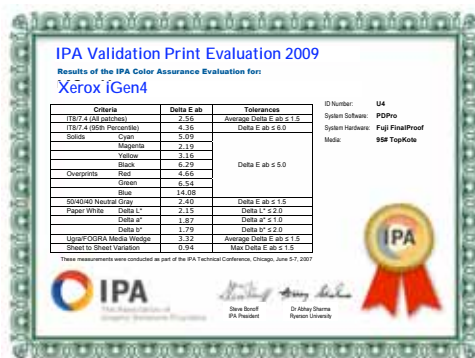


Figure: The Digital Print Forum will measure supplier samples and issue a certificate for Contract Proof and Validation Print according to ISO 12647-7.2 criterion. The certificates are provided directly to the supplier, the supplier may or may not choose to make public one or other of their certificates. Samples shown are draft only.

We will issue two certificates based on measurement of the suppliers samples. The certificates relate to the color measurement and print uniformity only. It is important to define two different tolerance settings. There exist two different needs in the printing and publishing market. The first is the well-established *Contract Proof* that has very tight tolerances (e.g. average Delta E match to a characterization data set = 1.5). This tolerance is used in the SWOP/GRACoL Certification process and is routinely achieved on a single sheet of inkjet and other proofing systems, when printing on specific substrates and using well calibrated and characterized systems. When a Contract Proof is made according to a specific referenced printing condition it provides a good simulation of the final print product and therefore acts as a contract between the customer and the printer. The Contract Proof may travel with the job docket, providing a visual match for the press OK, and everybody else in the printing workflow.

For everyday production printing it is not practical, neither desirable to ensure such high tolerances. Every sheet in a medium length press run does not need to meet such exacting standards to meet customer expectations. The industry has therefore been developing a reduced, less-stringent set of requirements called *Validation Print*. This methodology has been used by the Fogra [5]. to certify the following systems: OCE CS 650, Xerox DC 700, Xerox DC 260 and Canon Image Press C1 [6].

The IPA Digital Print Forum will measure supplier samples and tell the supplier if they, according to ISO 12647-7.2 criterion [7], meet the Contract Proof and/or the Validation Print standard. The supplier then has some understanding and feedback, should they be interested in the applying for the FograCert program (existing) or the IDEAlliance Digital Press Certification process (to come). The certificate will be labeled “IPA Contract Proof Evaluation 2009” and “IPA Validation Print Evaluation 2009”. The certificate will show three columns – the target tolerance, the measured parameter, a Pass/Fail statement. Each supplier will be issued both certificates. The certificates are provided directly to the supplier, the supplier may or may not choose to make public one or other of their certificates.

Note that for certification, a supplier system must “pass” each test to achieve certification. The IPA Digital Print Forum does not offer official certification, and therefore provides feedback on all the tests, and does not define a pass or fail in terms of certification.

In summary:

#### **Contract Proof**

This is a higher quality test, aimed at 1-off color proofing

This uses tolerances that are similar to IDEAlliance SWOP/GRACoL Certification for proofing

This uses tolerances that are similar to the FograCert Contract Proofing System

This uses tolerances that are similar to ISO 12647-7-2007 (i.e. original 12647-7)

#### **Validation Print**

This is a lower quality level test, is for a single sheet, but may be used for digital production printing

This uses tolerances that are similar to FograCert Validation Printing System

This uses tolerances that are similar to ISO 12647-7.2 (i.e. the new part of 12647-7)

The following tests/tolerances will be used to evaluate supplier submissions.

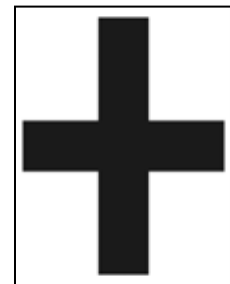
<b>Based on ISO 12647-7.2</b>	<b>Contract Proof</b>	<b>Validation Print</b>
<b>Substrate</b>		
Substrate (match to the white point of the target ref printing condition)	$\Delta E^*_{ab} \leq 3$	$\Delta E^*_{ab} \leq 3$
<b>Solids</b>		
Color difference between C, M, Y, K of the print compared to relevant ref printing cond.	$\Delta E^*_{ab} \leq 5$	$\Delta E^*_{ab} \leq 8$
Color difference between C, M, Y, K of the print compared to relevant ref printing cond.	$\Delta H \leq 2.5$	$\Delta H \leq 5$
<b>Print uniformity</b>		
Standard deviation between 9 locations on a sheet in L*, a* or b*	$\sigma \leq 0.5$	$\sigma \leq 1.5$
Color difference between any one point and the average of 9 points	$\Delta E^*_{ab} \leq 2$	$\Delta E^*_{ab} \leq 2$
<b>ISO 12647-7 Digital Control Strip 2007 #</b>		
Color difference between all patches of the control strip and the <b>reference print condition</b>	Maximum $\Delta E^*_{ab} \leq 6$ Average $\Delta E^*_{ab} \leq 3$	Maximum $\Delta E^*_{ab} \leq 12$ Average $\Delta E^*_{ab} \leq 3$
Hue angle difference between CMY and K only patches of the control strip <b>and the reference print condition</b>	Average $\Delta H \leq 1.5$	Average $\Delta H \leq 1.5$
<b>Outer gamut patches</b>		
A special set of 226 patches from the IT8.7/4 target	Average $\Delta E^*_{ab} \leq 4$	Average $\Delta E^*_{ab} \leq 4$
<b>All patches of the IT8.7/4</b>		
Comparison of all the patches of the ref data set to the print	Average $\Delta E^*_{ab} \leq 4$	Average $\Delta E^*_{ab} \leq 4$
Comparison of all the patches of the ref data set to the print	95 <sup>th</sup> percentile $\Delta E^*_{ab} \leq 6$	95 <sup>th</sup> percentile $\Delta E^*_{ab} \leq 6$
<b>Repeatability</b>		
Difference between primary and secondary solids of a print on consecutive days	$\Delta E^*_{ab} \leq 1.5$	$\Delta E^*_{ab} \leq 2.5$

Difference between mid-tones of a print on consecutive days	$\Delta E^*_{ab} \leq 1.5$	$\Delta E^*_{ab} \leq 3$
<b>Resolution and register (See Section 32)</b>		
Registration between any two color separations	$\leq 0.5 \text{ mm}$	$\leq 0.8 \text{ mm}$
C, M, and K positive, non-serif, type of 2 point size are legibly reproduced	Yes	Yes

# Where is the control strip printed?? Answer: It is not printed separately. It is (more or less) contained within the IT8.7/4 target so I will extract it from the measurement of the IT8.7/4 target and not have to measure again and introduce instrument measurement errors. If you want to locate the patch values yourself you can get the patch values from [idealliance.org](http://idealliance.org).

## 26. Fold and Crease Resistance

Output from all presses can create problems during finishing. In digital printing, we may believe that toner sits on top of the paper and does not penetrate the paper like printing ink [8]. When the sheet is folded the toner can crack. This is especially evident in cases of heavy coverage and/or folding across the grain direction [9]. The 2008 Digital Print Forum showed that some digital systems were better than offset, while others were worse. In 2009, this test will again be conducted at the Printing Applications Laboratory, Rochester Institute of Technology according to standardized test method ASTM F 1531. An image of a 100% K, “black cross”, will be printed by each supplier system. The sheet will be folded in the grain direction and at 90° to the grain direction. The cracked area will be digitally analyzed to compute the white paper visible using image processing techniques.



## 27. Taber Rub Resistance

Ink scuffing or rub off during shipping and handling can spoil the effect of quality printed products. The rub resistance of a sample will depend on many variables such as the choice of media, coating, characteristics of the toner particles, etc. Various instruments exist to determine the rub resistance of a printed sample, the Taber test is well established and accepted. The Taber test will be conducted at the Printing Applications Laboratory, Rochester Institute of Technology according to standardized test method ASTM 1478 [10].



In the Taber test, the sample is mounted on a rotating turntable, specimens are subjected to the rub-wear action of two abrasive wheels. Driven by the test sample, the wheels produce abrasion marks over approximately a 30 cm circular ring. This reveals abrasion resistance at all angles relative to the grain of the paper. The device simulates the motion of a truck or train during shipping, or processing of high-speed mail by the US Postal Service. At the end of the test, the before and after print will be measured and the % loss of density computed.

In 2009, we continue to request suppliers to provide a sample with no coating or post-print treatment of any kind. The only exception is the Xeikon system that includes as a normal part of the web-printing

process, a treatment whereby a specially designed mixture of water, salts, silicon oil and some wax is applied directly after printing. Xeikon have agreed to provide a sample with and without this liquid treatment, for this test.

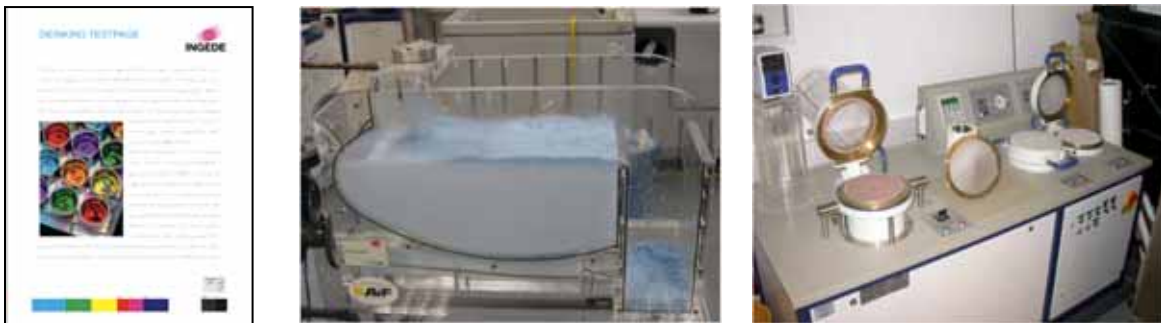
## 28. Fade Resistance

The early days of inkjet printing were plagued by dyes that exhibited fading and discoloration. Today inkjet prints show very good permanence. It is useful to use similar analysis to evaluate the stability of digital print processes. It is of interest to see the stability of the pigments used in digital print systems and also to observe if all four colors exhibit similar fade properties. An accelerated aging test exposes print samples to light and heat to determine their resistance to fading. The lamp emits intense UV radiation, which in a matter of hours approximates the destructive effect of a much longer period of ordinary daylight. These tests are an effective indicator of the degree of light stability that can be expected of a printed sample. The fade tests will be done in the Xe1 device that is part of the Q-Sun range of xenon test chambers from Q-Lab ([www.q-lab.com](http://www.q-lab.com)).

Samples will be exposed in steps, up to a maximum duration of 160 hours. The test will be performed in accordance to DIN 16525 "Testing of Prints and Printing Inks of the Graphic Industry" and ISO 12040. The Blue Wool scale is comparable to ASTM D 5383-02 and ASTM D5383-97.

In this test it is proposed to measure changes in density and  $L^*a^*b^*$  difference between the start and finish as a function of the Blue Wool scale ratings. A visual comparison is also part of the standards mentioned above, therefore a visual evaluation of any perceivable fading will be done.

## 29. Deinking at Fogra using INGEDE Method 11



*Figure: Approx 500 printed pages (left) will be pulped and de-inked by allowing the toner to separate from the paper by floatation (centre), the pulp will be made into a hand sheet (right) and measured for colorimetry  $Y$  or  $L^*$ .*

Green printing and sustainability are becoming important considerations in the market today. Good recyclability of printed products is highly desirable. Processes that improve image quality need to be balanced with the removal of these same particles during the deinking and recycling process. The International Association of the Deinking Industry (INGEDE) has a well documented test developed in conjunction with paper mills, paper research institutes and digital print suppliers. The deinking test is called INGEDE Method 11 [11,12]. In 2009 we will submit samples to Fogra to be tested according to INGEDE Method 11.

We seek to compare dry toner, liquid toner and offset printing technologies. From the 2008 Digital Print Forum we may conclude that liquid toner has some challenges, while dry toners showed no problems. In

many cases the deinkability parameters for dry toner were even better than for offset print samples. These findings are in agreement with the general consensus and with findings published by INGEDE (<http://www.ingede.com>). Inkjet continues to exhibit poor deinkability and is an issue if you are considering high-volume inkjet printing.

The test is based on a test form shown above. Each supplier will be required to print 500 copies (1Kg) of this form on their press. Recycling first requires deinking. In deinking the toner particles are detached from the fibers and fillers of the paper. Handsheets will be made using “before” flotation pulp, i.e. undeinked pulp, and a second set will be made using “after” flotation pulp, i.e. deinked pulp. The samples will be measured before and after the deinking process. The toner or dirt in the samples will also be analyzed for total area covered, size and count. Based on the threshold and target values, the deinking results are converted into an overall deinkability score, the final number helps to assess the deinkability of a print product as a whole.

These tests are expensive to conduct, yet they are of great interest to many in the wider print community, so in order to reduce costs and provide further analysis of the data, we are collaborating with Fogra. We will agree to share the data and Fogra may publish a report on the results and findings of this project together with the IPA and Ryerson University.

Contact: Alexander Schiller, Fogra Graphic Technology Research Association, Streitfeldstraße 19, 81673 Munich, Germany E-Mail: [schiller@fogra.org](mailto:schiller@fogra.org)

### **30. Special topics**

What can be done with the machine that is special? Each supplier may offer a number of distinguishing features such as special formats, special screening applications, packaging applications, spot gloss for texture, special transfer applications, etc. It is important to highlight these “added-value” options that make a product offering unique and can assist the customer in marketing digital to their clients.

Suppliers will be invited to provide print samples of any such features that are not already covered in the existing protocols. Suppliers should also provide a description of the feature, its cost and its intended market application.

We should allow only one page per system - simplex or duplex. The page cannot be a sales document or list of features of your press. What I had in mind for this insert was, e.g. Kodak NexPress has a spot emboss where the scales of a fish or the peel of an orange can be given a physical raised surface. It would be appropriate for have a real advert or a pretend advert with such an image. If you want to send me the digital file I can gain approval from Steve Bonoff and IPA, as inappropriate (sales) content or too thick material will not find it's way into the final product.

Plastic may interfere with the perfect binding we plan for the book. Very heavy card stock will disrupt the flow of the book and will interrupt the next entry in the book, it will "stop" the reader and may eclipse the next supplier's sample. Just like card adverts in a magazine. Stock similar to the main printing stock is preferred (100lb, text).

### **31. Press Speed**

Digital presses are now used for production printing. Of major importance to end-users is the production speed of the device. The production speed is so important that some suppliers include this parameter in the device name, e.g. Kodak NEXPRESS 2100 = 2100 A3 sheets per hour, NEXPRESS 2500 = 2500 A3 sheets per hour.

In this test we ask each supplier to use a stop watch to measure the time it takes to print 1000 sheets. We ask the supplier to use a stop watch to record the start and stop time of the press run. There are a number of tests in this Forum that require the printing of 1000 sheets, so one of those press runs can be chosen to benchmark the press speed. A sheet with known coverage, the INGEDE test form, may be specified. It is required that the test be supervised by the IPA or an independent third-party.

Some technologies can print faster when reducing the number of colors. Customers can choose to print monochrome, 2-color and 3-color jobs. This type of information is typically described in the spec. sheet, so we suggest that each individual print configuration does not need to be validated by IPA, unless there are specific issues in the user community.

### **32. Henry Freedman's Resometer™**

The Resometer software product [13] and test page allows us to analyze the performance of the digital printing system including the RIP and the print engine. The test page can be used to calculate actual RIP and printing parameters.



Henry Freedman will work with suppliers to understand the procedure to correctly print this form. Henry will also work with us to analyze the data collected from the supplier systems. One of the parameters to be reported is the image register and resolving power of the printing system. The image register should be 0.05mm for a contract proofing system, and 0.08 mm for a validation print. The resolving power of the print system should be such that C, M, K positive, non-serif, type of 2 point size is legibly reproduced (ISO 12647-7.2, Section 4.2.9).

It is essential that all participants own their own copy of this product before they submit their entry. Contact: Henry B. Freedman, Technology Watch, LLC, Box 2206, Springfield, VA, 22152 E-mail: [h.freedman@att.net](mailto:h.freedman@att.net)

### **33. On-site Reliability**

In this test we seek to measure the practical “uptime” of the device. We seek to survey printers and ask them to note the number of times and frequency with which there is a paper jam, imaging problem, toner replacement, paper mismatch error, etc. The source and duration of the stoppage will be noted. A simple metric can be

$$\frac{\text{Time running the jobs}}{\text{Total elapsed time}} = \% \text{ Productive time}$$

We aim to find a minimum of 10 customer sites for each device. Appendix B shows the questionnaire that will be used. Suppliers can provide “recommendations” for suitable sites, supplier recommendations may or may not be selected for the survey.

### **34. TC 130 and ISO 12647-7.2**

TC130 - WG3 – ISO 12647 is Technical Committee 130, with Working Group 3 that is looking at process control, proofing tolerances, printing tolerances, and aim points. There have been two meetings of TC130, WG3 in 2008 – in April in Paris [14] and 23-24 September, in Amsterdam [15]. The minutes of the Amsterdam meeting suggest that ISO 12647 may be divided as follows

ISO 12647-7 will deal specifically with a “Contract Proof” – existing standard  
ISO 12647-8 will deal specifically with a “Validation Print” – new standard

**From:** Abhay Sharma [<mailto:sharma@ryerson.ca>]  
**Sent:** Wednesday, March 18, 2009 8:48 PM  
**To:** Joe Fazzi; [Mike.Rodriguez@rrd.com](mailto:Mike.Rodriguez@rrd.com); Steve Smiley  
**Cc:** Dianne Kennedy; Steve Bonoff; Harrington, Patrick  
**Subject:** Agenda Item - Digital Print

“Print Properties & Colorimetric Committee Meeting March 31 – April 1, 2009  
We are working on the agenda now, send any topic suggestions or if you wish to present at this meeting..”

Dear Mike Rodriguez, Steve Smiley and Joe Fazzi

Your e-mail said to post agenda items to you, so here goes. I will not be attending the meeting but have the following suggested discussion point.

### **Digital Print Validation/Certification**

1) GRACoL/SWOP has recently been used for digital (e.g. HP Indigo 7000 with ORIS PRESS MATCHER and ORIS PEARL paper). This is there, it is available and has been used by HP. The tolerances are primarily aimed at inkjet, but the HP digital configuration passed, so great. We infer from this that, the system is at the same time, a digital color printer and a digital color proofer. Other suppliers may also choose to certify using this established process, no problem.

2) CONTRACT PROOF/VALIDATION PRINT is a distinction now being discussed where for digital printing we have a wider, more practical and useful tolerance for production printing. The following three situations all use this type of tolerancing:

ISO 12647-7.2  
FograCert  
IPA Digital Print Forum 2009

3) So the point is to keep this topic alive at the PPC meeting and raise this issue within the IDEAlliance Digital Print Working Group, so that the current GRACoL/SWOP program be extended to encompass new tolerances. All participants in the IPA Digital Print Forum are interested in this topic, in fact I am copying Patrick Harrington, Xerox on this e-mail who contacted me today, and is an example of a supplier who has a keen interest in knowing where all this is going. The Digital Print Forum results will tell us the “state of the art” of all major digital print suppliers, we just need to keep the PPC program moving forward. If possible please raise and discuss this at the PPC meeting, and I am available to provide input as required.

Sorry I don't plan to attend at Fujifilm – but I have visited that facility in the past – and I used to work for them!

Best wishes

Abhay

**From:** Joe Fazzi <[JFazzi@idealliance.org](mailto:JFazzi@idealliance.org)>  
**Date:** Wed, 18 Mar 2009 21:56:01 -0400

**To:** Abhay Sharma <[sharma@ryerson.ca](mailto:sharma@ryerson.ca)>, "Mike.Rodriguez@rrd.com" <[Mike.Rodriguez@rrd.com](mailto:Mike.Rodriguez@rrd.com)>, Steve Smiley <[ssmiley@vertisinc.com](mailto:ssmiley@vertisinc.com)>  
**Cc:** Dianne Kennedy <[DKennedy@idealliance.org](mailto:DKennedy@idealliance.org)>, Steve Bonoff <[Steve@ipa.org](mailto:Steve@ipa.org)>, "Harrington, Patrick" <[patrick.harrington@xerox.com](mailto:patrick.harrington@xerox.com)>  
**Subject:** RE: Agenda Item - Digital Print

Abhay,

We do have this topic on the draft agenda and as you have stated, it is a very important subject. Many thanks for the input. Sorry to hear you can't join us in Chicago.

Regards,  
Joe

Joe Fazzi

Vice President, Print Media

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[www.swop.org](http://www.swop.org) <<http://www.swop.org/>> [www.g7global.org](http://www.g7global.org) <<http://www.g7global.org/>>

[www.gracol.org](http://www.gracol.org) <<http://www.gracol.org/>>

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