FLAAR

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Annotated Bibliography

of Suggested Reading on UV-Cured Inkjet Printers

INTRODUCTION

IMI and the Tiara Group are two separate companies which each organize educational conferences on wide format printers. IMI, in particular, has seminars on industrial wide format (which is UV cured printers). Since FLAAR attends these conferences (and occasionally lectures on topics other than UV cured inks) we have some of their reports. These conference proceedings have been utilized as background reading prior to updating the present FLAAR report.

Articles come in several flavors:

- trade magazine articles,
- technical articles from companies manufacturing UV supplies,
- White Papers,
- and conference reports.

The articles in trade magazines are publicity for the specific wide format printer under consideration but usually have some useful and practical information. Technical articles and conference reports tend to be the most helpful because they are relatively neutral. Outside reports from independent researchers appraising the situation are rare.

If you wish to bring yourself up to speed on UV-curable inkjet technology quickly, there are three sources that you should mine:

- RadTech, www.radtech.org
- Sartomer, www.sartomer.com
- IMI, www.imiconf.com if you are in the Americas, or www.imiEurope if you are in that part of the world.

Digital Graphics magazine has included informative articles on UV-curable inkjet chemistry and technology during 2005-2007. Their articles are more professional than then mere press releases that fill competing trade magazines.

LIST OF SUGGESTED READING

We do not list our own FLAAR publications on UV printers (by Nicholas Hellmuth) nor the increasing number of his articles during 2006 in SignGraphic magazine (Turkey), SIP (Germany) or Digital Graphics (USA).

This list is intended only to suggest basic reading: this is not a total-bibliography on UV printing, or on UV chemistry. This covers wide-format inkjet UV, not UV for printing narrow format labels. Microsoft Word software does not allow making a list in this format; the software forces the dates to be in numerical order (even when you tell the software to bug off). So a few of the dates may have been altered by the software in its dogged attempt to keep any numbers in any series in perfect sequential order. Even when I format this for no numerical order, it comes back in and wants to force a bullet-like sequential format.

AVERY DENNISON

2002 UV Ink Jet Digital Flatbed Printers.

A PowerPoint presentation of 13 pages by the company Avery Dennison. This company makes materials that a UV printer can print on. 2002 was very early in the development of UV-curable inkjet technology.

BALDWIN, HOWARD

2004 Ink Jet System Considerations for UV Printing. IMI, 2nd UV Ink Jet Symposium.

Has excellent discussion of problems of gellation, including illustrations.

BAKER, RICH

2002 Design Considerations for Using UV Curable Inks in Piezo DOD Ink Jet Systems. Giga Information Group, PowerPoint, conference report.

BIG PICTURE MAGAZINE

2006 For Flatbeds Only: Rigid Substrates. The Big Picture Magazine, Sept 2006, pp. 50-58.

Lengthy, lots of listings, so an excellent guide; but nowhere is a mention of any defects, warping, need for corona treatment, problems of adhesion, need to clean by hand before printing. The discussion of Fome-Cor does not indicate that this material warps when you hang it on the wall and thus looks cheap. It warps relatively quickly after you hang it (if you mount photos to it).

CAHILL, VINCE

2004 UV's Turn. Industrial inkjet, Volume 1, Issue 3, Nov/Dec. 2004. Pira International.

CAHILL, VINCE

2005 The Growth of UV Curable Inkjet. SGIA Journal, First Quarter 2005, pp. 3-9.

CAMPBELL, NICK

2005 LEDs for UV Curing -- Past, Present & Future. 13th Annual European Ink Jet Printing Conference, November 2005, Lisbon, www.imi-Europe.com.

CANTRELL, ROBIN

1999 Safety and Handling of UV/EB Curing Materials. RADTECH Report, Sept/Oct 1999, pp. 23-28.

CLARKE, JOE

2007 A candid Q&A session on UV-curing techniques with two leading graphic output houses. Digital Graphics magazine, January 2007, pp. 42-45.

CLARKE, JOE

2006 UV-Curing Inks: Free Radical vs. Cationic. Digital Graphics, Vol. 10, No. 6, June, pp. 22-28.

CLARKE, JOE

2006 UV-Curing Inks: Free Radical vs. Cationic. Digital Graphics, Vol. 10, No. 6, June, pp. 22-28.

CLEARY, NESSAN

2008 Larger Side of Life. International Sign Magazine. October 2008 p 38

The author explains why wide-format printers are migrating to UV inkjet while discussing the experience of three companies in Europe in this area.

CLEARY, NESSAN

2008 Heading your bets with a Flatbed. International Sign Magazine. October 2008. pp 44-45.

The author discusses the pros and cons of new entry-level UV flatbeds compared to UV hybrid printers.

CUNNINGHAM, ELIZABETH

2005 Durst Rho600 UV Rigid Printer. Wide-Format Imaging, Aug. 2005, p 36-38.

DECKERS, BERNARD

2002 Applications of UV-Inkjet. IMI conference, Feb.2002, 5th Annual Toner, Ink Jet Ink & Imaging Chemicals Conference, Orlando.

ELSBERND, MARK

2005 Innovation with Ricoh Industrial Ink Jet Technology and New Applications. 13th Annual European Ink Jet Printing Conference, November 2005, Lisbon, www.imi-Europe.com.

The ColorSpan UV printers use Ricoh printheads, as do the ColorSpan solvent ink printers.

EVE, WILL

2004 UV Printer Design – The Dark Side. IMI Ink Jet Printing Developers Conference.

Dr. Will Eve is the Technical Director, Inca Digital, Cambridge, UK. His paper covered:

- Difference Between UV & Solvent Ink Jet
- Printer Architecture
- Keeping It Covered Up
- The Wetting Problem
- Choosing A Lamp
- Oxygen Inhibition & Inerting

FRITSCH, EILEEN

2002 Flatbeds: a platform for new profits. The Big Picture Magazine, July/August 2002, pp. 58ff

GAIGER, NIGEL AND SHAUN HERLIHY

2005 Engery Curing in Inkjet Digital Production Printing. SGIA Journal, Fourth Quarter 2005, pp. 35-39.

Very informative article with an abundance of technical information yet not impossible to understand.

GILL, JAMES

2004 UV Ink Jet Market Overview and Update. IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

GILL, JAMES

2005 New M-Class: Shaped Piezo Silicon MEMS – A Breakthrough in Piezo Printhead Design for Industrial Printing & Decorative Applications. 13th Annual European Ink Jet Printing Conference, November 2005, Lisbon, www.imi-Europe.com.

GUSTAVSON, DENISE M.

2004 Tempo. Nov. 2004, Wide-Format Imaging, p. 46.

HUDD, ALAN L.

2005 UV Product Implementation & Applications. UV Ink Jet Printing Course. Nov 2005, Lisbon, IMI-Europe.

HUTCHINSON, IAN

2005 UV Chemistry. UV Ink Jet Printing Course. Nov 2005, Lisbon, IMI-Europe.

KING, DAVE

2003 Flat-out Getting to the Profits: Justifying the purchase of a UV-curable flatbed printer. Digital Graphics Magazine, October 2003.

KING, DAVE

2008 Final Cut to Automation. Digital Graphics Magazine, March 2008, pp. 30-37

KING, DAVE

2008 Saving Those Valuable Substrates. Digital Graphics Magazine, October 2008, pp. 66-68

KING, DAVE

2005 The Long and the Flat of it. Digital Graphics Magazine, July 2005, pp. 18-23.
This is better than articles in most trade magazines because it dares to list what does not work as well as to praise what works well. Most trade magazines don't list the deficiencies of products as pointedly as would be preferable.

KLANG, JEFFREY, AND JAMES BALCERSKI

UV Curable Ink Jet Raw Material Challenges. Sartomer Company.

Very technical chemistry but useful if you understand chemistry.

KLANG, JEFFREY, AND JAMES BALCERSKI

2002 UV Curing Technology: Issues for Inkjet Formulations. Sartomer Company.

KLANG, JEFFREY, AND JAMES BALCERSKI

2002 New Developments in the Commercialization of UV Curable Inkjet Inks. Sartomer Company.

The author cites a prediction, amusing in hindsight, that the sale of UV printers will equal the rate of sales of solvent ink printers by 2005. Another missed target is that "4,100 wide format UV printers will have been sold by 2005." These were predictions by two different consulting companies, one whose predictions are generally accepted, the other whose predicts are usually off totally. The larger sellers of solvent ink printers: Mimaki and Seiko, do not make mass-market UV printers: Mimaki makes only niche-market UV printers and Seiko makes none at all. Mutoh's UV printer is not even finished yet; nor is Roland's. So there is no way for the rate of sales of UV printers to equally solvent printers if the major manufacturers don't even produce UV printers, at least not as of November 2005. Mimaki does, but their nice printer has probably sold several dozen, whereas their JV3 solvent printer has sold over 6,000.

LARSON, RICHARD

2004 UV Curable InkJet Chemistry Platforms: Cationic vs Radical. IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

LEAMAN, LORI AND BEN P. ROSENFIELD

2005 Finding Good Fortune in Flatbed UV Inkjets. Screen Printing, August, pp. 48-54.

Discusses print shops, one with a Durst Rho 160; another with a Scitex Vision VEEjet, another with a NUR Tempo, and a different shop with a Vutek PressVu 200/400. Very informative for being in a trade magazine. Mentions a few of the glitches of each printer, which is rare for a trade magazine.

LHOTKA, BONNY, KRAUSE, DOROTHY SIMPSON, AND KARIN SCHMINKE

2005 Flatbeds and Fine Art: Fine Art and the Flatbed Printer. Digital Graphics, Vol. 9, No 9, September, pp. 16-22.

LOCKWOOD, ADRIAN

2004 Where are UV Lamp Systems in Inkjet Today? And Where are they going in the Future? IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

NATER, R. BRUCE

2004 How Flat is your Future. Wide-Format Imaging magazine, August 2004, pp. 14, 18.

MAITLAND, JOHN

2005 UV Curing. UV Ink Jet Printing Course. Nov 2005, Lisbon, IMI-Europe.

MARX, DAN

2005 Critical Questions for Flatbed Purchases. SGIA Journal, Fourth Quarter 2005, pp. 13-16.

Well written. Its questionnaire format is quite similar to the FAQ format that FLAAR has been using since 2003 for UV (and since 2001 for giclee printers), including in our public lectures since Print '05. Two of the questions are even more similar. However his way of expressing the other questions and the answers are in his own words so I will assume that the similarity is coincidental because of common sense: UV printers have certain features and it is logical that two people might ask the same questions. His article definitely substantiates that a questionnaire format is the best way to look at the pros and cons of each UV printer.

MERGENTIME, KEN

2008 Finding the Right RIP. October 2008. pp 36-38 .

The author provides a detailed list of the most known RIPs and gives information of the features each item offers or lacks.

MIDDENDORF, PEGGY

2004 Road to Flatbeds: Why and how to add a wide-format flatbed printer to your workflow. The BIGPICTURE magazine, Nov/Dec 2004, pp. 36-40.

Refining UV Ink. The BIGPICTURE magazine.

NORDSON CORPORATION

Global UV Solutions. Two different booklets available at Nordson booth at trade shows.

NUR (THE COMPANY)

2004 Material Handling in Flatbed Inkjet Printers.

Although this is a PR release, it has quite a bit of useful information.

OLDHAM, JOHN

2002 Flat out Fantastic. Modern Reprographics, Nov. 2002, pp. 22-23.

PECK, GRETECHEN A.

2006 The Flatbed Market Ignites. Digital Output, March 2006, pp. 34, 36-41.

Nice to see an article long enough in a trade magazine to cover enough territory. However there is no independent assessment of the manufacturer's claims, no discussion of the pros and cons of the UV-curable technology, and no information on differences among different printers (or various formats of UV-cured inks or materials). Plus the word "hybrid" is potentially misused: we define hybrid as a solvent ink printer that has been jerry-rigged to enable printing also on flatbed material. We prefer "combo" to describe printers with conveyor belts, such as the Zund 215, Vutek, and Agfa. The article also features a UV printer that does not function and has been withdrawn (the Agfa :Anapurna 100). Nonetheless there are useful tidbits of information, especially the quotes from end-users.

REID, CRAG AND JOHN CRUMBAUGH

2006 UV Curable Inkjet. Digital Output magazine, August 2006, p. 18.

An article but directly from the manufacturer, however DuPont releases tends to be relatively accurate compared to some other press releases.

ROSENFIELD, BEN P.

2005 Caring for your Inkjet's UV-Curing System.
Screen Web, on-line article. www.screenweb.com/index.php/channel/5/id/2250

SAUNDERS, PETE

2004 UV Inks the Future. Pira, Vol. 1, Issue 3, pp. 37-41.

SARTOMER

Glossary of UV/EB Terms. Sartomer.

A useful glossary. Most of the Sartomer articles are available from their website.

SCHNEIDER, LORI

2005 Not a Flat Market for Flatbed. Wide-Format Imaging magazine, August, pp. 20-23.

Rather dated, since two of the companies in her list of UV printers were bankrupt at the time of publication. And the Zund 250 in her list was in the process of being withdrawn.

It is because of lists of this nature (with errors and omissions) that we have gone to the effort to attend trade shows in across the USA, throughout Europe, and even in India and Dubai, in order to obtain what you expect from a university professor: namely thoroughness.

SCHIFFNER, BILL

2009 Screen USA Truepress Jet2500UV Grand-Format UV Inkjet Printer. Wide-Format Imaging, Sept. 2009, p. 26-27.

First, at 2.5 meters, I am not sure this is really grand format in size. Screen is an internationally respected manufacturer (also they own Inca Digital in the UK). The printer has many nice features. But, the article is a typical "success story:" not one iota about any possible downside of the machine. Not a mention that it is the lowest selling combo-style printer in the world (not because it is bad, however, but because of marketing reality). And no mention that several new features are being added to improve earlier versions. So what if the machine he is writing about is an earlier version? I assume it will be retrofitted, but there is no mention of this.

SIEGEL, STEPHEN B.

2004 UV LED Curing Technology as applied to Ink Jet Printing. IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

STEIN, TODD

2002 Equipment Manufacturer's Perspective on Ink Development and use. IMI conference, Feb.2002, 5th Annual Toner, Ink Jet Ink & Imaging Chemicals Conference, Orlando.

STOWE, R.W.

2004 Techniques of Optimizing UV Ink Jet Curing Process. IMI, 2nd UV Ink Jet Symposium, Scottsdale, Arizona, Feb. 2-3, 2004.

STOWE, R.W.

No date

UV Science for the Non-Scientist, Part I: Demystifying UV Curing. Reprint available from Fusion UV Systems.

STOWE, R.W.

No date

The Challenges of Industrial UV Ink Jet. Fusion UV Systems. PDF, 2 pages.

TEMPLE, STEVE

2005 Hybrid Sideshooter – Latest Developments in Piezo DOD Printhead Architecture. IMI 13th Annual European Ink Jet Printing Conference. Lisbon, November 2005.

This presentation discusses Xaar grayscale printhead technology, used by licensees Agfa and Toshiba Tec, among others. Toshiba Tec heads are used by Agfa ;Dotrix and by Mimaki UV printers. Agfa printheads are used by Mutoh Cobra and the Thieme M Press (but not by Agfa's own :Dotrix).

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TRIBUTE, ANDREW

2004 Inkjet Flatbed and Super Large Format Printers Star at DRUPA 2004. Seybold Reports, Vol. 4, No. 5, pp. 19-20.

Incomplete and inadequate information. Seybold has fallen since its outstanding report on DRUPA 2000.

YANDELL, PAUL

2005 The Ups and Downs of UV Wide Format Printing. IMI 13th Annual European Ink Jet Printing Conference. Lisbon, November 2005.

WALSHE, PAUL

2005 The Challenges of Ink Jet Ink Formulation for Packaging. IMI 13th Annual European Ink Jet Printing Conference. Lisbon, November 2005.

This article has excellent coverage of oxygen inhibition, nitrogen blankets, and ink migration relative to printing with UV-curable inks.

WORK, RAY

2008 Developments in Cationic UV-Cure Inkjet. Digital Graphics magazine, March 2008, pp 44-47.

WORK, RAY

2007 UV Ink and Printer Safety. Digital Graphics magazine, Feb. 2007, pp. 34-35.

(NO AUTHOR)

2008 Survival of the Fittest. International Sign Magazine. October 2008. pp 26-30

The author explains why while some sign shops and print businesses cut spending, others decide to make large capital investments to survive in a competitive market.

(NO AUTHOR)

Flatbed Printer Resource Guide, Wide-Format Imaging magazine. No date whatsoever, but probably circa 2004.

The last page of Wide-Format Imaging magazine tends to have a one page “Success Story” on UV printers in many issues. However their “Success Story” on one Chinese-made UV printer that is sold in the US did not mention the serious issues, such as that more than 50% of that same brand printers sold in the first year were returned, and probably more than 20% in the second year.

Another UV printer, our understanding is that more than 25% of the people who have bought them are not completely satisfied. Why did the "Success Story" on this printer not mention these facts?

Printer after printer on the pages of this magazine have notable issues: even UV printers made in Europe. We learn about these issues clearly when we visit printshops that have these brands. Even UV printers that cost between $250,000 and $350,000 have features that don't function as claimed by their own advertisements.

Why don't the trade magazine articles mention these facts?

If you know of another article which we have missed, please let us know. We estimate that the IMI conference on UV-curable ink will be a priceless resource, but we do not yet have all their workbooks. Several of the authors at that conference are already listed below anyway.

www.imiconf.com/completed/uvink.html
This includes the informative proceedings of an entire scientific conference, "1st UV Ink Jet Symposium".

www.radtech.org/jul_aug01_p_20.pdf
The original of "A Short History and Current Development of UV-Curing for Ink Jet Printing by Vincent J. Cahill.

www.radtech-europe.com/download/deckerspapermay.pdf
Bernard Deckers, Barco Graphics, "Applications of UV-inkjet inks in the Graphic Arts Industry." Excellent article. Clear, and covers a lot of technical aspects, yet in a readable manner. As a comment, the editor finds the touted grayscale technology useful for speed, but ineffective in quality.

www.sartomer.com/wpapers/5056.pdf
Jeffrey Klang and James Balcerski, "UV Curing Technology: Issues for Inkjet Formulations."

www.screenweb.com/inks/cont/UVCuring.html
"The Mysteries and Myths of UV Curing" by Bea Purcell. Although ScreenWeb is for screen printers, this article can help understand similar processes in UV-curable inkjet systems.

www.spectra-inc.com/spectranews/pdf/news_2002/GIGA_2002_25th%20Annual.pdf
"Design Considerations for Using UV Curable Inks in Piezo DOD Ink Jet Systems," by Rich Baker. This is a longer version of his other PowerPoint presentation on essentially the same topic.

SOURCES AND RESOURCES ON THE INTERNET

Links are not always maintained, so links that we found while doing research may not be active links today.

Digital Output Magazine

http://www.digitaloutput.net/content/ContentCT.asp?P=1302
Crowley, Kim. **Offerings, Highlights, and Trends in Grand Format Printers**
December 2008, Digital Output magazine

http://www.digitaloutput.net/content/ContentCT.asp?P=1053
Tetreault, Melissa. **Grand Stands Its Ground. Grand Format Is a Mainstay Thanks to UV Inks and New Applications.** December 2007, Digital Output magazine

The author provides an annotated list of the main manufacturers and distributors of wide-format UV printers.

http://www.digitaloutput.net/content/ContentCT.asp?P=1237
SGIA 2008. A Preview of the GA Show.
September 2008, Digital Output Magazine.

http://www.digitaloutput.net/content/ContentCT.asp?P=1210
Franklin, Thomas. **The World is Flat. Flatbeds Take on Printing.**
July 2008, Digital Output Magazine.

http://www.digitaloutput.net/content/ContentCT.asp?P=1207
Peck, Gretchen. **Specialized Solutions**. **Options for Every Sign Shop Requirement.**
July 2008, Digital Output Magazine.

http://www.digitaloutput.net/content/ContentCT.asp?P=1206
Peck, Gretchen. **Setting Precedents. New Wide Format Printers.**
July 2008, Digital Output Magazine.

http://www.digitaloutput.net/content/ContentCT.asp?P=1199
Peck, Gretchen. **High-Class Upgades. Better, Faster, and Less Expensive to Operate.**
June 2008, Digital Output Magazine.

http://www.digitaloutput.net/content/ContentCT.asp?P=1190
Peck, Gretchen. **Adding to the Line Up. Manufacturers Ensure A Print Solution for All.**
June 2008, Digital Output Magazine.

The Big Picture Magazine

http://www.bigpicture.net/index.php?openchan=yes&channelnum=11&content=4693&displaynow=yes
The Hot Applications for 2009. September 2008. Big Picture.

http://www.bigpicture.net/index.php?openchan=yes&channelnum=11&content=4144&displaynow=yes
UV Roll-to-Roll Printing will Grow, says I.T. Strategies. July 2007. Big Picture

http://www.bigpicture.net/index.php3?openchan=yes&channelnum=2&content=4868&displaynow=yes
Fujifilm Launches Acuity Advance X2. February 2009. Big Picture.
You can see the current model specifications to compare features: http://www.fujifilmgs.com/pages/uv_flatbed_printers/157.php

http://www.bigpicture.net/index.php3?openchan=yes&channelnum=2&content=4828&displaynow=yes
Gerber Scientific, Inc. Debuts the Solara ion^{V}. January 2009. Big Picture.
You can compare the features of both models in the following link: http://www.gspinc.com/ion/

http://www.bigpicture.net/index.php3?openchan=yes&channelnum=1&content=4794&displaynow=yes
Jetrix 2515 from Inktec. December 2008.

http://bigpicture.net/index.php?openchan=yes&channelnum=2&content=4617&displaynow=yes
Durst Rolls Out 320R UV, Rhopac 160, Single-Pass SP 60. July 2007. Big Picture.

http://bigpicture.net/index.php?openchan=yes&channelnum=2&content=4627&displaynow=yes
EFI Vutek DS Series Flatbed. July 2008. Big Picture.

http://bigpicture.net/index.php?openchan=yes&channelnum=13&content=4550&displaynow=yes
Sun Chemical and Durst Develop Thermoforming Ink. May 2008. Big Picture.

http://bigpicture.net/index.php?openchan=yes&channelnum=13&content=4461&displaynow=yes
Nazdar Lyson 7100: New UV-curable inks for Gandinnovations' Jeti. May 2008. Big Picture.

http://bigpicture.net/index.php?openchan=yes&channelnum=13&content=4391&displaynow=yes
White Ink from Gandinnovations. February 2008. Big Picture.

http://bigpicture.net/index.php?openchan=yes&channelnum=13&content=4362&displaynow=yes
Jeti Premium Inks for Gandi UV Printers. January 2008.

Wide-Format Imaging

http://www.wide-formatimaging.com/web/online/Industry-NewsTrends/UV-Curable-Inkjet-Fastest-Growing-Segment-of-Wide-Format-Printing-Market/1$3770
UV-Curable Inkjet Fastest Growing Segment of Wide-Format Printing Market. November 2008. Wide-Format Imaging.

http://www.wide-formatimaging.com/web/online/Products/Oc-Rolls-Out-Arizona-350-XT-/5$4048
Océ Rolls Out Arizona 350 XT. February 2009. Wide-Format Imaging.

http://www.wide-formatimaging.com/web/online/Products/EFI-Releases-VUTEk-GS3200-and-GS5000r/5$4166
EFI Releases VUTEk GS3200 and GS5000r. March 2009. Wide-Format Imaging.

Other online resources

www.alliedphotochemical.com/whitepapers/Economies.pdf
Discussion of true 100% UV curable solids by Stewart McKenzie, 2002.

www.all-pak.com/plasticgloss.asp?navid=42
Plastic Containers Glossary.

http://americanprinter.com/ar/printing_flatbed_digital_pressuvcurable/
Ahort item on UV-curable but ends up as an ad for the Inca Eagle 44.

www.ampef.com/gloss.html
Although not written for digital imaging readers, this glossary actually has several terms of use to people who seek assistance in understanding some of the technology in a UV curable inkjet printer.

www.bplightbrigade.com/html/digital_flatbeds.html
“Digital Flatbeds – an overview of the market and the affect these printers may have on your business.” The claims on this company’s website verge on the possibly misleading... they do not point out the need for primers or pre-treatment. They blissfully neglect to warn anyone about adhesion issues or abrasion concerns. And they don’t mention the reality of top coating or lamination.

www.coatings.de/articles/balmer.pdf
“UV market: the latest trends,” by Brian Balmer. Although on UV-curable coatings much of the chemical and technical info is comparable to what you need to know about UV-curable inks.

www.colorcon.com/no-tox/shared_lit/NS22_PositionUV2_5-01.pdf
Position paper on health hazards.
www.corotec.com/techinfo/papers.html
Informative white papers on corona treatment of plastic surfaces to better receive UV-cured inks.

www.ddrmag.co.uk/aprmay05/bi_flatbeds_retail_feature.php
"Flatbeds are for Retail." A discussion of the use of flatbed printers by Palladeo.

www.durstuk.co.uk/imgs/pdf/PRO_Imageco.pdf
Durst Rho "Success Story" or in this case called a customer profile.

www.enerconind.com/treating/index.html
Helpful website to learn about surface treating (pre-treating) for subsequent printing with UV inks, so the ink will adhere and won't rub or flake off as easily.

www.energy.ca.gov/pier/reports/600-00-013.html
In California the days for allowing VOCs from solvent ink printers are numbered. Indeed California itself is pushing print shops to UV alternatives.

www.energy.ca.gov/reports/2002-01-10_600-00-013.PDF
"UV Printing on Plastics Project," 1999, 87 pages, California Energy Commission.

www.flexonet.co.uk/contents/news/1809200208365354 85.html
General comments on UV curable inks for inkjet.

www.filmet.com/BigPicFlatbeds.pdf
Big Picture Magazine

www.functionalmaterials.com/Html/Products/Inks/Rink/wh3p_rink_over.htm
RINK Radiation Curable Inks.
www.hassiaredatron.com/glossary.html
Hassia Redatron, "Flexible Packaging Equipment / Printing Terminology Glossary." Defines OPP, PE, PET, PP, etc.

www.ilwooin.co.kr/ilwooin/DMD.pdf
Brochure, in English, on the TampoPrint DMD DSP Digital Screen Press.

www.imagereportsmag.co.uk/april/feature_april3_1.html
"Are Flatbed printers a threat or an opportunity to suppliers of lamination systems?" Mike Budd, Seal Graphics

www.imiconf.com/completed/uvink.html
Include the informative proceedings of an entire scientific conference, "1st UV Ink Jet Symposium."

www.inspirationfarm.com/GG/articles/article9.html
This page offers a helpful definition of dichroic glass, a key ingredient in UV lamp reflectors to lower the heat that reaches the material being printed on.

www.korins.co.kr/m/uv/UVPS%20Product%20Data%20Sheets/InkCureAnalyzer.pdf
Ink cure analyzer product.

http://mail.jujo-chemical.co.jp/english/info4/GLOSSARIES.htm
Glossary, but not specifically on UV-curable.

http://members.misty.com/don/uvbulb.html
Useful mainly in its description of hazards, but also has other helpful technical information. I found this in 2006, so it should still be on-line.

www.mse.eng.ohio-state.edu/~COLIJN/Digital_Imaging/sld035.htm
One page only; binary and grayscale printing.

www.nordson.com/NR/rdonlyres/86A09A72-4A03-4B37-A4FD-D0BEABA40B23/0/PIRANordsonVersionUVInkJetFinalIntegratedWEB.PDF
Seven pages. Nordson has much helpful literature on UV inkjet curing technology, but their lamps are not used on many wide-format inkjet printers. The main brands of lamps that are used today and in the past are from Dr Hönle and from Integration Technologies.

www.paperloop.com/db_area/archive/pponews/2002/wk09_30_2002/125.shtml
Beta test site for BEL 2000 (ScitexVision) printer of Belcom North America Group LLC. However this printer does not use UV curable inks. Its ink chemistry is kept secret and not identified even when you get the specs of the printer from the company.

www.pcimag.com/CDA/ArticleInformation/features/BNPFeaturesItem/0,1846,17196,00.html
Misc. info on oligomers.

http://pffc-online.com/ar/paper_uvcurable_jet_inks/
Richard Podhajny, “UV-Curable Jet Inks.”

http://pira.atalink.co.uk/articles/article-100.phtml
“Direct to media - a great profit opportunity. As usual, shows rosy future without practical considerations of reality of adhesion and other issues.

www.psrc.usm.edu/guym-pre.html
In a biography of a professor it describes his specialty, photopolymerization, as UV curing.

www.radtech-europe.com/download/deckerspapermay.pdf
Bernard Deckers, Barco Graphics, “Applications of UV-inkjet inks in the Graphic Arts Industry”

www.radtech.org/jul_aug01_p_20.pdf
The original of “A Short History and Current Development of UV-Curing for Ink Jet Printing by Vincent J. Cahill.

www.radtech.org/industry/Graphic%20Arts/p.%2026-32%20UV%20Report.pdf
On UV curable ink in general.

www.radtech.org/industry/Automotives/evol_of_uv.pdf
Although not UV-cured inkjet oriented, this is a useful article and helps explain doping.

www.rayotek.com/technical.htm
I could spend hours reading about all this. Although it is too late for most of us to return to school and learn the chemistry and physics of all this, there is lots of informative material on the Internet, such as this site, which describes some of the differences between glass and quartz. You have to use quartz, not glass, with the UV lamps in UV-cured inkjet printers.

www.sartomer.com/wpapers%5C5057.pdf
Jeffrey Klang, et al, New Developments in the Commercialization of UV Curable Inkjet Inks.

www.sartomer.com/wpapers%5C5057.pdf
Jeffrey Klang, et al, “New Developments in the Commercialization of UV Curable Inkjet Inks.”

www.sartomer.com/wpapers/5056.pdf
Jeffrey Klang and James Balcerski, “UV Curing Technology: Issues for Inkjet Formulations.”

www.sartomer.com/wpapers/5055.pdf
Joshua Oliver, “New Photocure Polyester Oligomers for Abrasion Resistant Applications.”
Too technical for a normal reader.

www.sartomer.com/wpapers/1070.pdf
A useful glossary; unfortunately did not find it until we had finished our own.

www.sartomer.com/wpapers/5054.pdf
“UV Curable Ink Jet Raw Material Challenges” by Klang and Balcerski.

www.sartomer.com/wpapers/5035.pdf
“Studies of Pigmented UV Curable Systems by Real Time FTIR,” by Bo Yang, Sartomer Company.

www.sartomer.com/techlitcure.asp
Lists all the white papers and reports on UV-curable inks and chemistries available from Sartomer company. This is a veritable encyclopedia of information.

Sericol Imaging, www.sericol.com/imaging, their ads tout that their Uvijet ink will print “onto almost everything...”

www.screenweb.com/digital/cont/odyssey0201.html
Steward Partridge, 2001: A Flatbed Odyssey: Flatbed inkjet printers have finally arrived.
Screen Printing Magazine.

www.screenweb.com/digital/cont/odyssey0201a.htm
The Eagle has landed (almost) 2001: A Flatbed Odyssey?

www.screenweb.com/digital/cont/headsup3.htm
"Spectra, Xaar, and Aprion Technologies: Heads Up!." Brief but informative.

www.screenweb.com/digital/cont/odyssey0201.html
Steward Partridge, 2001: A Flatbed Odyssey: Flatbed inkjet printers have finally arrived. Screen Printing Magazine.

www.screenweb.com/inks/cont/UVCuring.html
"The Mysteries and Myths of UV Curing" by Bea Purcell. Although ScreenWeb is for screen printers, this article can help understand similar processes in UV-curable inkjet systems.

www.screenweb.com/inks/cont/inkupdate03.html
"...Realities of UV-ink Compatibility..." Tom Keegan, Nazdar.

www.screenweb.com/pdfs/isaprinters04.pdf,
Wide-Format UV and Solvent-System Piezo Inkjet Printers, no date, but probably circa 2004 since it lists the Flora FUV printer which was the predecessor to the eventual DuPont UV printer.

www.seyboldreports.com/SRPS/subs/291516/0717ps291516.pdf
A report on DRUPA with interesting tidbits of what UV-cured ink printers were shown at DRUPA 2000, which was the dawn of the UV-cured inkjet boom that hit in 2004-2005.

www.signindustry.com/vinyl/articles/2003-03-31-JL-UV-1.php3
UV curable Technology, Part I, Jennifer LeClaire.

www.signindustry.com/vinyl/articles/2003-04-15-JL_UVpt2.php3
UV curable, Part II, ink benefits, Jennifer LeClaire.

www.signindustry.com/vinyl/articles/2003-05-08-JL_UVpt3.php3
Part III

www.signindustry.com
"UV-Curable Technology, Part I: The Ultraviolet Media Debate." Avery indicates a few of the shortcomings of some substrates and situations, such as the ink does not (yet) hold up on corrugated areas of vehicles, or over rivets.

www.sgia.org/db/member/dig_flatbed/descriptions.html
Helpful list albeit not very complete and includes many printers which are not in the appropriate class.

www.spectra-inc.com/spectranews/pdf/news_1999/IS&T99UV_Inks_Rich_Baker.pdf
"Practical Considerations for using UV Reactive Inks in Piezo DOD Printheads" by Richard Baker, Spectra Inc.

www.tampoprint.de/dt/wirueberuns/referenz/artikel/festoimagetpT17_3235.pdf
Does appear to show their inkjet printer.

www.thebigprint.com/info/Library/flatbedprinters.article.shtml
The European companies listed here did not in fact show any flatbed inkjet printers at ISA or SGIA in 2002. Whether they will reveal new products at DRUPA 2004 remains to be seen.

www.uvprocess.com/tecsup/glossary.htm
Very long glossary on general UV curing; however this page was not available on their site subsequently.

www.uvsystems.com/FAQ.asp?faq=gn
General questions and answers about UV lights, but mainly as lighting (not for UV-curing of ink).

http://vcesolutions.com/library/uvcuring.pdf
On UV curable inks, by Vincent Cahill.

Most recently updated January 2010.

First issued February 2004. Updated October 2005. Updated November 2005, January 2006, June 2006, March 2007, May 2007, July 2007, March 2009.

Reality Check

Being a university professor for many years does not mean we know everything. But intellectual curiosity often leads us to enter areas that are new to us. So we do not shirk from entering areas where we are obviously not yet expert. If in your years of wide format printing experience have encountered results different that ours, please let us know at ReaderService@FLAAR.org. We do not mind eating crow, though so far it is primarily a different philosophy we practice, because since we are not dependent on sales commissions we can openly list the glitches and defects of those printers that have an occasional problem.

FLAAR and most universities have corporate sponsors but FLAAR web sites do not accept advertising, so we don't have to kowtow to resellers or manufacturers. We respect their experience and opinion, but we prefer to utilize our own common sense, our in-house experiences, the results from site-visit case studies, and comments from the more than 53,000 of our many readers who have shared their experiences with us via e-mail (the Survey Forms).

Licensing Information

If you wish to distribute this report to other people within your company, please obtain a site licensing agreement for multiple copies from FLAAR by contacting ReaderService@FLAAR.org Substantial discounts are available for licensing to distribute within your company; we call this a subscription. The advantage of a subscription license is that you can opt for automatic updates. You may have noticed that FLAAR reports tend to be updated as additional information becomes available.

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To distribute this report without subscription/license violates federal copyright law. To avoid such violations for you, and your company, you can easily order additional copies from www.wide-format-printers.NET.

Update Policy

Starting in 2008, updates on UV-curable wide-format inkjet printers are available for all individuals and companies which have a subscription, or to companies who are research project sponsors. If you are a Subscriber or manager in a company that is a research sponsor, you can obtain the next update by writing ReaderService@FLAAR.org. If you are neither a Subscriber or a research sponsor, simply order the newest version via the e-commerce system on www.wide-format-printers.NET. Please realize that because we have so many publications and many are updated so frequently that we have no realistic way to notify any reader of when just one particular report is actually updated.

There is a free PDF that describes the UV-curable inkjet printer Subscription system. Subscriptions are available only for UV-related wide-format printer publications.

FLAAR Reports on UV-curable roll-to-roll, flatbed, hybrid, and combo printers are updated when new information is available. We tend to update the reports on new printers, on printers that readers ask about the most, and on printers where access is facilitated (such as factory visits, demo-room visits, etc).

Reports on obsolete printers, discontinued printers, or printers that not enough people ask about, tend not to be updated.

FLAAR still publishes individual reports on solvent printers, and on giclee printers, but subscriptions on these are not yet available; these FLAAR Reports on solvent, eco-solvent, and water-based wide format printers have to be purchased one by one.

Please Note

This report has not been licensed to any printer manufacturer, distributor, dealer, sales rep, RIP company, media, or ink company to distribute. So, **if you obtained this from any company, you have a pirated copy.**

If you have received a translation, this translation is not authorized unless posted on a FLAAR web site, and may be in violation of copyright (plus if we have not approved the translation it may make claims that were not our intention).

Also, since this report is frequently updated, if you got your version from somewhere else, it may be an obsolete edition. FLAAR reports are being updated all year long, and our comment on that product may have been revised positively or negatively as we learned more about the product from end users.

If you receive any FLAAR Report from a sales rep, in addition to being violation of copyright, it is useful to know if there is a more recent version on the FLAAR web site, because every month new UV printers are being launched. So what was good technology one month, may be replaced by a much better printer elsewhere the next month.

To obtain a legitimate copy, which you know is the complete report with nothing erased or changed, and hence a report with all the original description of pros and cons, please obtain your original and full report straight from www.FLAAR.org.

Your only assurance that you have a complete and authentic evaluation which describes all aspects of the product under consideration, benefits as well as deficiencies, is to obtain these reports directly from FLAAR, via www.wide-format-printers.NET.

Citing and Crediting

A license from FLAAR is required to use any material whatsoever from our reports in any commercial advertisement or PR Release.

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to ask us first. FLAAR reports are being updated every month sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

The material in this report is not only copyright, it is also based on years of research. Therefore if you cite or quote a pertinent section, please provide a proper credit, which would be minimally "Nicholas

Hellmuth, year, www.FLAAR.org." If the quote is more than a few words then academic tradition would expect that a footnote or entry in your bibliography would reference the complete title. Publisher would be www.FLAAR.org.

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to license the report or otherwise notify us in advance. FLAAR reports are being updated every week sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

Legal notice

Inclusion in this study by itself in no way endorses any printer, media, ink, RIP or other digital imaging hardware or software. Equally, exclusion from this study in no way is intended to discredit any printer.

Advisory

We do our best to obtain information which we consider reliable. But with hundreds of makes and models of printers, and sometimes when information about them is sparse, or conflicting, we can only work with what we have available. Thus you should be sure to rely also on your own research, especially asking around. Find another trustworthy end-user of the same make and model you need to know about. Do not make a decision solely on the basis of a FLAAR report because your situation may be totally different than ours. Or we may not have known about, and hence not written about, one aspect or another which is crucial before you reach your decision.

The sources and resources we may list are those we happen to have read. There may be other web pages or resources that we missed. For those pages we do list, we have no realistic way to verify the veracity of all their content. Use your own common sense plus a grain of salt for those pages which are really just PR releases or outright ads.

We are quite content with the majority of the specific printers, RIPs, media, and inks we have in the FLAAR facilities. We would obviously never ask for hardware, software, or consumables that we knew in advance would not be good. However even for us, a product which looks good at a trade show, sounds good in the ad literature, and works fine for the first few weeks, may subsequently turn out to be a lemon.

Or the product may indeed have a glitch but one that is so benign for us, or maybe we have long ago gotten used to it and have a workaround. And not all glitches manifest themselves in all situations, so our evaluator may not have been sufficiently affected that he or she made an issue of any particular situation. Yet such a glitch that we don't emphasize may turn out to be adverse for your different or special application needs.

Equally often, what at first might be blamed on a bad product, often turns out to be a need of more operator experience and training. More often than not, after learning more about the product it becomes possible to produce what it was intended to produce. For this reason it is crucial for the FLAAR team and their university colleagues to interact with the manufacturer's training center and technicians, so we know more about a hardware or software. Our evaluations go through a process of acquiring documentation from a wide range of resources and these naturally include the manufacturer itself. Obviously we take their viewpoints with a grain of salt but often we learn tips that are worthy of being passed along.

FLAAR has no way of testing 400+ specifications of any printer, much less the over 101 different UV printers from more than 46 manufacturers. Same with hundreds of solvent printers and dozens of water-based printers. We observe as best we can, but we cannot take each printer apart to inspect each feature. And for UV printers, these are too expensive to move into our own facilities for long-range testing, so we do as best as is possible under the circumstances. And when a deficiency does become apparent, usually from word-of-mouth or from an end-user, it may take time to get this written up and issued in a new release.

Another reason why it is essential for you to ask other printshop owners and printer operators about how Brand X and Y function in the real world is that issues may exist but it may take months for these issues to be well enough known for us to know the details. Although often we know of the issues early, and work to get this information into the PDFs, access to information varies depending on brand and model. Plus with over 300 publications, the waiting time to update a specific report may be several months. Plus, once a printer is considered obsolete, it is not realistic to update it due to the costs involved.

For these reasons, every FLAAR Report tries to have its publication date on the front outside cover (if we updated everything instantly the cost would be at commercial rates and it would not be possible to cover these expenses). At the end of most FLAAR Reports there is additionally a list of how many times that report has been updated. A report with lots of updates means that we are updating that subject based on availability of new information. If there is no update that is a pretty good indication that report has not been updated! With 101 models of UV printers, several hundred solvent printers, and scores of water-based printers, we tend to give priority to getting new reports out on printers about which not much info at all is available elsewhere. So we are pretty good about reporting on advances in LED curing. But glitches in a common water-based printer will take longer to work its way through our system into an update, especially if the glitch occurs only in certain circumstances, for example, on one type of media. With several hundred media types, we may not yet have utilized the problem media. While on the subject of doing your own research, be sure to ask both the printer operator and printshop owner or manager: you will generally get two slightly different stories. A printer operator may be aware of more glitches of the printer than the owner.

If a printer is no longer a prime model then there is less interest in that printer, so unless a special budget were available to update old reports, it is not realistic to update old reports. As always, it is essential for you to visit printshops that have the printers on your short-list and see how they function in the real world.

But even when we like a product and recommend it, we still can't guarantee or certify any make or model nor its profitability in use because we don't know the conditions under which a printer system might be utilized in someone else's facility. For ink and media, especially after-market third-party ink and media, it is essential that you test it first, under your conditions. We have no way to assure that any ink or media will be acceptable for your specific needs in your specific print shop. As a result, products are described "as is" and without warranties as to performance or merchantability, or of fitness

for a particular purpose. Any such statements in our reports or on our web sites or in discussions do not constitute warranties and shall not be relied on by the buyer in deciding whether to purchase and/or use products we discuss because of the diversity of conditions, materials and/or equipment under which these products may be used. Thus please recognize that no warranty of fitness or profitability for a particular purpose is offered.

The user is advised to test products thoroughly before relying on them. We do not have any special means of analyzing chemical contents or flammability of inks, media, or laminates, nor how these need to be controlled by local laws in your community. There may well be hazardous chemicals, or outgassing that we are not aware of. Be aware that some inks have severe health hazards associated with them. Some are hazardous to breathe; others are hazardous if you get them on your skin. For example, some chemicals such as cyclohexanone do not sound like chemicals you want to breathe every day. Be sure to obtain, read, and understand the MSDS sheets for the inks, media, and laminates that you intend to use. Both solvent, eco-solvent, and UV-curable inks are substances whose full range of health and environmental hazards are not yet fully revealed. It is essential you use common sense and in general be realistic about the hazards involved, especially those which are not listed or which have not yet been described. FLAAR is not able to list all hazards since we are not necessarily aware of the chemical components of the products we discuss. Our reports are on usability, not on health hazards.

Most inks are clearly not intended to be consumed. Obviously these tend to be solvent inks and UV-curable inks. Yet other inks are edible, seriously, they are printed on birthday cakes. Indeed Sensient is a leader in a new era of edible inks. Therefore the user must assume the entire risk of ascertaining information on the chemical contents and flammability regulations relative to inks, media or laminates as well as using any described hardware, software, accessory, service, technique or products.

We have no idea of your client's expectations. What students on our campus will accept may not be the same as your Fortune 500 clients. In many cases we have not ourselves used the products but are basing our discussion on having seen them at a trade show, during visiting a print shop, or having been informed about a product via e-mail or other communication.

Results you see at trade shows may not be realistic

Be aware that trade show results may not be realistic. Trade shows are idealized situations, with full-time tech support to keep things running. The images at a trade show may be tweaked. Other images make be "faked" in the sense of slyly putting on primer without telling the people who inspect the prints. Most UV inks don't stick to all materials; many materials need to be treated.

Or the UV prints may be top-coated so that you can't do a realistic scratch test.

Booth personnel have many standard tricks that they use to make their output look gorgeous. In about half the cases you will not likely obtain these results in real life: in most cases they are printing unidirectional, which may be twice as slow as bi-directional.

Trade show examples tend to be on the absolutely best media. When you attempt to save money and use economy media you will quickly notice that you do not get anywhere near the same results as you saw in the manufacturer's trade show booth, or pictured in their glossy advertisement. Five years ago we noticed Epson was laminating prints to show glossy output because their pigmented inks could not print on actual glossy media. The same equipment, inks, media, and software may not work as well in your facility as we, or you, see it at a trade show. All the more reason to test before you buy; and keep testing before you make your final payment. Your ultimate protection is to use a gold American Express credit card so you can have leverage when you ask for your money back if the product fails.

Images printed at trade show may be in uni-directional mode: so you may not realize the printer has bi-directional (curing) banding defects until you unpack it in your printshop. Bi-directional curing banding is also known as the lawnmower effect. Many printers have this defect; sometimes certain modes can get rid of it, but are so slow that they are not productive.

You absolutely need to do print samples with your own images and the kind provided by your clients. Do not rely on the stock photos provided by the printer, ink, media, or RIP manufacturer or reseller. They may be using special images which they know in advance will look fabulous on their printer. Equally well, if you send your sample images to the dealer, don't be surprised if they come back looking awful. That is because many dealers won't make a serious effort to tweak their machine for your kind of image. They may use fast speed just to get the job done (this will result in low quality). Check with other people in your area, or in the same kind of print business that you do. Don't rely on references from the reseller or manufacturer (you will get their pet locations which may be unrealistically gushy): find someone on your own.

Factors influencing output

Heat, humidity, static, dust, experience level of your workers (whether they are new or have prior years experience): these are all factors that will differ in your place of business as compared with test results or demo room results.

Actually you may have people with even more experience than we do, since we deliberately use students to approximate newbies. FLAAR is devoted to assisting newcomers learn about digital imaging hardware and software. This is why Nicholas Hellmuth is considered the "Johnny Appleseed" of wide format inkjet printers.

Therefore this report does not warranty any product for any quality, performance or fitness for any specific task, since we do not know the situation in which you intend to use the hardware or software. Nor is there any warranty or guarantee that the output of these products will produce salable goods, since we do not know what kind of ink or media you intend to use, nor the needs of your clients. A further reason that no one can realistically speak for all aspects of any one hardware or software is that each of these products may require additional hardware or software to reach its full potential.

For example, you will most likely need a color management system which implies color measurement tools and software. To handle ICC color profiles, you may need ICC color profile generation software and a spectrophotometer since often the stock pre-packaged ICC color profiles which come with the ink, media, printers and/or RIPs may not work in your situation. Not all RIPs handle color management equally, or may work better for some printer-ink-media combinations than for others.

Be aware that some RIPs can only accept ICC color profiles: you quickly find out the hard way that you can't tweak these profiles nor

generate new ones. So be sure to get a RIP which can handle all aspects of color management. Many RIPs come in different levels. You may buy one level and be disappointed that the RIP won't do everything. That's because those features you may be lacking are available only in the next level higher of that RIP, often at considerable extra cost. Same thing in the progression of Chevy through Pontiac to Cadillac, or the new Suburbans. A Chevy Suburban simply does not have all the bells and whistles of the Cadillac Escalade version of this SUV.

Don't blame us… besides, that's why we are warning you. This is why we have a Survey Form, so we can learn when you find products that are inadequate. We let the manufacturers know when end users complain about their products so that the manufacturers can resolve the situation when they next redesign the system.

Most newer printer models tend to overcome deficiencies of earlier models. It is possible that our comparative comments point out a glitch in a particular printer that has been taken care of through an improvement in firmware or even an entirely new printer model. So if we point out a deficiency in a particular printer brand, the model you may buy may not exhibit this headache, or your kind of printing may not trigger the problem. Or you may find a work-around.

Just remember that every machine has quirks, even the ones we like. It is possible that the particular kind of images, resolution, inks, media, or other factors in your facility are sufficiently different than in ours that a printer which works just fine for us may be totally unsatisfactory for you and your clients. However it may be that the specific kind of printing you need to do may never occasion that shortcoming. Or, it may be that your printer was manufactured on a Monday and has defects that are atypical, show up more in the kind of media you use which we may not use as often or at all during our evaluations. Equally possibly a printer that was a disaster for someone else may work flawlessly for you and be a real money maker for your company.

So if we inspect a printer in a printshop (a site-visit case study), and that owner/operator is content with their printer and we mention this; don't expect that you will automatically get the same results in your own printshop.

In some cases a product may work better on a Macintosh than on a PC. RIP software may function well with one operating system yet have bugs and crash on the same platform but with a different operating system. Thus be sure to test a printer under your own specific work conditions before you buy.

And if a printer, RIP, media, or ink does not function, return it with no ands, ifs or buts. Your best defense is to show an advertising claim that the printer simply can't achieve. Such advertising claims are in violation of federal regulations, and the printer companies know they are liable for misleading the public.

But before you make a federal case, just be sure that many of the issues are not user error or unfamiliarity. It may be that training or an additional accessory can make the printer do what you need it to accomplish. Of course if the printer ads did not warn you that you had to purchase the additional pricey accessory, that is a whole other issue. Our reviews do not cover accessories since they are endless, as is the range of training, or lack thereof, among users.

The major causes of printer breakdown and failure is lack of maintenance, poor maintenance, spotty maintenance, or trying to jerry-rig some part of the printer. The equally common cause of printer breakdown is improper use, generally due from lack of training or experience. Another factor is whether you utilize your printer all day every day. Most solvent and UV printers work best if used frequently.

If you are not going to use your printer for two or three days, you have to put flush into the system and prepare it for hibernation (even if for only four or five days). Then you have to flush the ink system all over again.

Also realize that the surface of inkjet prints are fragile and generally require lamination to survive much usage. Lamination comes in many kinds, and it is worth finding a reliable lamination company and receiving training on their products.

Also realize that no hybrid or combo UV printer can feed all kinds of rigid materials precisely. Some materials feed well; others feed poorly; others will skew.

Although we have found several makes and models to work very well in our facilities, how well they work in your facilities may also depend on your local dealer. Some dealers are excellent; others just sell you a box and can't provide much service after the sale. Indeed some low-bid internet sales sources may have no technical backup whatsoever. If you pay low-bid price, you can't realistically expect special maintenance services or tech support later on from any other dealer (they will tell you to return to where you paid for the product). This is why we make an effort to find out which dealers are recommendable. Obviously there are many other dealers who are also good, but we do not always know them. To protect yourself further, always pay with a level of credit card which allows you to refuse payment if you have end up with a lemon. A Gold American Express card allows you to refuse payment even months after the sale. This card may also extend your warranty agreement in some cases (check first).

Most of the readers of the FLAAR Reports look to see what printers we use in our own facilities. Readers realize that we will have selected the printers that we like based on years of experience and research. Indeed we have met people at trade shows who told us they use the FLAAR web site reports as the shopping list for their corporate purchases.

Yes, it is rather self-evident that we would never ask a manufacturer to send a product which we knew in advance from our studies was no good. But there are a few other printers which are great but we simply do not have them in our facilities yet.

So if a printer is not made available by its manufacturer, then there is no way we can afford to have all these makes and models in our facility. Thus to learn about models which we do not feature, be sure to ask around in other print shops, with IT people in other corporations, at your local university or community college. Go to trade shows…. but don't use only the booth…ask questions of people in the elevator, in line at the restaurant, anywhere to escape the smothering hype you get in the booth.

Realize that a FLAAR Report on a printer is not by itself a recommendation of that printer. In your local temperature, in your local humidity, with the dust that is in your local air, with your local operator, and with disorientation of the insides of a printer during rough shipment and installation, we have no knowledge of what conditions you will face in your own printshop. We tend to inspect a printer first in the manufacturing plant demo room: no disjointed parts from any shipment since this printer has not been lifed by cranes and run over a rough pot-holed highway or kept in smeltering heat or freezing cold during shipment.

Taking into consideration we do not know the conditions in which you may be using your hardware, software, or consumables, neither the author nor FLAAR nor either university is liable for liability, loss or damage caused either directly or indirectly by the suggestions in this report nor by hardware, software, or techniques described herein because.

Availability of spare parts may be a significant issue

Chinese printers tend to switch suppliers for spare parts every month or so. So getting spare parts for a Chinese printer will be a challenge even if the distributor or manufacturer actually respond to your e-mails at all. Fortunately some companies to have a fair record of response; Teckwin is one (based on a case of two problematical hybrid UV printers in Guatemala). The distributor said that Teckwin sent a second printer at their own expense and sent tech support personnel at their expense also. But unfortunately both the hybrid UV printers are still abandoned in the warehouse of the distributor; they were still there in January 2009. But Teckwin has the highest rating of any Chinese company for interest in quality control and realization that it is not good PR to abandon a client or reseller or distributor all together.

Recently we have heard many reports of issues of getting parts from manufacturers in other countries (not Asia). So just because you printer is made in an industrialized country, if you are in the US and the manufacturer is X-thousand kilometers or miles away, the wait may be many days, or weeks.

Lack of Tech Support Personnel is increasing

The book of sales in the third quarter of 2008 resulted in many tech support problems.

The recession resulted in even more: some manufacturers may need to skimp on quality control during a recession, or switch to cheaper parts suppliers. Plus they are not hiring enough tech support during a recession. So the bigger and more successful the company, in some cases the worse these particular problems may be.

Any new compiled printer may take a few months to break in

Any new printer, no matter who the manufacturer, or how good is the engineering ane electronics, will tend to have teething issues. Until the firmware is updated, you may be a beta tester. This does not mean the printer should be avoided, just realize that you may have some downtime and a few headaches. Of course the worst case scenario for this was the half-million dollar Luscher JetPrint: so being “Made in Switzerland” was not much help.

Counterfeit parts are a problem with many printers made in China

Several years ago many UV printers made in China and some made elsewhere in Asia had counterfeit parts. No evaluation has the funding available to check parts inside any printer to see if they are from the European, Japanese, or American manufacturer, or if they are a clever counterfeits.

Be realistic and aware that not all materials can be printed on equally well

Many materials don’t feed well through hybrid (pinch roller on grit roller systems) or combo UV systems (with transport belts). Banding, both from poor feeding, and from bi-directional (lawnmower effect) are common on many UV-curable inkjet printers.

It is typical for some enthusiastic vendors to claim verbally that their printer can print on anything and everything. But once you unpack the printer and set it up, you find that it requires primer on some materials; on other materials it adheres for a few weeks but then falls off.

And on most hybrid and many combo printers, some heavy, thick, or smooth-surfaced materials skew badly. Since the claim that the printer will print on everything is usually verbal, it is tough to prove this aspect of misleading advertising to a jury.

Not all inks can print on all materials. And at a trade show, many of the materials you see so nicely printed on, the manufacturer may be adding a primer at night or early in the morning: before you see the machine printing on this material.

We feel that the pros and cons of each product speak more than adequately for themselves. Just position the ad claims on the left: put the actual performance results on the right. The unscrupulous hype for some printers is fairly evident rather quickly.

Be sure to check all FLAAR resources

Please realize that with over 200 different FLAAR Reports on UV printers, you need to be sure to check the more obscure ones too. If a printer has a printhead issue, the nitty gritty of this may be in the FLAAR Report on printheads. The report on the model is a general introduction; if we discussed the intimate details of printheads then some readers might fall asleep. And obviously do not limit yourself to the free reports. The technical details may be in the reports that have a price to them. Our readers have said they prefer to have the general basics, and to park the real technical material in other reports that people can buy if they really want that level of information.

So it may be best to ask for personal consulting. The details of the problems with the ColorSpan 5400uv series are rather complex: namely the center row of the Ricoh printheads. This would require an expensive graphic designer and consultants to show the details. And the design of the printhead would probably be altered by the time we did any of this anyway. So it is essential to talk with people: with other end-users, and with FLAAR in person on a consulting basis.

Acknowledgements

With 19 employees the funding has to come from somewhere, so we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

- The freedom of a professor or student to speak out relative to the pros and cons of any equipment brought to them to benchmark.
- The freedom to design the research project without outside meddling from the manufacturer.

Fortunately, our budget is lean and cost effective as you would expect for a non-profit research institute. As long as we are not desperate for money we can avoid the temptation to accept payment for reprinting corporate PR hype. So the funding is used for practical research. We do not accept (nor believe) and certainly do not regurgitate corporate PR. For example, how many manufacturer’s PR photos of their products have you seen in our reports or on our web sites?

Besides, it does not take any money to see which printers and RIPs function as advertised and which don’t. We saw one hyped printer grind to a halt, malfunction, or otherwise publicly display its incapabilities at several trade shows in a row. At each of those same trade shows another brand had over 30 of their printers in booths in virtually every hall, each one producing museum quality exhibits. Not our fault when we report what we see over and over and over again. One of our readers wrote us recently, “Nicholas, last month you recommended the …… as one of several possible printers for our needs;

we bought this. It was the best capital expenditure we have made in the last several years. Just wanted to tell you how much we appreciate your evaluations…."

FLAAR is a non-profit educational and research organization dedicated for over 36 years to professional photography in the arts, tropical flora and fauna, architectural history, and landscape panorama photography.

Our digital imaging phase is a result of substantial funding in 1996 from the Japanese Ministry of Public Education for a study of scanning and digital image storage options. This grant was via Japan's National Museum of Ethnology, Osaka, Japan. That same year FLAAR also received a grant of $100,000 from an American foundation to do a feasibility study of digital imaging in general and the scanning of photographic archives in particular.

The FLAAR web sites began initially as the report on the results of these studies of scanners. Once we had the digital images we began to experiment with digital printers. People began to comment that our reports were unique and very helpful. So by 1999 we had entire sections on large format printers.

FLAAR has existed since 1969, long before inkjet printers existed. Indeed we were writing about digital imaging before HP even had a color inkjet system available. In 2000 FLAAR received an educational grant from Hewlett-Packard large format division, Barcelona, Spain, for training, for equipment, and to improve the design and navigation on the main web sites of the FLAAR Network. This grant ran its natural course, and like all grants, reached its finishing point, in this case late 2005.

In some cases the sponsorship process begins when we hear end-users talking about a product they have found to be better than other brands. We keep our ears open, and when we spot an especially good product, this is the company we seek sponsorship from. It would not be wise of us to seek sponsorship from a company with a sub-standard or otherwise potentially defective printer. So we usually know which printers are considered by end-users to be among the better brands before we seek sponsorship. After all, out of the by now one million readers, we have heard plenty about every single printer out there.

We thank MacDermid ColorSpan (now part of HP), Hewlett-Packard, Parrot Digigraphic, Color DNA, Canon, Gandinnovations, and other companies for providing funding for technology training for the FLAAR staff and our colleagues at Bowling Green State University in past years and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Sun LLC, Caldera, EskoArtwork, Raster Printers (EFI Rastek), DEC LexJet, DigiFab, Barbieri electronic, Seiko II, Mutoh Europe, IP&I, Dilli, Yuhan-Kimberly, GCC, Grapo, Durst, and WP Digital for providing funds so that we can make more of our publications free to end-users. During 2000-2001 we had grants to cover all the costs of our publications, and all FLAAR Reports were free in those early years. As that early grant naturally expired after a few years, we had to begin charging for some of our reports to cover costs. Now (in 2009), we are seeking corporate sponsorship so we can gradually make another 20% of our publications free to our readers.

Since 2006 we do a major part of our evaluations at a factory and headquarters demo room. Since the university does not fund any of these trips, it is traditional for the manufacturer to fund a research sponsorship. In the US this is how most university projects are initiated for decades now, and it is increasing. In fact there is a university in Austria that is not an "edu" but is a "GmbH", funded by the chamber of commerce of that part of Austria. In other words, a university as an educational institution, but functioning in the real world as an actual business. This is a sensible model, especially when FLAAR staff need to be on the road over a quarter of a million miles per year (roughly over 400,000 km per year total for the staff). Obviously this travel is hosted since unless money falls from heaven there most realistic way to obtain funding to get to the demo rooms for training is direct from the source.

It has been helpful when companies make it possible for us to fly to their headquarters so we can inspect their manufacturing facilities, demo rooms, and especially when the companies make their research, engineering and ink chemistry staff available for discussions. When I received my education at Harvard I was taught to have a desire to learn new things. This has guided my entire life and is what led me into wide-format digital imaging technology: it is constantly getting better and there is a lot to learn every month. Thus I actively seek access to improving my understanding of wide format printer technology so that we can better provide information to the approximately quarter-million+ readers of our solvent and UV printer web site (www.large-format printers.org) and the over half a million who read either our wide-format-printers.org site or our roughly half million combined who read our digital-photography.org and www.FineArtGicleePrinters.org sites.

Barbieri electronic (color management), Caldera (RIP), ColorSpan, DEC, Durst, EskoArtwork, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Dilli, GCC, NUR, Oce, Shiraz (RIP), Sky AirShip, Sun, Teckwin, VUTEk, WP Digital, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. Bordeaux, InkWin and Sunflower ink have brought us to inspect their ink manufacturing facilities and demo rooms. We have visited the world headquarters and demo rooms of HP in Barcelona and received informative and helpful technology briefings roughly every two years. We are under NDA as to the subjects discussed but it is important that we be open where we have visited. Mimaki Europe has had FLAAR as their guest in Europe to introduce their flatbed UV printer, as have other UV-curable manufacturers, again, under NDA as to the details since often we are present at meetings where unreleased products are discussed. Xaar has hosted an informative visit to their world headquarters in the UK. You don't get this level of access from a trade magazine writer, and I can assure you, we are provided much more detailed information and documentation in our visits than would be provided to a magazine author or editor. Companies have learned that it's a lot better to let us know up front and in advance the issues and glitches with their printers, since they now know we will find out sooner or later on our own. They actually tell us they realize we will find out on our own anyway.

Contributions, grant, sponsorships, and project funds from these companies are also used to improve the design and appearance of the web sites of the FLAAR Information Network. We thank Canon, ColorSpan, HP, ITNH, and Mimaki for providing wide format printers, inks, and media to the universities where FLAAR does research on wide format digital imaging. We thank Epson America for providing an Epson 7500 printer many years ago, and Parrot Digigraphic for providing three different models of Epson inkjet printers to our facilities on loan at BGSU (5500, 7600, 7800). We thank Mimaki USA for providing a JV4 and then a Mimaki TX-1600s textile printer and Improved Technologies (ITNH) providing their Ixia model of the Iris 3047 giclee printer.

We thank 3P Inkjet Textiles and HP for providing inkjet textiles so we could learn about the different results on the various textiles. IJ Tech-

nologies, 3P Inkjet Textiles, ColorSpan, Encad, HP, Nan Ya Pepa, Oracal, Tara and other companies have provided inkjet media so we can try it out and see how it works (or not as the case may be; several inkjet media failed miserably, one from Taiwan, the other evidently from Germany!). We thank Aurelon, Canon, ColorGate, ColorSpan, ErgoSoft, HP, PerfectProof, PosterJet, Onyx, Ilford, CSE ColorBurst, ScanvecAmiable, Wasatch and many other RIP companies for providing their hardware and software RIPs.

We thank Dell Computers for providing awesome workstations for testing RIP software and content creation with Adobe Photoshop and other programs. We also appreciate the substantial amount of software provided by Adobe. As with other product loaned or provided courtesy of ProVar LLC (especially the 23" monitors which makes it so much easier to work on multiple documents side by side).

We thank Betterlight, Calumet Photographic, Global Graphics, Westcott, Global Imaging Inc. Phase One, and Bogen Imaging for helping to equip our archaeological photo studios at the university and its archaeology museum in Guatemala. Heidelberg, Scitex, CreoScitex (now Kodak) and Cruse, both in Germany, have kindly provided scanners for our staff to evaluate.

We really liked some of the results whereas some of the other products were a bit disappointing. Providing samples does not influence the evaluations because the evaluators are students, professors, and staff of Bowling Green State University. These personnel are not hired by any inkjet printer company; they were universities employees (as was also true for Nicholas Hellmuth). The testing person for the HP ColorPro (desktop printer) said he frankly preferred his Epson printer. When we saw the rest results we did not include this Heweltt-Packard ColorPro printer on our list of recommended printers, but we love our HP DesignJet 5000ps so much we now have two of them, one at each university.

Sometimes we hear horror stories about a printer. The only way we can tell whether this is the fault of the printer design, or lack of training of the operator, is to have the printer ourselves in-house. Of course some printer manufacturers don't understand the reasons we need to have each make and model; they are used to loaning their demo units for a week or so. That is obviously inadequate for a serious review.

Some of the media provided to us failed miserably. Three printers failed to meet common sense usability and printability standards as well (HP 1055, one older desktop model (HP Color Pro GA), and one Epson). Yet we know other users who had better results; maybe ours came down the assembly line on a Monday or Friday afternoon, when workers were not attentive. One costly color management software package was judged "incapable" by two reviewers (one from the university; second was an outside user who had made the mistake of buying this package).

So it's obvious that providing products or even a grant is no shield from having your products fail a FLAAR evaluation. The reason is clear: the end user is our judge. The entire FLAAR service program is to assist the people who need to use digital imaging hardware and software. If a product functions we find out and promulgate the good news. If a product is a failure, or more likely, needs some improvement in the next generation, we let people know. If a product is hyped by what an informed user would recognize as potentially false and misleading nonsense, then we point out the pathetic discrepancies very clearly.

This is what you should expect from an institute which is headed by a professor.

Actually, most of our reviews are based on comments by end users. We use their tips to check out pros and cons of virtually every product we discuss. You can't fool a print shop owner whose printer simply fails to function as advertised. And equally, a sign shop owner who earns a million dollars a year from a single printer brand makes an impact on us as well. We have multiple owners of ColorSpan printers tell us that this printer is their real money earner for example. We know other print shops where their primarily income is from Encad printers. Kinkos has settled on the HP 5000 as its main money maker production machine, and so on.

Yet we have documentation of several print shop companies whose business was ruined by specific brands that failed repeatedly. It is noteworthy that it is always the same brand or printer at both locations: one due to banding and printheads then simply no longer printing one color; the other brand due to pokiness of the printer simply not being competitively fast enough. Same with RIPs, we have consistent statements of people using one RIP, and only realizing how weak it was when they tried another brand which they found substantially better. Thus we note that companies which experiment with more than one brand of product tend to realize more quickly which brand is best. This is where FLAAR is in an ideal situation: we have nine RIPs and 25 printers. Hence it is logical that we have figured out which are best for our situation.

Grant funding, sponsorship, demonstration equipment, and training are supplied from all sides of the spectrum of printer equipment and software engineering companies. Thus, there is no incentive to favor one faction over another. We receive support from three manufacturers of thermal printheads (Canon, ColorSpan and HP) and also have multiple printers from three manufacturers of piezo printers (Epson, Seiko, Mutoh, and Mimaki). This is because piezo has definite advantage for some applications; thermal printheads have advantages in different applications. Our reviews have universal appeal precisely because we feature all competing printhead technologies. Every printer, RIPs, inks, or media we have reviewed have good points in addition to weaknesses. Both X-Rite and competitor GretagMacbeth provided spectrophotometers. Again, when all sides assist this program there is no incentive to favor one by trashing the other. Printer manufacturer ad campaigns are their own worst enemy. If a printer did not make false and misleading claims, then we would have nothing to fill our reviews with refuting the utter nonsense that is foisted on the buying public.

It is not our fault if some printers are more user friendly, print on more media than other brands. It is not our fault that the competing printers are ink guzzlers, are slow beyond belief, and tend to band or drop out colors all together. We don't need to be paid by the printer companies whose products work so nicely in both our universities on a daily basis. The printers which failed did so in front of our own eyes and in the print shops of people we check with. And actually we do try to find some redeeming feature in the slow, ink gulping brands: they do have a better dithering pattern; they can take thick media that absolutely won't feed through an HP. So we do work hard at finding the beneficial features even of printers are otherwise get the most critique from our readers. Over one million people will read the FLAAR Information Network in the next 12 months; 480,000 people will be exposed to our reports on wide format printers from combined total of our three sites on these themes. You can be assured that we hear plenty of comments from our readers about which printers function, and which printers fail to achieve what their advertising hype so loudly claims.

An evaluation is a professional service, and at FLAAR is based on more than 11 years of experience. An evaluation of a printer, an ink, a software, laminator, cutter or whatever part of the digital printing workflow is intended to provide feedback to all sides. The manufacturers appreciate learning from FLAAR what features of their printers need improvement. In probably half the manufacturers FLAAR has dealt with, people inside the company did not, themselves, want to tell their boss that their pet printer was a dog. So printer, software, and component manufacturers have learned that investing in a FLAAR evaluation of their product provides them with useful return on investment. Of course if a printer manufacturer wants only a slick Success Story, or what we call a “suck up review” that simply panders to the manufacturer, obviously FLAAR is not a good place to dare to ask for such a review. In several instances it was FLAAR Reports that allowed a company to either improve their printer, or drop it and start from scratch and design a new and better one.

And naturally end-users like the opportunity to learn about various printers from a single source that covers the entire range from UV through latex through all flavors of solvent.

We have also learned that distributors often prefer to accept for distribution a printer or other product on which a FLAAR Report already exists.

We turn down offers of funding every year. These offers come from PO Box enterprises or products with no clearly visible point of manufacture. Usually the company making the offer presumes they can buy advertising space just by paying money. But that is not what our readers want, so we politely do not accept such offers of money.

Contributions, grants, sponsorships, and funding for surveys, studies and research is, however, open to a company who has an accepted standing in the industry. It is helpful if the company has a visible presence at leading trade shows and can provide references from both end users and from within the industry. Where possible we prefer to visit the company in person or at least check them out at a trade show. Obviously the product needs to have a proven track record too. Competing companies are equally encouraged to support the FLAAR system. We feel that readers deserve to have access to competing information. Competition is the cornerstone of American individualism and technological advancement.

FLAAR also covers its costs of maintaining the immense system of 8 web sites in three languages and its facilities in part by serving as a consultant such as assisting inkjet manufacturers learn more about the pros and cons of their own printers as well as how to improve their next generation of printers. It is especially useful to all concerned when manufacturers learn of trends (what applications are popular and for what reasons). For example, manufacturers need to know whether to continue designing software for Mac users, or concentrate software for PC users. So the survey form that you fill out is helpful to gather statistics. You benefit from this in two ways: first, you get the FLAAR reports in exchange for your survey form. Second, your comments bring (hopefully) change and improvement in the next generation of printers. When we do survey statistics, then the names, addresses, and telephone numbers are removed completely. A survey wants only aggregate numbers, not individuals. However, if you ask about a specific brand of printer, and do not opt out, we forward your request to a pertinent sponsor so you can obtain follow-up from that brand, since we ourselves do not have enough personnel to respond to each reader by telephone. But we do not provide your personal information to outsiders and our survey form has an opt out check-off box which we honor.

FLAAR also serves as consultants to Fortune 500 companies as well as smaller companies and individuals who seek help on which printers to consider when they need digital imaging hardware and software.

A modest portion of our income comes from our readers who purchase the FLAAR series. All income helps continue our tradition of independent evaluations and reviews of inkjet printers, RIPs, media, and inks.

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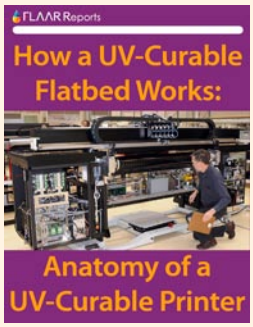

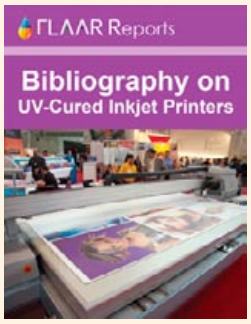

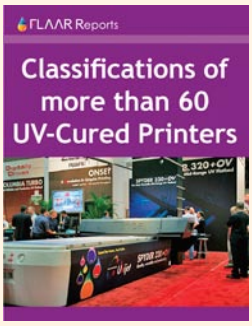

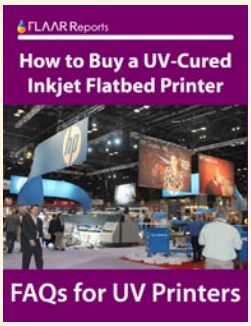

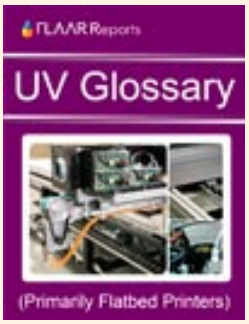

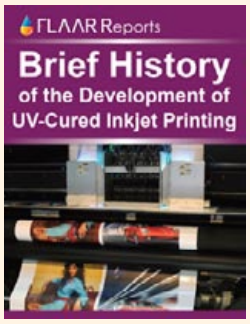

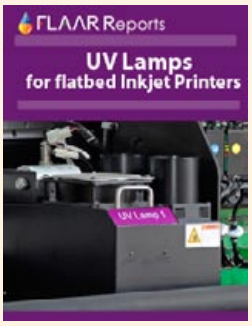

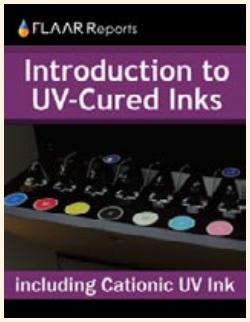

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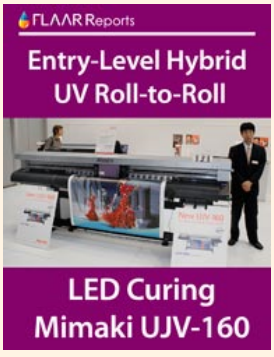

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