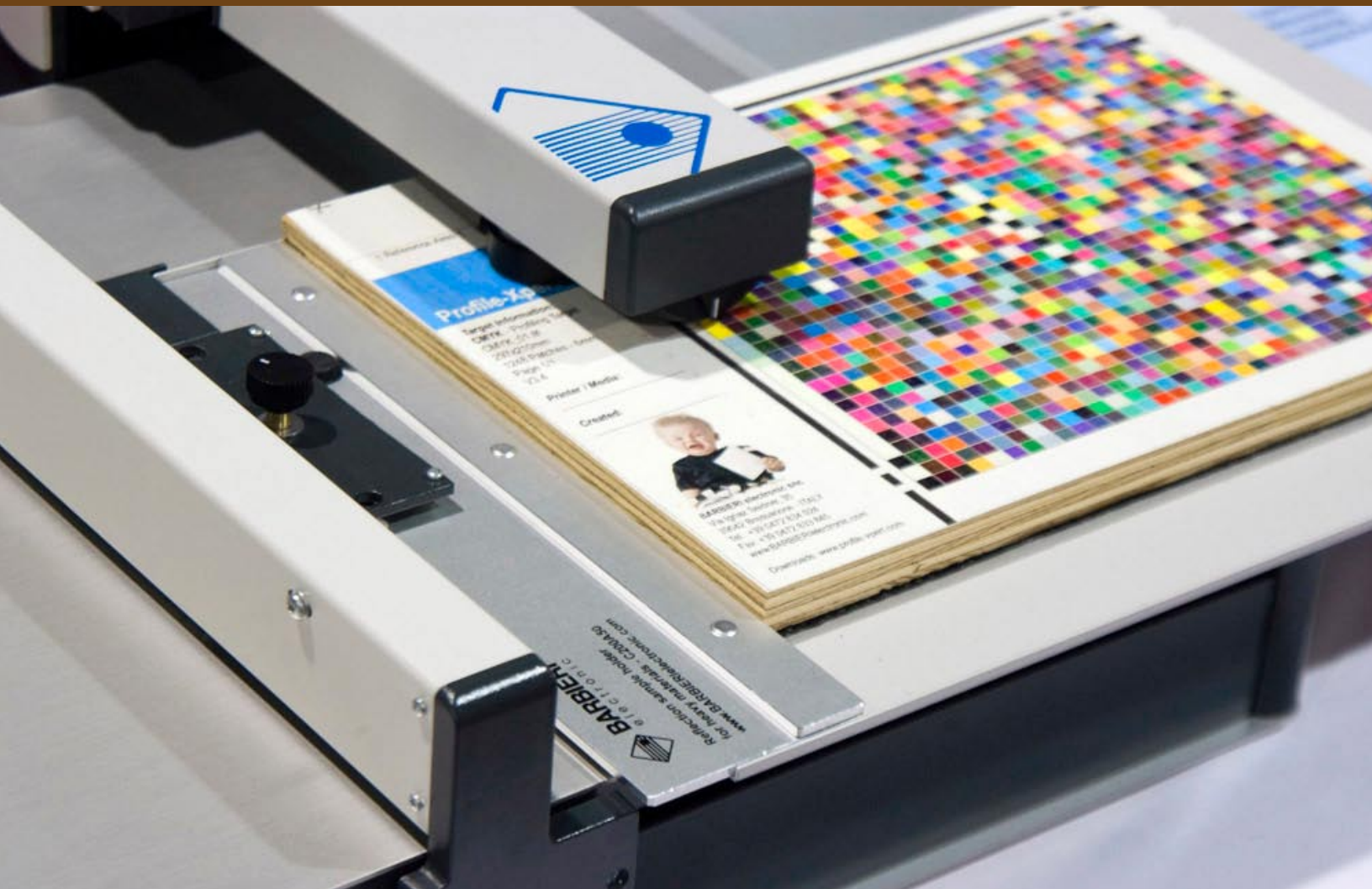


# Glossary of terms on Color Management & ICC Color Profiles



for wide format printers,  
digital cameras, and scanners



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## Introduction

Our goal is that this glossary is to assist printshop owners, managers, and printer operators, as well as students of graphic design, photography, and printing. This glossary should also be informative for photographers, artists, giclee ateliers, and printing shops of all kinds, especially signage.

FLAAR has separate glossaries on digital photography, on wide-format inkjet substrates and media, on UV-cured flatbed printers, and is preparing a glossary on wide-format inkjet printers for textiles. These can be obtained from various web sites in the extensive network of FLAAR sites including [www.wide-format-printers.NET](http://www.wide-format-printers.NET).

A major focus of FLAAR is in archaeological research and museum displays. To reproduce the color of an ancient mural or artifact is what has led me into color management. In other words this glossary began as my own quest to learn how to handle colors so that my exhibit photographs represented the colors of the original paintings or sculptures. I felt it would be helpful to others to have the results of my years of research teaching myself about the basics of color management. I still have a long way to go, but this FLAAR Report is a good introduction to color management jargon.

Most good books on color management have a short glossary, but tend not to have an extensive one and rarely illustrated no matter how long or short. Then there are dozens of glossaries on the Internet. Several of these simply copy from the others. Most of these are not illustrated. So our intent was to gradually build up a corpus of at least basic illustrations. Since all software is copyright, we can't do screen captures as illustrations until we have staff and time to go through the endless paperwork to obtain permission. So the initial illustrations are mainly for hardware. The other limitation on illustrations is the cost of preparing them. Thus we appreciate the help of research sponsorship from corporations.

Because so many of the glossaries on the Internet copy from each other, our goal was to work in a manner to avoid plagiarism of the glossaries which already existed. You see too many plagiarized glossaries on the Internet already.

The best way to avoid plagiarizing another work is not to look at it when you are writing your own. So my portion of the following glossary was built up term by term by a long learning process which included attending IMI conferences, trade shows around the world, as well as reading books and articles on color management. To edit some difficult terms then we went back to the books, articles and on the Internet to understand the nuances of a term. Obviously some terms are so basic and standard that there is no way to define it without the definition being similar to everyone else: you would define a hand as having fingers and a thumb.

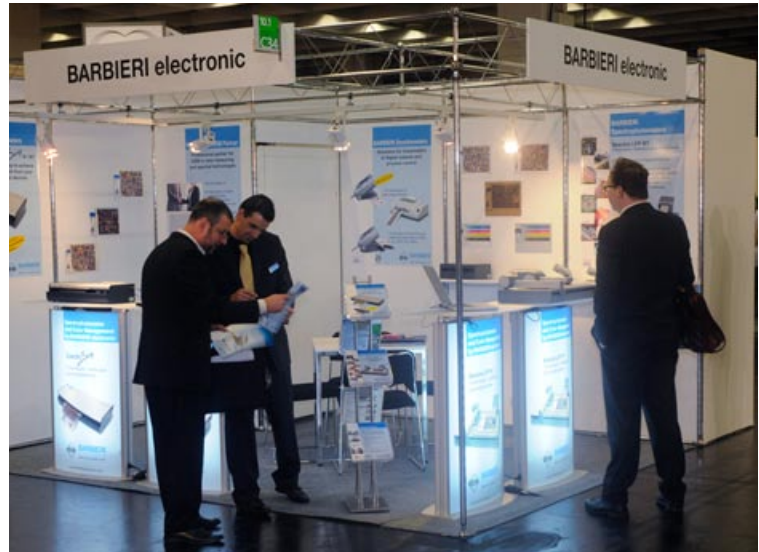
Earlier versions of this glossary were assigned to students to assist in organizing. Stephanie Madeya did a capable job during her period of co-op internship. Paul Huhtala undertook later revisions. Because of the costs of maintaining the research institute at the university, the resulting bibliography had a nominal fee. Of course most people preferred a free glossary on the Internet rather than paying, even if the Internet glossaries lacked illustrations.



But the university ran out of funding by 2007, so FLAAR returned to St Louis in May 2008, which is where we were located before moving to Ohio. During 2008 I decided to bring this glossary up to date by further improvements. The goal was to make this new FLAAR glossary on color management available at no cost (so there would be less incentive to seek other Internet bibliographies). To make any report free to the worldwide readership of FLAAR web sites implies a sponsor to provide funding, and we thank BARBIERI electronic, a leading color management company in Europe for providing funds to expand and improve this glossary and to make it available to our readers at no cost.

This glossary is essential for the newbie and intermediate user, as well as for any new employee. The terms contained within are related to aspects of color management, including basic information pertaining to color theory as well as information directed more towards the color management workflow.

The present version (October 2008, updated November 2008 and again in May 2009) is a major update over previous years, but this will be further updated about once every year.



*BARBIERI electronic booth at Photokina 08*

**Glossary**

**18% gray** has long been used as a standard reference in gray balance for photography. The gray patch under the yellow patch is the closest on the Macbeth ColorChecker to 18% gray it has Lab values of 52.0.0.

**4-color process**, a printing process that utilizes four colors of ink, Cyan, Magenta, Yellow, and Black, to reproduce colors.

**5000° K**, standard color temperature for viewing colors (in a viewing booth) in the United States.



*Macbeth ColorChecker*

**6-color** can mean either a printing process that utilizes Cyan, light cyan, Magenta, light magenta, Yellow, and Black to reproduce colors or can mean CMYK plus Orange and Green. Light colors are not really separate colors, they are separate ink lines that help in transitions. In comparison, 6-color process color can produce more colors than 4-color process, due to the two additional inks. But for billboards and banners, or any signage viewed at a distance, four colors are plenty. Four color images are lower cost to print because you use less ink. Wide-format inkjet

printers exist with eight colors and with up to 12 ink lines. However few RIP software or color management software can handle more than six colors. See also **Hexachrome**.

## A

**Absolute Colorimetric** is one of four **rendering intents**. The goal of the Absolute Colorimetric intent is to clip those colors which don't fit into the target device gamut, but all colors which fit both the gamuts remain the same. "Target device" usually means a printer. Alternative rendering intents are **Relative Colorimetric**, **Perceptual**, and **Saturation**. Which one to choose depends on whether you are dealing with pie charts, or photographs or logos (which depend on accurate matching of spot colors). For logos one of the colorimetric options is best. (Andrew Rodney, "ColorSync and ICC"). For example, If your image is primarily spot colors, you will tend to prefer absolute colorimetric. This rendering intent functions by taking colors that are outside the output device gamut and shifting or pulling them into the gamut. See also **clipping**.

**absolute color reference systems** are three-dimensional color models based on hue, saturation, and lightness. The early versions of these systems were presented in the form of color charts. The Munsell color charts would be one well known absolute color reference system. Europeans, especially in German speaking countries, may know the **DIN** system better. For those for whom a numerical system of color nomenclature and reference is too rigid and mathematical, there are also **verbal color designations**.

**achromatic color**, color lacking hue, meaning that it either totally reflects or absorbs light. Examples of achromatic color include white and black. See also **chromatic color**.

**additive color model** is demonstrated by the mixture of colored lights to form all colors. Experiments have demonstrated that with varying percentages of Red, Blue, and Green light you can form most other colors. Also known as additive primary colors. If you take any two additive primaries and combine them, you get one of the subtractive primary colors (C, M or Y). An example of additive color is the color produced by your computer monitor or digital projector. 100% of Red, Blue, and Green forms white. 0% of RGB is black. See also **subtractive color model**.

**additive primaries**, also known as the additive primaries of red, green, and blue. These colors are the base of the additive color model. Your monitor displays in RGB and scanners scan in RGB. Although your inkjet printer reproduces color in CMYK, cyan, magenta, yellow, and black, most large-format printer firmware prefers to receive files in RGB. When working in Adobe PhotoShop, do not convert files into CMYK and then return them back to RGB. Converting a file from RGB to CMYK clips part of the color gamut. Let your RIP or printer driver make that conversion for you. See also **subtractive primaries**.

**Adobe Gamma**, a function to calibrate monitors provided by Adobe Systems.

**Adobe RGB 1998**, sometimes written as Adobe RGB. Released in 1998, Adobe RGB 1998 requires the use of a monitor profile and then in theory, images will display identically on any monitor that is using the same profile. Most professional graphic designers prefer Adobe RGB

1998 as their working color space. See also **sRGB** and **Colormatch RGB**.

**algorithm**, a mathematical equation to transform aspects of an image from one state to another. An algorithm may be used to transform a color from RGB through LAB to CMYK.

## B

**banding** are horizontal lines on a print. Banding is an undesirable effect of all sizes and shapes of inkjet printers, both piezo and thermal. Banding may be present only across one color (usually a solid black or solid cyan). Or banding may be continuously across the entire range of colors. Banding is a result of the path of the printhead across the media. There may be lines or absence of image within the bands.

At trade shows circa 2000-2003 the printer that showed banding defects the most were Roland printers, though if you take the last dozen trade shows, at least one printer of every brand has been banding at least once. Encad has the best record of seldom banding (reputedly because it sprays so much ink out of its Lexmark heads that the ink obliterates any banding tracks).

Nowadays (since the last several years) the Roland is for signage and not really made for giclee or photo printing any more. The newer Mutoh printers have software that allows the user to correct for banding from media advancement (Intelligent Interweaving from Mutoh). Roland and other companies have copied this concept, either by license or by creating their own method of gradient masking. In general, banding today (2009) is less a problem that it was five years ago. You should not accept banding from your printer. A banding is a defect. In most cases it can be overcome when the end-user understands what kind of banding is involved, and how to resolve the problem.

For more intimate details on banding see the FLAAR Report on "Piezo vs Thermal: Pros and Cons, Fact vs. Fiction."

Banding is called many other things, such as streaking, but it is not a streak, it is a continuous horizontal defect.

- Banding on inkjet is more complex than a different kind of banding on desktop office laser printers; several kinds of banding may occur in wide format inkjet output.

Printers that use UV-cured ink have an additional kind of banding called "bi-directional banding." This defect, also called curing banding or the lawnmower effect, is described in FLAAR Reports on UV printers. See also **chromatic banding**.

**base linearization**, see **linearization**, **re-linearization**, **calibration**.

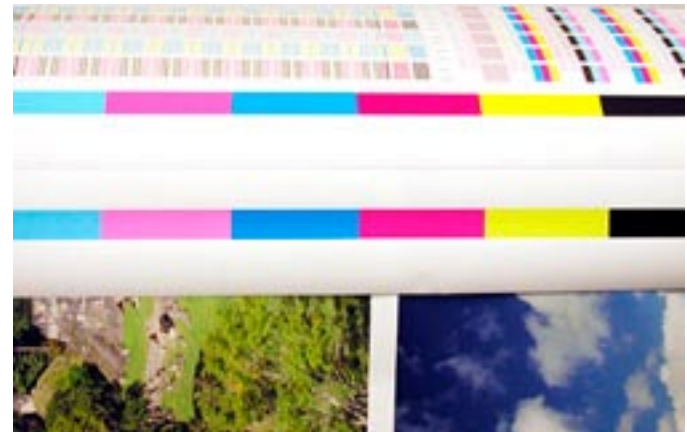
**basICColor** is a German color management company. Their software is considered excellent. Their motto is "the basICCs of color management." Website is [www.basiccolor.de](http://www.basiccolor.de). I have, however, not yet had the opportunity to receive and thereby not the opportunity to test their products in person.

**black** is the absence of any color because the object has absorbed all color and hence reflects none back to the observer. In theory black results when you combine all three primary subtractive colors. But the actual inks or paints are not pure enough and the end result would be a muddy dark brown. Hence in printing you need pure black colorant to produce your black type and other desired blacks. In the abbreviation CMYK, Cyan, Magenta, Yellow, black, the K is thought to come from the old fashioned printer's term as the key color. See also "**rich black**"

**black point** is the darkest part of your scene where you still wish to be able to see details, such as within a dark shadow. If it were pure black there would be nothing to see. See also, **white point**.

**black point adjustment** (Green p. 133) is the process of adjusting the shadow areas of an image to enhance image detail, the opposite of white point adjustment. Adding black to the shadow areas of the image will make this adjustment. See also **white point adjustment**.

**black point compensation** is the adjustment of black points between different color spaces, which allows for the darkest darks of an image to remain unchanged.



*Calibration strips for printer self-calibration. Taken From HP 5000*

**blooming** (in a digital photography) tends to occur on areas of high brightness when the information (from the electrical charge) for one area spills over into adjacent areas.

**blue**, one of the three additive primary colors, otherwise known as B of the RGB acronym.

**brighteners** are chemicals added to the surface layers of inkjet media to make them whiter than white. To counteract this unnatural brightness, a **spectrophotometer** may need a UV filter to make unbiased readings. See also **inkjet receptor layer**.

**brightness** is the **lightness** or darkness of the emission of light. The sun is bright. Brightness is the measure of the intensity of light in a color from bright to dim. Brightness is also dependant on the amount of color that is reflected from a surface.

**bronzing** is an undesired effect resulting from coincidental reflections primarily from pigmented ink and especially on glossy media, mostly noticeable from large areas of ink and especially black. See also **gloss differential**.

## C

**calibration** (standardizing) vs **characterization** (describing). Calibration returns the device to a known state by checking the state you find it in, then adjusting it to a preferred state which

is a known state. You calibrate first, then characterize it. Initial calibration of an output device begins with **linearization** of that device. Fraser describes all this in terms a lay person can actually understand (2003:114). . See also **linearization**, **characterization**, **monitor calibration**, and **printer calibration**.

**calibration bars**, sometimes referred to as calibration colors or **target** or **swatch**. These bars are printed in either grayscale or color and can be measured by a color measurement instrument to determine if the color of the printed output is accurate.

**canned profile** is a pre-developed ICC profile that are made by printer, media, and ink manufactures, or by a commercial profiling company. These profiles can produce varying results, as the conditions at the facility where the profiles were created may be much different from the conditions within your facility. Plus, their printers, the age of their printheads, all affect their profiles. Your printheads may be different. Indeed photographers have told me that even with two of “the same” printer models, a canned profile will result in one color on one printer and slightly different nuances of color on the “same” printer model next to it (in the same temperature, humidity and on the same media). Therefore It is recommended avoiding canned profiles and that custom profiles be developed.

The reason that printer manufactures so eagerly provide you with canned ICC profiles is so that you use their canned profiles and thereby their ink and their own branded media. But if you know how to do your own ICC color profiles, then you can do select media that is less expensive. See also **custom profile**, **color profile** and **ICC color profile**.

**capture**, in digital imaging jargon means to take a picture or do a scan, to “capture” the digital image with a capture device.

**CCD**, charge coupled device, the imaging sensor of many digital cameras (except those that use a CMOS sensor).

**channel**, specific color areas of an image. Examples of channels are red, green, or blue for RGB and cyan, magenta, yellow, and black for CMYK.

**characterization** means profiling a device; profiling means you describe it colormetrically using color measuring tools. You calibrate the device first, then characterize it. The best definition of characterization I have seen in the process of reading countless books as background research is by Fraser et al. 2003:114: “profiling, which is often called characterization, is the process by which we record a device’s behavior into a profile. It doesn’t change the device’s behavior; it just records how this device makes color and what colors it can (and cannot) reproduce.”

The ICC profile contains device specific information (in numerical form) to help create consistent output results. Characterization is done after calibration of the output device and requires the use of color measurement instrument and third-party color management software.

**chroma** is **saturation**, the quality of a color that is the combination of hue and brightness. White, black, and gray have no chroma. Adobe Technical Guides. Glossary of Color manage-



ment Terms. Chroma is elsewhere defined as “deviation from gray.” (Raja Balasubramanian et al. The Industrial Physicist, p. 20).

**chromatic banding** results when the sequence of colors being printed with the carriage going from left to right is a different sequence of colors when the printhead carriage is going the other direction. This has to do with the sequence of the printheads. If each ink color has only one printhead, then it may be first color down with the carriage moving to the left and last color down when the carriage is moving back the opposite direction. The final color (of the mixture of CMYK) will vary slightly depending on the sequence of color laydown. One way to avoid chromatic banding is to have two printheads for each color and mirror their positions. In this way the sequence of color is the same no matter what direction the carriage is moving.

**chromaticity coordinates**, based upon the CIE xy Chromaticity Diagram. Chromaticity coordinates describe the redness greenness and yellowness blueness of a color, otherwise known as hue description of the color.

**chromatic color**, color that has hue, meaning that it reflects light to create different colors. Examples of chromatic color include red, green, blue, yellow, etc. See also **achromatic color**.

**chromaticity**, description of the redness greenness and yellowness blueness of a color, otherwise known as hue description of the color. Also abbreviated as C\*.

**CIE**, French for Commission International de l’Eclairage, otherwise known as the International Commission of Illumination. They are credited with the creation of the CIE Lab color space.

**CIE Lab**, also written **CIE L\*a\*b\*** (see also LAB). “L” stands for lightness, “A” stands for the color location between magenta and green, “B” stands for the color location between yellow and blue. Paraphrased from Print Publishing (p. 456). In jargon it is really called LAB (also written Lab). It is not an acronym but is spelled and usually thought of as one anyway. Lab is a device independent color space. The intent is to have a color description that is based on the way we humans view color with our own eyes.

**CIE LUV**, color space also known as CIE L\*U\*V\* or CIELUV.

**CIE standard illuminates**, CIE data pertaining to different light sources as viewed by a CIE standard observer.

**CIE standard observer**, observer that represents a human with the sense of normal color vision.

**CIE tristimulus values**, reference amount needed to match color stimulus.

**CIE xy chromaticity values**, chromaticity coordinate values that describe the redness greenness and yellowness blueness of a color.

**clipped**, occurs when colors that are outside the output device gamut are shifted to be capable of being reproduced by an output device. See also **Absolute Colorimetric**, one of the four rendering intents.

**CLUT**, also known as color look-up table.

**CMD**, Color Measurement Device (Onyx, p. 5).

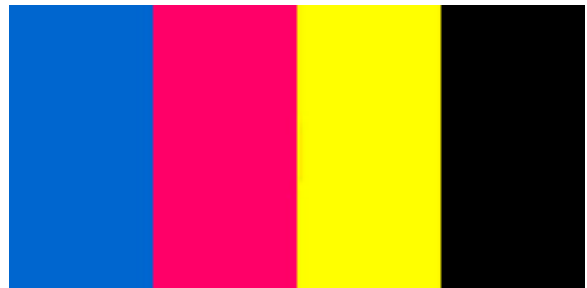
**CMC**, also known as color management committee.

**CMS**, otherwise known as color management system. The CMS is used to translate color gamut information from one device to another device, while retaining accurate color information.

**CMM**, otherwise known as color matching method. The part of the CMS that is responsible for the color gamut translation function between the device and the profile.

**CMY**, cyan, magenta, and yellow. Otherwise known as the subtractive primary colors.

**CMYK** stands for Cyan, Magenta, Yellow, and black or Key color (based on traditions in printing from the previous century). Otherwise referred to as the subtractive primary colors. The colors that are used in the inkjet printing process. Note: “B” is not used for black since it could be confused with process Blue.



*CMYK color. When overprinted, it can produce full color. Also Know as 4-color process inks*

**color** (brightness, colorfulness and hue) color requires an observer, an object, and a light source.

**color adaptation** is the known propensity of the human eye to recognize certain colors as standardized even when under a differing light they have a color cast. Thus a white sheet of paper is interpreted by the brain as white even when moved from tungsten (yellow) light to bluish fluorescent lighting.

**colorants**, additives (pigments or dye) used to create color for inks used in the printing process.

**color balance** is an even **grayscale**. Your color balance is “off” when your gray looks pink or your sky looks purple. Color balance is not corrected by color management whatsoever. Color management would merely tell the output device how to properly reproduce the color imbalance in the original image. To correct the color balance you need to do a white balance (or gray balance), either before you take the photograph, or afterwards in Adobe Photoshop or iCorrect from Pictographics.

**color by the numbers**. You can represent RGB (or CMYK) by numbers 0 through 255, or by

percentages, 0-100%. You can find the colors and see their numbers on the 0-255 scale in the color picker of Adobe Photoshop.

**color cast**, the visually noticeable tint in red, blue, green or an off-gray. Gray does not have a color cast. Color cast can be removed from an image by the manipulation of the image color channels. See **gray balance**.

**color configuration**, data specific to an ink set and media that is sent to the printer along with a job to produce accurate color.

**color conversion**, changing from one color model to another. For example the RGB to CMYK conversion that is performed by the RIP software when printing to an ink jet printer.

**color correction**, the process of altering an image so that it displays realistic color. Color correction can be done in a variety of different methods, including color balancing and manipulation of color curves. To color correct an image, Adobe Photoshop or other similar manipulation programs are needed.

**color curves**, tool that can be utilized in the color correction process of an image. Color curves can be adjusted as one, or they can be adjusted as specific channels.

**color designation system**, see **Munsell** and **verbal color designation**

**color gamut**, the range of colors that can be reproduced within a color space.

**colorimeter** is an instrument which seeks to measure color in the same manner as the human eye. "A device that measures luminosity of colors" (A&W GATF p. 41) in a manner similar to that of the human eye. "better at measuring color differences than individual colors" (Brues). A spectrophotometer is more accurate because it can handle a wider spectrum. You tend to use a colorimeter to measure a monitor and a spectrophotometer to measure a printed test patch (Monaco by X-Rite: p. 22)

**color key**, a sample print that is used for a customer proof to display what the final job prints will look like in terms of color. See also **proof**.

**Colormatch RGB**, a working color space which is the standard for prepress imaging. See also **Adobe RGB 1998** and **sRGB**.

**colorimetric rendering** results in clipping out of gamut colors. Then all the colors in the original are brought into the gamut the output device can handle. Use colorimetric rendering if you have spot colors; do not use colorimetric rendering with most photographs. There are two kinds of colorimetric rendering intends: **Relative Colorimetric** and **Absolute Colorimetric**. See also **perceptual rendering**.

**color management**, the process of reproducing accurate color from device to device. Color management is not at all the same as color correction or color balancing (**gray balance** or

**white balance**). Color management does not correct poor color, it only manages image colors from input to output devices. Color correction (color balance) is intended to adjust poor color. Color management is intended to take color from RGB color space, transfer it to an intermediate color space, Lab or similar, and finally to CMYK for either offset or inkjet printing.

**color matching**, basis for the science of what is referred to as color management. Color matching is the process of producing accurate and consistent color from device to device. There are many functions, such as the development of an ICC profile and choice of the correct rendering intent, which are crucial for accurate and reliable color matching.

**color model**, this term is utilized differently by various authors. Most specialists consider **additive color** and **subtractive color** as color models; **colorimetric rendering**, **perceptual rendering** can be assumed under color models. Fraser calls **RGB**, **CMYK**, and **CIE Lab** color models. Yet others call those **color spaces**. Either definition shows the important fact that color models are classified into various categories to be represented and differentiated between one another.

**color profile**, otherwise referred to as ICC color profiles. Color profiles can and should be generated for both input and output devices. These profiles play an important role in color matching, since they contain device specific information pertaining to a devices ability to reproduce color. Color profiles are created by manufactures of output and input devices, but it is recommended that custom profiles be generated, because they will reflect the specific of your work environment. See also **custom profile**, **canned profile** and **ICC color profile**.

**color reference systems** is a color system in which colors can be identified by name and the true color can be looked up in color reference documentation provided by the manufacturer. Examples of color reference systems are Pantone, Toyo, and Truematch. See **absolute color reference systems**.



*The X-rite and DTP70 are some of the color instruments used in bulding a color profile.*



*BARBIERI Spectro Swing RT, used for building a color profile (in this picture for transparent backlit media).*



**color spaces** include **RGB, CMYK, CIE L\*a\*b\***. (Caponigro 21-35; Ciaglia pp. 94-95; see also the X-Rite booklet and the Agfa booklet) Fraser calls the color space the three-dimensional representation of a color model ([www.creativepro.com/story/feature/11132.html](http://www.creativepro.com/story/feature/11132.html)). The term color space is utilized differently by various authors. Some consider the term to define RGB, CMYK, and Lab. Others consider the term to define all of the colors that a color model is capable of producing.

**color separations**, individual printout of colors used in an image. If an image is four colors, there will be four separate prints, if the image is two color, there will be two separate prints and so on.

**color sequence**, the sequence in which colors can be viewed from the visible spectrum.

**color shift** is an unwanted change in color. Color shift can be caused by using an incorrect rendering intent or using the wrong color model when sending a job to an output device.

**ColorSync** was Apple's system color management extension that was the predecessor to the ICC profile system that is the current industry standard. ColorSync existed before the ICC color profiles that we use today. Apple was one of the founding members of the ICC. A good description of a ColorSync workflow is available from Roy Bohnen and Sean O'Leary, pp. 54-57 and elsewhere in their booklet.

**color temperature** is measured in degrees Kelvin. Color temperature is based on an idealized black radiant body which, as heated, starts out glowing red and as the heat rises turns to blue white. A technical definition is available from from hundreds of different web sites.

**color viewing booth** is a hooded booth with the hood intending to keep other light from falling on the subject whose color is being studied. In the US, a viewing booth uses light which tries to simulate natural light at 5000K unless you wish a different color temperature. In Europe a different color temperature is preferred. Several companies are best known for making color viewing booths; the one I know best is Just Normlicht.

**color wheel**, a method of showing colors and their position next to each other.

**complementary color**, a color that is the exact opposite of another. Complimentary colors can be easily determined by locating the primary color on a color wheel and finding the color that is directly opposite. For example, the complimentary color to red is green and the complimentary color to blue is yellow. Combining complementary colors produced gray.



*Just Normlicht Color Viewing booth at GraphExpo 2004*

**composite file**, opposite of color separation. All colors in the image file are reproduced together as opposed to individually.

**cones**, color sensitive light receptors that are located in the retina of the human eye. The cone is the opposite of the rod, which is also located in the retina of the human eye, in that it is responsive to high light source brightness. See also **rods**.

**contrast** is the relationship between darks and lights in an image. A color management system usually wants to know the darkest and lightest areas of an image.

**cool color**, a color that has a hue related to blue colors on the color wheel. The opposite of a cool color is a warm color. See also **warm color**.

**correction**, color correction is what you do with Adobe Photoshop, Pictographics iCorrect, and comparable software. This is not calibration nor characterization. Two good books on color correction are by Dan Margulis and another by Michael Kieran.

**CMM** = Color Matching Module, “will interpret the information contained within a device profile and carry out the instructions on the way the color gamut of each device should be treated.”

**Cyan** is also called **process blue**; one of the three primary subtractive colors. Also known as C in the CMYK acronym.

**custom profile**, the opposite of a canned profile. Custom profiles are developed in house and reflect the specifics of the particular work environment such as temperature, humidity, age of materials, etc. Custom profiles help to ensure consistent color reproduction from device to device. If you are doing commercial production printing you will eventually wish custom profiles. The reason you want a custom profile is that it is accomplished in your shop with your room temperature and humidity. See also **color profile** and **canned profile** and **ICC color profile**.

## D

**D50**, otherwise known as 5000° K. This is the industry standard for viewing color for accuracy and consistency.

**D65**, otherwise known as 6500° K. This is the calibration standard for monitors.

**Delta E** is how to pronounce  $\Delta E$ ; a standard for measuring difference in color. The smallest difference in color a normal (healthy) person with healthy eyes can distinguish.

**densitometer**, a device that measures the density of colors. Densitometers work by measuring the amount of light that is reflected to the eye (light which is not absorbed) and assigning that amount a value based upon absorption factors of white light. A densitometer could be considered a color tool but is not intended to measure color, but rather relative density. A densitometer enables you to read pixel values directly from the screen. Print Publishing (p. 344). Barbieri

has been manufacturing densitometers since 1983 (for photography, where quality counts). See also **colorimeter**, **spectrophotometer**.

**density** is the ability of a surface to absorb a source of light. Light colors have low density; dark colors have high density because not much light is reflected off them.

**density range**, value difference between the lowest density level and the highest density level of an object.

**device**, informally described a device is hardware, such as a monitor, printer, scanner, or digital camera. See also **drift** (device drift).

**device dependent** is a color whose gamut is dependent on the type and even the specific device within that type. So two printers (or monitors, or scanners), even if the same make and model, can exhibit differences in color reproduction.

**device independent**, a color space whose appearance does not change with every device which displays it.

**diffuse highlight**, the lightest part of an image for which you wish to see visible detail still preserved. see also **highlight** and **specular highlight**.

**differential gloss**, see **gloss differential**

**DIN**. Wikipedia says this really means Deutsche Institute fuer Normung, but 100% of the people that I ask say it means Deutsche Industriennorm (German industrial standard(s)). This organization sets standards (norms) for German industry.

**dot pitch**, differential distance between phosphors or dots contained within a monitor. Monitors with a lower dot pit are considered to be of better quality, because of their ability to create a better display. See also **phosphor**.

**drift**, as in, device drift. A printer's output will "drift" as the printheads become worn out, as the temperature and humidity change. In this case you will occasionally wish to re-linearize the device to compensate for the drift.

**dye**, colorant used in the printing process.

**dye sublimation**, is a chemical process whereby heat is applied to an inked surface. The heat turns the ink (so no more individual droplets). The result is continuous tone. Dye sublimation works best on polyester. The color of the printed material before heat is applied is not the color you achieve



*Klieverik GTC 3400 for Dye Sublimation*

**dynamic range**, the range of measurable density values, usually used for the range a scanner can detect.

## E

**edit a profile**, in effect means you take the profile and tweak it yourself. In other words, you use subjective impressions to tweak what is supposed to be a scientifically valid objective profile. Once you realize you may have to, or desire to, tweak a profile, this sort of ridicules the entire ICC profiling process. Now you see why some printshops simply skip color profiling all together and tweak from the beginning (and skip even trying to apply profiles. Downside of not using ICC profiles or color management workflow is that only your current printer operator can replicate a desired result. If the operator is sick, or retires, or jumps to another job elsewhere, you have no way to replicate what he or she was doing. But if you have a color management workflow, any new employee can come in and repeat what was being done by anyone else.

**embedded profile**, an ICC profile that is attached to a file, which can be used by other applications.

## F

**flat color**, color that is solid and contains no blends or gradations.

**fluorescing**, the process of light absorption and reflection, which produces bright colors. Reflection may produce a different hue than absorption.

**FOGRA**, a non-profit research institute in Munich, Germany dedicated to setting standards in offset printing. FOGRA is now realizing that offset printing is being gradually replaced in some aspects by inkjet presses. At a recent FOGRA event (autumn 2008), FLAAR was one of several presenters on the wide-format UV-cured inkjet aspects of the changes that are coming into the offset printing world.

**four color black** is a black made of K plus CMY. See also **rich black**.



*Dr. Nicholas Hellmuth lecturing at FOGRA 2008*

## G

**GCR**, Gray Component Replacement. This process replaces portions of the CMY ink with black ink throughout the image including highly saturated areas, as opposed to UCR (Under Cover Removal) which removes CMY primarily in shadow areas which are supposed to be neutral anyway. Check to make sure that a large dose of GCR has now lowered the gloss, contrast,



and saturation of the end result. (Field 1999:175; 218). Advantages include the ability to print cleaner with brighter colors, disadvantages include loss of shadow detail.

**gamut**, the range of colors which can be achieved by the device. see **color gamut**.

**gamut compression**, compression of the color gamut based upon the amount of colors that the output can realistically reproduce. Rendering intent also plays a large role in gamut compression, due to the gamut mapping that is completed.

**gamut mapping** is necessary when moving color from one device to another when their respective device specific color gamut differs. The gamut mapping is what is undertaken to arrange the transformation with as little change as possible. One Adobe author uses the word gamut mapping in a manner that I would interpret as synonymous with **rendering intent**.



*Black tonal scale used for measuring gamma.*

**gamut simulation**, simulation of the color gamut available for one device on another. This mimics available device colors, so it is good for creating proofs.

**generic profiles** are the **canned profiles** that you get with the inkjet printer hardware, software, inks, or media. Unfortunately, your printhead wear, the temperature and humidity of their printer won't be the same as your own printer or environment. If you are serious about color matching you will prefer to work with **custom profiles**. Generic profiles may also be called stock profiles or canned profiles.

**gloss**, a form of surface finish, a quality which reflects light. Pigmented inks may suffer from differential gloss defect. Some glossy surfaces may be too reflective, but this is a matter of personal preference. Gloss may be enhanced by lamination. See also **matte** and **satın**.

**gloss differential**. Pigmented inks may suffer from differential gloss defects because some inks are more glossy than others. You see the difference when some pure dark surfaces look muddy in comparison to other colors near them. Some glossy surfaces may be too reflective and others look nice; this is a matter of personal preference. Gloss may be enhanced by lamination. Gloss differential may also be eliminated or minimized by lamination. See also **matte**, **luster**, **satın** finishes.

**grain**, 1 The direction in which the fibers run in paper. Grain, 2: the ditty pattern of inkjet drops. grain, 3, grain of film as seen in a photographic print. The higher the ISO the more grain. Digital equivalent of grain is noise.

**gray** is the absence of any color cast. Gray is neutral. Whether light gray or dark gray or anything in between; gray is gray.

**gray balance**, the process of removing colorcast tint from a color. Gray balance is needed when C, M and Y are not in proper proportions and all colors make a shift towards the colorcast tone and may happen at several stages of production.

**gray levels** range (the number of) levels between the lightest and darkest parts of the scale.

**grayscale**: a grayscale image in digital jargon means a black and white image. Grayscale is not normally intended to mean a scale of gray.

**green**, one of the three additive primary colors, otherwise known as G of the RGB acronym.

**greyscale**, in printhead jargon, has nothing to do with the color gray, white, or black or any color. A greyscale head is contrasted with a normal binary head. This technology gets complex fast and is best left to a printer or printhead glossary. The Xaar website and IMI conference PowerPoint presentations explain what a greyscale printhead is.



*Dr. Nicholas Hellmuth at XAAR facilities inspecting the XAAR Printheads*

## H

**halftones**, the series of dots that comprise a continuous tone image.

**hard proofing**, image is printed to show what the final output will look like in terms of color and quality. At this point, changes can be made if necessary. This method may extend the time of the production process, but can alleviate costly mistakes. Hard proofing is the direct opposite of soft proofing. See also **soft proofing**.

**Hexachrome** inks, a trademark name for a special 8-color ink set. Hexachrome inks were popular with offset printing but were not successful at all in the world of inkjet. Roland tried to offer Hexachrome inks circa 2002-2003 but there was not much interest among sign printing companies (uses too much ink, so raises cost; and most clients are not willing to pay for the difference because they barely notice the improvement). Encad offered their own version of an 8-color ink set, but called it Octachrome since Hexachrome is a trademark. Octachrome was not very popular. ColorSpan had more success with an 11-ink and 12-ink system but the Roland d'Vinci attempt with 12 colors was not very successful (in part because there was not enough fine art media at the full width of that Roland printer, in part because there was not a large enough market demand to create a really good 12-ink color set, and in part because Epson did not want to encourage people to think that any printer but Epson could produce giclee).

**High-Fidelity (Hi-Fi) Color**, color that is reproduced using more than four, usually six or more. See also **Hexachrome**, **4-color process** and **6-color process**.

**highlight, highlight area**, the lightest part of the photograph, which will tend to be burned out (**specular highlight**). In a digital photograph you want the white point to have detail, so you can see the texture or substance which is white. Otherwise you get just pure white highlight with no detail (the detail is “burned out”). Highlight may be synonymous with **white point** and specular highlight (more a term for digital photography). See also **black point**.

**HSB display** (Green p. 29), available via Macintosh color-picker. Stands for **Hue**, **Saturation**, and **Brightness**. A color model that measures color in these terms. You can access an HSB display on your Macintosh color picker.

**HSL**, a three-dimensional color model that stands for **Hue**, **Saturation**, and **Lightness**. A few older color management software or scanner software still allows you to manipulate the color balance in HSL. Photoshop does Hue and Saturation. Check out Dan Margulis’s book on Adobe Photoshop. See also **LAB**.

**hue** Is represented by the name of a color. For example, blue, green, and yellow. The human eye determines color through hue, **chroma**, and **brightness**.

**HutchColor HCT**, a scanner target from Don Hutcheson made specifically for scanners. I have, however, not yet had the opportunity to receive and thereby not the opportunity to test their products in person.

## I

**ICC**, International Color Consortium. Their web site is [www.color.org](http://www.color.org). Established in 1998 by eight leading companies in the field of printing and computers, with the intent of creating cross-platform color management system standards. Adobe, Agfa-Gevaert, Kodak, and computer and software companies such as Microsoft were founding members. FOGRA was an honorary initial member.

**ICC color profile** identifies the components of the original color by a numerical designation and tells the output device how to recreate in the new gamut a color as close to the original as possible. A profile is a code, or map, or designation. You can see the actual codes in your software if you wish. The purpose of an ICC profile is to convert color between two devices. ICC profiles are embedded into the document for transfer to the printer.

**.icc**, Macintosh platform file extension for the ICC profile. Windows applications use the file extension .icm.

**ICC profiles – generating**, individual device profiles are recommended and may be generated with the use of specialized profile making software and color management equipment.

**ICC profiles – editing**, generally done with the use of profile making software. Recommended for only those that have skills and experience in color editing.

**ICM**, Windows PC version of ICC. Macintosh applications use the file extension .icc.

**ink limit** is working out at which point the total of CMYK inks on top of each other is too much ink (not this much is needed). You set your ink limit before you do your ICC profile. You can save a lot of money by using less ink if you have a good RIP software (such as Wasatch or Caldera and others) and learn how to use this RIP software and color management workflow to set your ink limit. In some cases you can pay for the color management tools from the amount of ink that you no longer waste.

**inkjet receptor layer** is the coating (layer) whose chemicals interact with the ink. The inkjet receptor layer is on top of the base material (which may be paper or synthetic material). If the chemicals in the inkjet receptor layer include artificial brighteners you need to be aware of this when doing ICC profiles. You may need to use a filter to handle the artificial brighteners. When you are printing with UV-cured ink, and full-strength solvent ink, the materials on which you print usually do not need an inkjet receptor layer.

**input**, the image that goes into a printer (the output device). **Output** is the hard copy which comes out of any printer. Hence a digital camera or scanner produces input for an inkjet or laser printer output.

**input device** usually implies a digital camera or a scanner.

**Intent**, meaning color rendering intent: **absolute colorimetric**, **relative colorimetric**, **perceptual**, **saturation** are the four color rendering intents. In lay persons terms, intent means do you want natural color (perceptual) or noticeable colors for image on signage (saturation).

**IT8 target**. An accepted industry standard target image for calibrating scanners. However for color balance for digital cameras, or as any kind of reference for digital photography, the standard is the (Gretag)**Macbeth ColorChecker** (ironically not the version that was available during roughly 2002-2004). Don't leave any of these test charts exposed to sunlight.

## J

**Just Normlicht** is a German company that makes viewing booths.

## K

**Kelvin**, otherwise known as °K and is the standard for measuring color temperature degrees.

**Kodak gray card**, for decades this letter-sized cardboard was the basic standard for creating a gray balance for traditional photography. Kodak also offered a smaller glossy grayscale patch sheet. Today to varying degrees most Kodak reference cards have been replaced by those of GretagMacbeth, judged as more appropriate for digital values rather than offset printed values. The primary remaining advantage of the Kodak gray card is that it is larger than the gray square on the Macbeth ColorChecker.



## L

**Lab** is a way to describe color that is device independent (could be considered a safe haven for how to measure and describe colors). Lab is not an acronym; it can also be written  $L^*a^*b^*$  or CIE  $L^*a^*b^*$ . The best book for understanding working with Lab in Adobe Photoshop is by Dan Margulis. As an aside, if you move your file from RGB to Lab, it is not fatal to return it to RGB, but never try to then take your CMYK and turn it back into an RGB file. This is because once the file is in CMYK its gamut has been clipped, so it won't be the same when it is returned to LAB.

**LCH**, color model based upon the properties of luminance, chroma, and hue, which is an adaptation of the Lab color model. This model is different in that hue angle works in conjunction with the color wheel to determine the color hue.

**light** is the visible part of the spectrum (visible to humans). **Color** requires light, an object on which the light falls, and an observer.

**lightness** or value is part of how color is perceived or described by people (and I would guess perceived by some other animals). Lightness is on a scale from light to dark; 0% lightness represents black; 100% lightness represents white. The other two components of human perception of color are **chroma** (saturation) and **hue** (what a lay person would call the common name of the color). Lightness is one of the dimensions of the HSL color model. See also **brightness**.

**linearization**; the purpose of linearization is to adjust a device (in our instance, an output device, namely a wide-format inkjet printer) to take advantage of its full color gamut and **dynamic range**. The first printout of color patches will show the current state; correction will result in a more even pattern stretched out to the maximum possible for that device. Fraser et al. shows a good before and after (his fig. 5-3, p. 121).

Linearization may best be accomplished through your RIP software, assuming yours handles linearization well. ColorSpan printers can accomplish linearization on-board from their own software and a measuring device built into the printer itself. Today (since autumn 2006), the HP Z-series printers with an onboard i1 spectrophotometer and software system can handle linearization within the printer's own system.

**linearization target** is a set of four rows of colors: Cyan, Magenta, Yellow, and grayscale (black). The first patch is pure white, then more and more ink is added in 10% increments until the final patch is 100% of that color. This is an idealized density series. You should be able to see the difference in colors as 10% more ink is added at every stage. But in the real world, this ideal is not found until you calibrate your printer. So you first print out the linearization target. Then you notice which patch is the darkest. This needs to be "moved" to the 11<sup>th</sup> position by telling the software which position the target is in initially. Because if fully cyan Cyan is in the 8<sup>th</sup> position, you are wasting 10% of ink in the 9<sup>th</sup> position and 20% of ink in the 10<sup>th</sup> position. So your software resets the ink, when you print out the next linearization target, maximum Cyan should now be at the end. You do the same for the grayscale and for Magenta and Yellow. You have now linearized the density stages of your printer in today's temperature, humidity, ink, on this media. Some linearization targets are more than 11 levels; some are 21 levels.

**luminance** may be considered a synonym for brightness. The definition was originally based on a video signal, now used as part of the HSL manner of showing colors. Best to check out the books on color management or books on Adobe Photoshop, especially by Dan Margulis.

**luminosity** is the range from black to white in a CIE L\*a\*b\* color space, relating to the amount of light reflected from an object to create color.

**luminous color**, color that is produced via the reflection from an object that is illuminated, meaning that light is produced from the object reflection. See also **self-luminance color**.

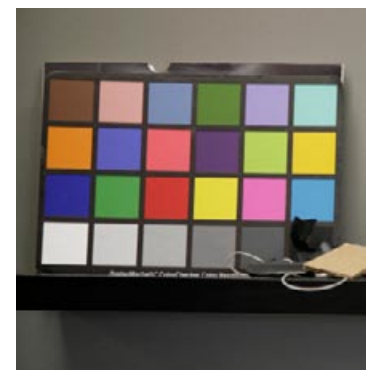
**luster** a kind of surface appearance to inkjet materials, especially for fine art or photographs. There are slight variations and nuances in how each inkjet media company calls the surface finish on their printable materials. Satin, gloss, glossy, or pearl, silk finish, are among many options. Some luster surface finishes may offer with less gloss contrast, or **bronzing**.

**LUT**, otherwise known as a LookUp Table, which is an index of CIE Lab values corresponding with RGB and CMYK values used by a device. An ICC color profile is essentially a lookup table for moving a file from RGB (which is what the camera or scanner produces) into CMYK (which is what the RIP or printer driver create from the RGB file to send to the printer, most of which print with CMYK). The lookup table is prepared in LAB values. So the image goes from RGB to LAB and from LAB to CMYK.

The printers that are the exception (that print in RGB, not in CMYK) are the Durst Lambda, Océ LightJet and other similar technologies that print with LED-related lights on photo-sensitive paper (in other words, these LED-related light printers are not inkjet).

## M

**Macbeth ColorChecker** is cardboard, letter sized, with 24 squares of matte colors. Although Gretag bought Macbeth already several years ago, the ColorChecker is still known by the original name, Macbeth. The ColorChecker DC (digital camera) has not been as successful in becoming a standard. Since about 2006 Gretag-Macbeth belongs to X-Rite. Try to wear gloves when you handle a Macbeth ColorChecker, especially after eating a meal or if your hands are wet.



*Macbeth ColorChecker*

**magenta**, one of the three primary subtractive colors, Also known as M in the CMYK acronym.

**matte**, media surface finish that is considered no gloss, low gloss, or flat. See also **luster** and **satin**.

**media**, any material (such as paper, canvas, etc) that is covered with a coating of chemicals to assist the inkjet laydown of inks is called media. The coating is called an **inkjet receptor layer**.

**metamerism** is the effect when two colors which match under one light source (such as lighting inside a store) no longer match when you take them to view under another light (such as outside in sunlight). In inkjet printing metamerism is most talked about relative to Epson's pigmented inks, especially in the models 7500 and 9500. Some people have suggested that Yellow is a color that causes problems with metamerism in Epson inks. Since about 2005 the metamerism in recent Epson inks is not as terrible as was metamerism circa 2001-2003. In other words, don't buy most old Epson printers. Metamerism is described in helpful detail by Fraser et al. 2003:25-32.

**monitor profile**, ICC profile of the working monitor space. This is the first step in the process of color management to reproduce accurate and consistent colors so that what is seen on the screen, is seen on the print.



*OPTIX MONACO, Monitor Calibration*



*The ECI 2002 CMYK target (Foreground ) and resulting prints*



*Binuscan calibration system from Photokina four to six years ago.*

**monochrome**, otherwise known as black and white printing.

**Munsell** (color) system. One of the most influential color-modeling systems was devised by Albert Henry Munsell, an American artist. Munsell desired to create a “rational way to describe color” that would use clear decimal notation instead of a lot of color names that he considered “foolish” and “misleading.” He was probably referring to the **Ridgway color system**, popular especially after 1912. The Munsell system, which he began in 1898 with the creation of his color sphere, or tree, saw its full expression with his publication, *A Color Notation*, in 1905. This work has been reprinted several times and is still a standard for colorimetry (the measuring of color).

## N

**named color**, a color with a registered name, rather than a numerical classification. A named color would be Pantone color. I am guessing that Munsell would be another.

**nanometer**, measurement for the wavelength of light.

**neutral**, a gray with no color cast. White or black are also neutral. They have no hue.

**neutral color**, a color with no color cast or improper hue. The colors in an image are considered neutral when the gray is itself perfectly neutral, namely that R, G, and B values are identical numbers. It makes no difference if the gray is light or dark; all that counts is that the gray is neutral. Once the gray in a scene is neutral, all other colors are also considered neutral. Unfortunately, many photographers (sometimes including myself) are too much in a hurry to gray balance their photographs during the actual photography. But at least you need to be sure to include something gray in the first photographs of the session so that the photos at least can be color balanced in software after the shoot.



*Neutral Image*

## O

**opacity**, density of color shade, ranging from transparent to opaque.

**optical density** is the measure of the blackness of a printed image. Optical density is also referred to as Black absorbs 100% of the light; white absorbs 0% of the light.

**output** tends to mean hard copy (something printed on a material, usually paper, substrate, or media), but in reality is anything which shows the image, hence a monitor or printer. Output is the image; **output device** is the hardware, such as printer. See also **input**.

**output device** would be a printer, to output **hard copy**, see also **input device**.

**P**

**palette**, the full range colors that are available for use by a particular device.

**Pantone** is a company specializing in producing color standards primarily for printing with traditional presses such as offset presses. As printing has become more digital and more with inkjet machines, Pantone has done its best to become relevant also to this new technology (but is only successful to a limited degree). But Pantone is still the standard reference for many logo colors (especially in the US). X-Rite bought Pantone by 2008, after previously buying GretagMacbeth.

**Pantone matching system (PMS)**, see **color reference scale**.

**patch**; each square or rectangle of color reference samples on a **target** is called a patch. Usually used in the plural, color patches.

**PCS**, profile connection space, a device-independent color space used by a color management module, CMM, for translating colors from one device's gamut to another. The CMM translates colors from the source color space defined by an ICC device profile to the PCS, and then to the destination color space using a second ICC profile. The PCS is selected by the CMM so it is not visible to users (the [www.Adobe.com](http://www.Adobe.com) web site provides more details).

**percent**, some traditional color specialists do **color by the numbers** (white being 0% RGB; black being 100% of RGB, Red being \*\*\*, Blue \*\*\*, Green \*\*\*). Others do color by percent, white being 0% Cyan, 0% Magenta, 0% Yellow. Black would be 100% C, M, and Y.

**perceptual rendering**, one of the four rendering intents. Perceptual rendering is recommended for photographic reproduction. Choosing this rendering intent, converts all colors into a realistic available color space, including out of gamut color, to the same degree, which preserves relative color relationships. The other color rendering intents are **Saturation**, **Absolute Colorimetric**, and **Relative Colorimetric**.

**pigment**, colorant used in the inks for printing. Ink pigments last longer in the sun than do dye molecules that are used in dye inks.

**Photoshop**, means Adobe PhotoShop, a software program for editing photographic images.

**PMS** stands for **Pantone matching system**.

**Profile Mechanic** is a color management product of a company named Digital Light & Color, Jonathan Sachs.

**printer profile**, ICC profile of the printer and its ability to reproduce color in terms of inks and media used. The printer file works in conjunction with the monitor profile to produce accurate color reproductions in terms of WYSIWYG. See also **ICC profile**, **monitor profile**, and **WYSIWYG**.



**profile connecting space** is the standardized color space used for reference.

**profiling**, the process of obtaining a mathematical description (**profile**) of a device as in profiling a monitor, doing an **ICC color profile** of a particular ink-media combination. However before you “profile a device” you first have to **calibrate** that device.

**process colors** are colors whose components are Cyan, Magenta, and Yellow. Black is added to achieve better results. CMYK are used in the inkjet printing process. See also **spot colors**, **Pantone colors** and **primary colors**.

**proof** is a sample on paper or on the monitor (soft proof) of a print job to show what it will look like when printed on the main press. Since it is very expensive to turn on the press for a single sample, a hard proof has traditionally been made by a more economical printing machine. Today proofs are increasingly done with an inkjet printer, usually Epson or Hewlett-Packard, although other brands are also capable. A contract proof is the proof signed by the client as what he/she will accept in the final printed work. Sometimes referred to as a proofprint or a pressmatch.

## Q

## R

**RCS**, otherwise known as reference color space. RCS is a representation of colors in a device-independent color space.

**red**, one of the three additive primary colors, otherwise known as R of the RGB acronym.

**Relative Colorimetric** adjusts all colors relative to the white point of the target gamut. Out of gamut colors are moved to the nearest color which the target gamut can reproduce. The other three rendering intents are **Perpetual**, **Saturation**, and **Absolute Colorimetric**.

**Relative Colorimetric**, one of the four rendering intents. Choosing this rendering intent, adjusts all colors relative to the white point of the target gamut. Out of gamut colors are moved to the nearest color that the target gamut is capable of reproducing, which is a color shift.

**re-linearization**, to measure and compensate for changes in a device caused by usage, temperature, humidity, etc. When an output device has drifted from its base linearization by natural change over time, it is probably the moment to undertake a relinearization (see also, **base linearization** and/or **linearization**)

**rendering intent** are options for transforming (converting) colors of one **gamut** into another more restricted color gamut. Since you can't have all the original colors in the target gamut, something has to be sacrificed. Each of the four different rendering intents sacrifices something different to achieve a desired effect in the new gamut. The four rendering intents are **Relative Colorimetric**, **Absolute Colorimetric**, **Perceptual**, and **Saturation**. These rendering intents are nicely described and pictured in comparative color images by Fraser et al. 2003:88-92.

Perceptual (for photographs)

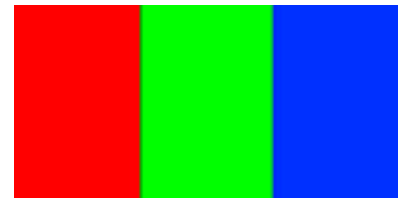
Saturated (for signage, to get saturated colors)

Relative Colorimetric (for specific colors that you need to reproduce exactly such as a logo color)

“**rich black**” is 100% K with varying amounts of Cyan, Magenta, and Yellow.

**Ridgway color nomenclature system.** Ridgway was an ornithologist who worked with color nomenclatures. But already in 1913 there was critique of the capricious manner of naming colors which was common in Ridgway’s day (William Leon Dawson, A Practical System of Color Designation. A Partial Critique of Ridgway’s “Color Standards and Nomenclature”). The Ridgway naming system (and others of that era) are typical of what **Munsell** reacted against to form a more rigidly repeatable standardized color reference system. The Munsell system is still used today, indeed as an archaeologist the Munsell color system is what we use to designate the colors of ancient murals, painted vases, etc. As a humorous footnote, the Ridgway book cost \$8 but registered postage cost 20 cents, so you can estimate that \$8 was a huge sum in that day (1912). His first foray into color nomenclature had been almost three decades earlier (1886), “Nomenclature of Colors for Naturalists.”

**RGB**, stands for **R**ed, **G**reen, and **B**lue color. These are the additive primary colors. RGB images use these three colors to reproduce up to 16.7 million colors on-screen. RGB is the standard color model for output displays such as monitors and projectors. RGB images are three channel images, so they contain 24 (8 x 3) bits per pixel.



*RGB Color. Colors are added via light to make color. Has a much larger color gamut than CMYK*

**rods**, less sensitive light receptors that are located in the retina of the human eye. It is opposite of the cone, which is also located in the retina of the human eye, in that it is not responsive to high light source brightness. See also **cone**.

## S

**satin** finish media surface finish that is reflective, but not highly reflective. Satin media can be thought of as in between glossy media and matte media. See also **glossy**, **luster**, **matte**.

**saturation** The measurement of the intensity of a color. When an image is set to 0% saturation it loses all color information, it becomes grayscale. When an image is set to 100% saturation the colors become the greatest intensity possible; vividness is highly saturated, dullness is less saturated. A lay person’s description of saturation might be how strong the color was. Covering a color with a glossy surface, such as lamination, will increase the perceived saturation. See also **lightness** and **chroma**.

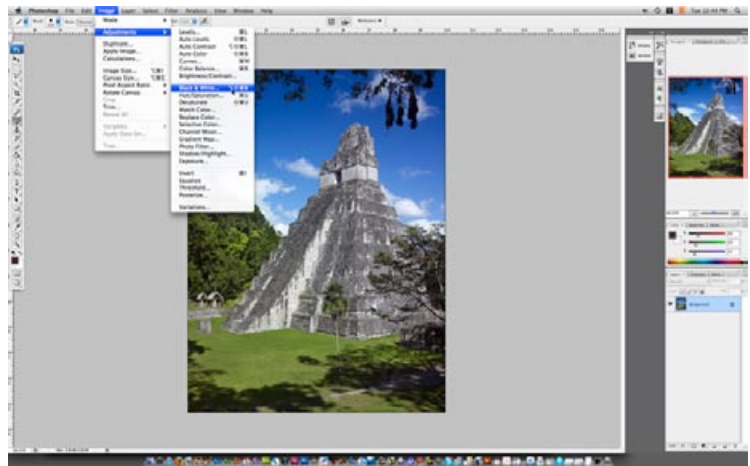
**saturation rendering**, one of the four rendering intents, useful for printing pie charts, bar charts, and other business presentations that need highly saturated colors. This kind of rendering intent will be pretty but not always accurate in individual colors. Other rendering intents are **Absolute Colorimetric**, **Relative Colorimetric**, and **Perceptual**.

**scanner profile**, ICC profile of the scanner in relation to the values of color that it is able to capture. The scanner profile differs from the monitor and printer profiles in that it is considered to be an input profile. See also **monitor profile** and **printer profile**.

**screen capture**, same as screen dump or **screen grab**

**screen grab**, same as **screen capture** or screen dump. To take a photo of the active software dialog boxes on your monitor.

**secondary colors**, the colors formed by combining two **primary colors**. Secondary additive colors are cyan, magenta, and yellow; secondary subtractive colors are red, blue, and green.



*Screen grab sample*

**self-luminous color**, color that is produced via an object that is considered to be self-luminous, meaning that the light that produces colors is directed from within, not reflected from the exterior. See also **luminance color**.

**setting white point**. In your image from a digital camera, you don't want the white point to be R 250, B 250, G 250 since that is pure white with no visible individual color or event **tint**. You want your white point to be capable of showing some detail.

**soft proofing**, the image of the eventual output is seen only on a computer monitor. Soft proofing may also be done in an on-line environment, via a web-based system. Naturally this implies that the monitor has received appropriate calibration. This method of proofing is proving to be very valuable in time restricted and repeat jobs. See also **hard proofing**.

**spectral data** is the chart of each wavelength in a particular color. Spectral data are gathered with an instrument such as a spectrophotometer reading reflected values without reference to a human observer or "lighting changes or rendering intent"

**spectrophotometer** is an instrument that measures diverse characteristics of light that is either reflected from or transmitted through a surface.

A spectrophotometer can calibrate monitors as well as output devices (a printer for example). For some measurements (such as of monitors) you could use either a spectrophotometer or a colorimeter. For linearization you could use a spectrophotometer or a densitometer. But you can't use either a colorimeter or densitometer for measuring some features of the color management workflow that requires a spectrophotometer. So if you intend to add professional color management workflow to your printshop you will need a good spectrophotometer. Be sure to select one that can read both reflective (normal) and transmissive (transparent) materials. Transmissive materials would include acrylic and other substrates used for backlit applications.



*BARBIERI spectrophotometer Spectro LFP at SGIA 2008*



*BARBIERI spectrophotometer Spectro LFP at SGIA 2008*



*BARBIERI spectrophotometer Spectro Swing R at Photokina 2008*



**specular highlight** is the area of pure white with no detail; reflection of light on a glossy surface would be a specular highlight. This is “printed” as pure white paper. The other highlight, which still preserves detail, is either just the **highlight**, or the **diffuse highlight** for those more inclined to technical jargon.

**spot colors** are special colors blended by the ink company that would be difficult to obtain using CMYK in your inkjet printer. It is not also easy to create logo colors with **process colors**. So spot colors are especially pertinent for printing logo colors to help with brand recognition. In rare cases you can obtain spot color inks by special order for your inkjet printer manufacturer. You might also consider fluorescent inks or metallic inks as spot colors, but these are rarely used in inkjet printers

**sRGB** was an attempt by Hewlett-Packard and Microsoft to make color choices easy for the lowest common denominator, namely colors on the Internet. sRGB came to the foreground with Adobe Photoshop version 5. Professionals were aghast that such a low gamut color space was favored. The next version of Adobe Photoshop made it easier to select Adobe RGB or other professional quality. See also **Adobe RGB 1998** and **Colormatch RGB**.

**step wedge**, the series of tones in steps of rising or falling density, in the grayscale charts available commercially or which your color management software prints as a test for **linearization**.

**sublimation**, output method that produces photo realistic color prints

**subtractive color model**, see **subtractive primary color model**.

**subtractive primaries**, cyan, magenta, and yellow are the subtractive primary colors. Cyan subtracts red, magenta subtracts green, and yellow subtracts blue. See also **additive primaries**.

**subtractive primary color model** is used to explain printing inks. With subtractive color the surface absorbs certain wavelengths and reflects others. Your eye receives the reflected wavelengths. Your rods and cones interpret that as a specific color. Cyan, Magenta, and Yellow are the subtractive primary colors. Red, Blue, Green are the **additive** colors. All books on color theory picture and explain all this fully.

**swatch** (for color management) is what I call a **target**.

**swatch book**, a book of samples, often of materials; often shows different versions of one material (such as different colors, or colors on coated and also on uncoated media).

## T

**tag**, the ICC color profile consists of numerical information that tags the designated system.

**tagged** means that the embedded profile is put into the file so that it interacts with the file whenever necessary.



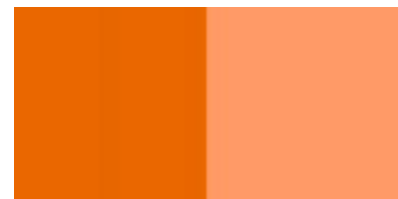
**target**, in color management jargon this is the printed file with all the squares of colors (the “patches”). You will first print the target file with your printer; then cut it out and stick it into the **spectrophotometer** to be read. A synonym for target in this sense would be **swatch**. There are also standard reference targets which you buy already printed, such as the **IT8 Reflective 5x7 target**.

**TIFF** is short for Tagged Image File Format for digital images, abbreviated .tif. If you are doing professional digital photography, you should save your working images in .tif format instead of .jpg.

**tint**, a color that has been reduced in its opacity.

**tonal gradation** Adjustment of the red, green and blue channels. Print Publishing (p. 461)

**tonal range**, the difference between the lightest light and the darkest dark, otherwise known as the highlights and shadows of an image.



*Example of a orange tint.*

**tone curves**, see **gamma curves**.

**total ink coverage** of CMYK would be 400%. But that means so much ink is jetted onto the paper that it takes a long time to dry. Plus you are wasting ink. So you need to set the % of each ink so that the total is not excessive.

**transform** is a color transformation to change a color from the color of one device to color available on another device. Uses a source profile through the transform to compare with a destination profile. A transform is sort of like a translation from one language to another language.

**transmissive reading**, for taking readings of such as backlit film. X-Rite had a model T for this, DTP41/T. But if you have a lot of backlit or other transparent materials to profile, you might consider one of the BARBIERI spectrophotometers.

**tristimulus data** would include RGB and CMY. These are dependent on viewing conditions and other factors, as opposed to **spectral data** which is a measured reading with a color tool such as a **spectrophotometer**.

**true color**, otherwise known as 24-bit color.

## U

**UCR**, Under Cover Removal, obviously removes something, in this case removes some of the CMY and replaces them with K (black). This results in lower printing costs since colored ink costs more than black ink (on traditional offset presses at least). The removal of the colors is

especially for unsaturated areas which are supposed to be neutral anyway. Removal of colors also keeps the inkjet paper from swelling up due to excess water (from all the ink). Inkjet media has limits on how much water(ink) it can handle. UCR is explained and pictured in all good books and descriptions of conventional printing and color management, such as by Bohnen and O'Leary p. 19-24). See also **GCR**, Gray Component Replacement which adds black ink everywhere, not just in shadow areas.

**UV** filter, such as in for handling papers with artificial brighteners (which fluoresce).

## V

**value**, the numerical sequence given to a color or density range for interpretation.

**verbal color designation**, such as red, orange, brown. There is no internationally accepted system of culturally valid color designations though black, white, and red would be the closest. For example, the Mayan languages tend to bunch blue and green together as *yax*. As a result the National Bureau of Standards and the ISCC (Inter-Society Color Council worked on a solution. Their suggested verbal color designations are presented in a book by Kelly and Judd (1955). I recommend this book for anyone that needs to designate or describe color with words understandable to more intelligent mortals. Obviously the Munsell system, Lab, and all the others have their validity also.

**viewing booth**, a booth with special lighting of a known standard, in the United States 5000° K. A viewing booth usually sits on a table, but larger ones may be freestanding. Just Normlicht is one of several companies that market viewing booths.

**visual spectrum**, the part of the spectrum that is visible to the human eye. The colors of the visible spectrum include red, orange, yellow, green, blue, indigo, and violet.

## W

**warm color**, a color that has a hue related to red colors on the **color wheel**. The opposite of a warm color is a cool color. See also **cool color**.

**Web safe colors** are all in RGB since computer monitors work with light, so the colors produced by your monitor are **additive** primaries, Red, Green, and Blue.

The Web safe color palette contains a maximum of 256 colors. The number is limited due to old viewing capabilities of monitors and since has not changed.

**white** is the result of mixing 100% Red, 100% Blue, and 100% Green, the three **additive primaries**. see also **black**.

**white point** (for photographers), is the area of the photograph where you still want to see detail in the brightest whites. The white point will tend to be in the **highlights**. Most good software nowadays will find the white point for you, and allow you to see it on the monitor. You may need to do **white point adjustment** (Green p. 132), synonymous with **setting white point**, usually via a **histogram** See also **black point**.

**white point** (for color management), setting the white point during monitor calibration. The idea is to have the white point of your monitor at your preferred setting, 5000 degrees Kelvin for North American traditional preference, or 6500 K for European standards.

**workflow** means what steps you go through from beginning to end of any process. In wide-format inkjet printing a basic workflow would be input through output and then finishing. Input means digital capture (digital camera or scanning), through working the file in Adobe Photoshop and other imaging software; feeding the image through RIP software, printing, cutting, and top coating or lamination if that is part of your process. A strictly color management workflow means starting with gray balance (during input), profiling the monitor, linearization through the RIP software and then handling the color tools and their ICC profiling software. Proofing in a **viewing booth** would be another step in the color management workflow.



*Color Management Workflow*

**working space**, literally, the space in which you work your image. Working usually means editing which implies improving the image in Adobe Photoshop. RGB and CMYK may be considered working spaces. A working space should be a device independent color space [www.rgbnet.co.uk](http://www.rgbnet.co.uk) Grayscale and Spot are the other working spaces besides RGB and CMYK. Working space for Internet pages and low-level electronic publications tends to mean sRGB. But for professional photography and significant printing jobs, it's best to use **Adobe RGB**.

**WYSIWYG**, the acronym used for the phrase “what you see is what you get,” which is the bases of color management. The problem is that what you see on the monitor is not always what you get on the print.

## X

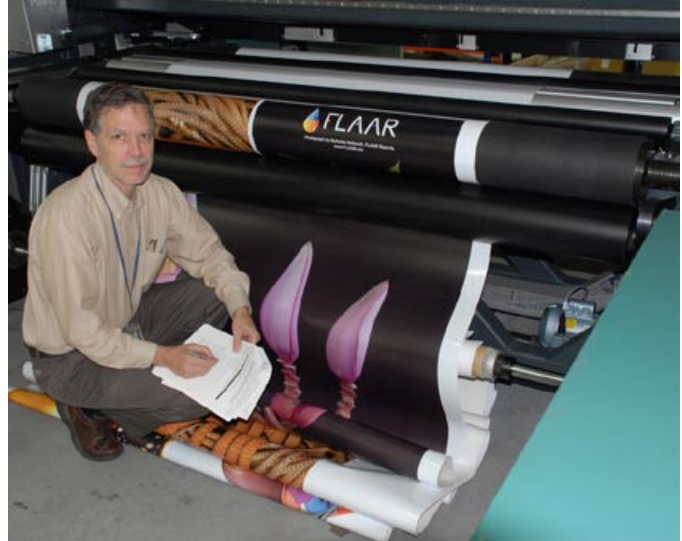
**X-Rite** is a manufacturer of entry-level color management hardware. X-Rite bought first Monaco color management software and then X-Rite bought GretagMacbeth and then Pantone. Currently BARBIERI electronic is one of the few remaining independent color management companies that develop and manufacturer spectrophotometers for inkjet printing output. It is essential in any field of endeavor to have competition, and not a monopoly. Competition encourages innovation and keeps prices fair to the end-user.

## Y

**YCC** color space, used in the ill-fated Kodak Photo CD system. My least favorite color system because it is based on interpolation after Kodak has stripped away much of the color information.

Avoid Kodak Photo CD images whenever possible. I call it the “yuck” color space. Kodak has fared poorly with most digital imaging technologies except for making CCD sensors. However their main competitor there, Dalsa, also makes excellent CCD sensors.

**yellow**, one of the three subtractive primary colors. In inkjet printing you get light Cyan and light Magenta and sometimes light black, but you rarely get light Yellow. That is because a light tone of yellow is no appreciable help; yellow is already relatively light. So trying to offer a printer with light Yellow ink simply takes up an entire ink channel without producing much benefit. NUR, and thus now HP Scitex, is one of the few printers that consistently offers light Yellow. So far no one has been able to conjure up a significant benefit of this extra ink channel and the printheads that it occupies.



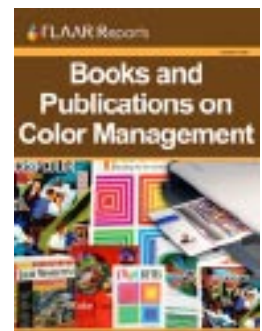
*Dr. Nicholas Hellmuth inspecting NUR Tempo print samples*

## Z

### Resources on Color Management

FLAAR has a complete (separate) book review report specifically on books which cover color management. That set of book reviews is part of the FLAAR Reports.

Adobe  
Apple  
Digital Light & Color  
HutchColor LLC



### Other Glossaries

<http://apsprinting.com/glossary.html>

Not a single PDF but html; so you have to click on each letter of the alphabet.

### Articles on Color Management

FLAAR has a complete (separate) book review report specifically on books which cover color management. That set of book reviews is part of the FLAAR Reports.

**Bourgoin, Michael**

Introduction to Color Management Systems.

**Eads, A.**

2002. Why it's time to make time for color management. The Big Picture magazine, Jan/Feb 2002, pp. 48-57.

**Howard, C.E.**

2002. Profiling color management progress. Electronic Publishing, Feb. 2002, pp. 29-31.

**Griffin, Jay**

2002. Color Management and Software Issues for Successful Digital Textile Printing. 6<sup>th</sup> Annual Digital Printing of Textiles Conference, IMI, Oct 2002, Palm Springs, California.

**ICC**

2001. ICC Color Management. International Color Consortium, PowerPoint presentation.

**O'Quinn, D.**

2000. Print publishing: A Hayden shop manual. Indianapolis, Hayden Publishing.

**Powers-Jones, S.**

2002. Color Management 101. Digital Output, March 2002, pp. 24-27.

The Digital Graphics, The Big Picture Magazine and Digital Output are the three main trade magazines for wide format inkjet printing. They have something on color management at least once a year. Even when they are infomercials, at least you can see what is available. In Germany the leading trade magazine is SIP.

There is not really a magazine specifically on scanning or scanners. Magazines on digital photography sometimes have articles on color management. Try Digital Capture magazine.

A good book on color management is, "Real World Color Management," Peachpit Press (all their books are great). Authors are Bruce Fraser, Chris Murphy, and Fred Bunting. Buy this book immediately. Just be sure you set aside a rainy weekend to actually read it, and then additional time to practice with the tools and software.

**Other sources of glossaries specifically on color management:****Adams, Richard M, II and Joshua B. WEISBERG**

1998. The GATF Practical Guide to Color Management. GATFPRESS, Pittsburgh.

**Field, Gary G.**

1999. Color and its Reproduction. GATFPRESS, Pittsburgh.



**Fraser, Bruce, Murphy, Chris, and Fred Bunting**

2003. Real World Color Management. Peachpit Press, Berkeley.

An excellent book which describes everything. Nice long descriptions, with plenty of illustrations and examples. Some chapters are veritable glossaries in themselves. However this is not a practical guide for the lost soul who just needs to know how to do linearization and custom profiles to get his/her colors right in the final inkjet print. 533 pages are simply too much for the average mortal. I have considerable interest in learning color management, but I fell by the wayside after about 350 pages. Not that the book is bad, but that it explains too much detail about everything under the sun related to color management. In the process it neglects to walk the lost soul through what they have to do out in the print shop, starting at a print with an angry artist demanding to know why their inspirational colors in the original oil painting did not reproduce in the inkjet (giclee) print.

**Johnson, H.**

2003. Mastering digital printing. Muska & Lipman, Cincinnati.

**Kelly, Kenneth L., and Deane B. Judd**

1955. The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names. National Bureau of Standards Circular 553, U.S. Dept. of Commerce, Washington, D.C.

**Kornerup, A., and J.H. Wanscher,**

1967. *Methuen Handbook of Colour*. Second edition. Methuen Co., London. 243 pp and 30 two-page color plates.

**Ridgway, Robert,**

1912. *Color Standards and Color Nomenclature*. Washington, D.C., published by the author. 43 pp and 53 color pls.

**Other Crucial Sources**

*Operating Manual*, SpectroSwing, Automatic Reflection/Transmission Spectrophotometer, Edition 11/08.

*Operating Manual*, Spectro LFP RT, Automatic Reflection/Transmission Spectrophotometer, Edition 05/08.

*Operating Manual*, Profile-Xpert Gateway, BARBIERI Spectrophotometer Measuring Software Version 2.42 for Microsoft Windows, Edition 04/08.

*MonacoProfiler User Guide*, April 2002 (this happens to be the version we have in stock, if a more recent version becomes available, we will update).

### Significant Resources with Multiple White Papers

[www.color.org/whitepapers.xalter](http://www.color.org/whitepapers.xalter)

[www.colormangement.com/technical\\_resources/articles\\_and\\_white\\_papers/introductory\\_articles\\_and\\_presentations](http://www.colormangement.com/technical_resources/articles_and_white_papers/introductory_articles_and_presentations) (unfortunately most date to 2005; nothing recent).

### Sources and Resources on the Internet

These were some of the web sites that I used in 2003 and for other early editions of this glossary. But now I have updated this glossary to 2009.

<http://www.barbierielectronic.com/>

[www.color.org](http://www.color.org)

Web site of the International Color Consortium, ICC, Filled with potential information.

[www.colorcube.com/articles/theory/glossary.htm](http://www.colorcube.com/articles/theory/glossary.htm)

Great information on color terms such as hue and chromaticity, albeit short, the illustrations (in color) make it fully understandable. Be sure to visit their other links, such as “Color Models” to find a “Color Model Museum.” Great site, wish it kept going on and on.

[www.colorremedies.com/articles.html](http://www.colorremedies.com/articles.html)

Has articles on

- Managing Color in Photoshop 6
- Top 10 Color Management Pros/Cons
- The Intro Series (to ColorSync and ICC-based color management)

[www.colorsavvy.com/](http://www.colorsavvy.com/)

Commercial web site for their products; has one page of helpful information, a definite must read)

[www.colorsavvy.com/Products/Learn/Calibration.htm](http://www.colorsavvy.com/Products/Learn/Calibration.htm)

“Overview of Calibration”.

[www.computer-darkroom.com/](http://www.computer-darkroom.com/)

Ian Lyons on scanning, Photoshop, color management, and more).

[www.creativepro.com/story/feature/11132.html?origin=story](http://www.creativepro.com/story/feature/11132.html?origin=story)

Fraser.

[www.creativepro.com/story/feature/14331.html](http://www.creativepro.com/story/feature/14331.html)

Part of an excellent article by Bruce Fraser on color management from monitor onwards)

[www.dcs.napier.ac.uk/~mm/COL\\_G/CG\\_HTML/05/0501.HTM](http://www.dcs.napier.ac.uk/~mm/COL_G/CG_HTML/05/0501.HTM)

<http://desktoppub.about.com/cs/colorcalibration/>

Lists about ten sources on ICC color profiles, color management, for desktop publishing; I would bet that many of these links go to sites and pages filled with useful information on color management.)

<http://desktoppub.about.com/cs/iccprofiles/>

Links for tons of stuff on ICC color profiles)

[www.lexjet.com/lexjet/color\\_mgt\\_tools.asp](http://www.lexjet.com/lexjet/color_mgt_tools.asp)

Helpful info from a helpful wide format inkjet media company)

[www.lexjet.com/lexjet/photoshop\\_6.asp](http://www.lexjet.com/lexjet/photoshop_6.asp)

This page lists all the articles within the LexJet site on color management and related topics including resolution.

[www.matrixcolor.com/color/links.htm](http://www.matrixcolor.com/color/links.htm)

Links to color management.

[www.picto.com](http://www.picto.com)

A commercial site for Pictographics.

[www.pmel.org/Color-Glossary.htm](http://www.pmel.org/Color-Glossary.htm)

"Color Glossary." No illustrations.

[www.poynton.com/PDFs/Sun\\_Color\\_Mgmt.pdf](http://www.poynton.com/PDFs/Sun_Color_Mgmt.pdf)

Has some helpful definitions.

[www.sapdesignguild.org/resources/glossary\\_color/index1.html](http://www.sapdesignguild.org/resources/glossary_color/index1.html)

This nice glossary has color illustrations, which help the beginner and intermediate reader.

[www.tasi.ac.uk/advice/creating/targets.html](http://www.tasi.ac.uk/advice/creating/targets.html)

Color and resolution targets; lens resolution, not pixel resolution.

<http://tigger.uic.edu/~hilbert/Glossary.html>

"A Glossary of Color Science," by Alex Byrne and David Hilbert, from "Readings on Color, Vol. 2: The Science of Color," MIT Press, 1997.

First issued June 2003, updated October 2003, May 2004, January 2007, October 2008.  
November 2008

**Most recently updated May 2009 for FESPA**

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*These photographs explain why FLAAR is interested in color management. Our research projects on cacao work on understanding the different species, which species are indigenous to Guatemala (Central America) and which are introduced from South America. For our zoology projects, there are several species of iguana; these are babies and are obviously a green species, but zoologists appreciate seeing accurate colors. The iguana is pictured in 7th century Maya art. Hence we appreciate the patient training of our staff by companies that make color management hardware, software, or who provide assistance in learning about ICC color profiling workflow. BARBIERI electronic is providing support to our current initiative in providing information on color management to our readers.*

*For archaeological photography the color of an artifact is important to reproduce for museum exhibit signage (Photography by FLAAR Mesoamerica courtesy of Fundation La Ruta Maya).*

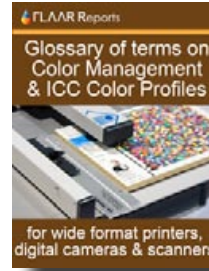
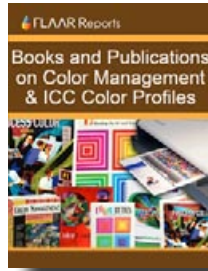
To obtain information about color management hardware and software for North America (especially USA), about the advantages of BARBIERI electronic, contact.

Don Bobenhouse  
 e-mail: [dbobenhouse@smartstuffinc.com](mailto:dbobenhouse@smartstuffinc.com)  
 Office phone: 636-532-6131

SmartStuff is the master distributor for BARBIERI electronic in the USA. In the past SmartStuff was master distributor for Kodak CreoScitex scanners (the best flatbed scanner in the world).

FLAAR has visited the offices of SmartStuff (they are near the office FLAAR in St Louis, Missouri). We know the company and the manager, Don Bobenhouse.





These reports on RIP software and Color Management for serious UV printers are free downloads on all FLAAR web sites (follow the link to 'free downloads') [http://www.wide-format-printers.net/reviews\\_reports\\_evaluations/free\\_download.php](http://www.wide-format-printers.net/reviews_reports_evaluations/free_download.php)

## RIP, COLOR MANAGEMENT, and ICC Color Profiles options

Once you have a serious UV-curable wide-format printer, you may prefer to have an equally serious RIP software and color management equipment.

The RIP software for simple water-based printers such as Canon, Epson, and HP may not be the same RIP software that could be most effective and productive on a UV-curable flat-bed or UV-cured roll-to-roll production printer.

I first noticed Caldera RIP on Gandinnovations UV printers several years ago, then I saw Caldera being used at the Mutoh Europe factory demo room in Belgium.

When I was visiting the Durst factories in Europe I again noticed that they were using Caldera RIP software.

So I requested access from Caldera so I could visit their world headquarters in Strasbourg, France, to spend several days learning more about their RIP. As a result there is now a FLAAR Report photo essay on this software.

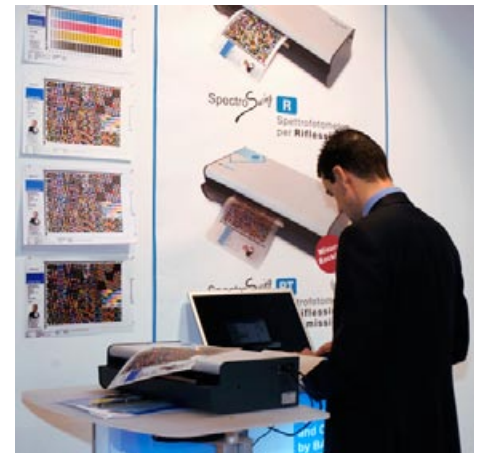
Most recently I have seen Caldera RIP at the Shanghai printer trade show in China, at DRUPA in Germany, at FESPA Digital in Geneva, SGIA '08 and Viscom Italy '08.

When I visited a large printshop in Maribor, northern Slovenia, they were using Caldera RIP and the manager of technical services for this company said, "Caldera does a good job." This company in Slovenia has about eight UV printers (about five of them from Durst) and an equal number of large solvent printers. They originally used a GretagMacbeth color man-

agement system but switched to BARBIERI because the BARBIERI spectrophotometer can read more efficiently and can handle textiles, backlit, wood and other materials that are either awkward or difficult on other brands of color management instruments. You can learn about the BARBIERI equipment either from their headquarters in Brixen or their distributors worldwide.



Caldera also offers a highly regarded spectrophotometer from Barbieri, the leading color management company in Italy (they are headquartered in the same city as Durst, the manufacturer of Rho UV-cured printers).



For further information on Caldera contact Joseph MERGUI [mergui@caldera.fr](mailto:mergui@caldera.fr)  
**If you have questions about color management**, if you are in the US you can contact: ImageTech at: [www.ImageTechDigital.com](http://www.ImageTechDigital.com)  
 Mark Spandorf (owner and president), [mark@imagedigital.com](mailto:mark@imagedigital.com) or 510 238-8905.  
 If you are in Europe or the rest of the world you can contact **BARBIERI** directly at: BARBIERI electronic snc, [info@BARBIERIElectronic.com](mailto:info@BARBIERIElectronic.com)  
[www.BARBIERIElectronic.com](http://www.BARBIERIElectronic.com)  
 Tel.: +39 0472 834 024  
 Fax: +39 0472 833 845





**As soon as you have your UV-flatbed printer, your printshop will desire to have a cutter or trimmer.**

First you need to trim. Simple cutting of the edges of your board so the edges are neat and clean. Then of course some clients will ask if you can do contour-cutting. This means you can offer additional services and earn additional income.

The best way to learn about trimmers is to ask a distributor who has more than one brand. This way they do not push their house brand and denigrate brands that they do not carry. Also, you want a real person that actually has experience. Otherwise you get a "box pusher" who is simply an Internet sales person, who does not know trimmer from dimmer.

The person we suggest is **Mike Lind** because his company, **Reprographic Designs**, handles all leading brands: KeenCut, Neolt, Meteor Metoschnitt, RotaTrim, etc. You can contact him at 1 281 492 2714 or [malind@msn.com](mailto:malind@msn.com).

His company is also the Master Distributor for Cruse reprographic scanners in the US and adjacent countries.



**XY Cutter Options**

In a period of economic recession printshops will tend to ask about options that are priced lower than high-end prices. Thus we suggest a possible solution at mid-range price: Gerber M class cutters. I have inspected two huge factory complexes of Gerber Scientific in 2008 (especially their cutters for fabrics) and will be visiting their facilities again in 2009.

**To contact Gerber:**

Phone (US): 800-222-7446, email: [cservice@gspinc.com](mailto:cservice@gspinc.com)  
 Fax: 800-227-6228 or 860-648-8064  
 Phone (Intl): 860-648-8028, email: [gspinternational@gspinc.com](mailto:gspinternational@gspinc.com)

*We have seen Gerber cutters at work during major trade shows, both in Europe and in the US. Gerber has dealers all across the US and Canada, and in Europe is served by Spandex.*

When you acquire a UV-curable wide-format printer you will eventually learn that an XY flatbed cutter is a useful accessory for thick rigid materials. The advantage of having an XY cutter is that you are selling not just the print, but a finished work. To stay ahead of the competing printshops in your city it helps to offer your clients a solution for every step of the printing workflow.



*Dr. Hellmuth shows a sample processed by the Gerber M Series cutter exhibited at GraphExpo '08.*



*Gerber M Series cutter at ISA '08.*

## 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 shrink from entering areas where we are obviously not yet expert. If in your years of wide format printing experience have encountered results different than ours, please let us know at [ReaderService@FLAAR.org](mailto: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

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In some instances a license would be available to distribute outside your company, including in other languages.

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](http://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](mailto: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](http://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](http://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](http://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



Heilmuth, year, [www.FLAAR.org](http://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](http://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 work-around. 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 may 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 uni-directional, 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 lifted 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 do 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 your 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 boom 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 and 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 Lüscher 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 counterfeit.

#### **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 incapacibilities 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, Barbleri electronic, Seiko II, Mutoh Europe, IP&I, Dill, Yuhon-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](http://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](http://www.FineArtGicleePrinters.org) sites.

Barbleri electronic (color management), Caldera (RIP), ColorSpan, DEC, Durst, EskoArtwork, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Dill, GCC, NUR, Océ, Shiraz (RIP), Sky AirShip, Sun, Teckwin, VUTEk, WP Digital, Xerox, Yuhon-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 Technologies, 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, ScanvecAmlable, 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, Softex, CreoSoft (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 Hewlett-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 improve-

ment 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 primary 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



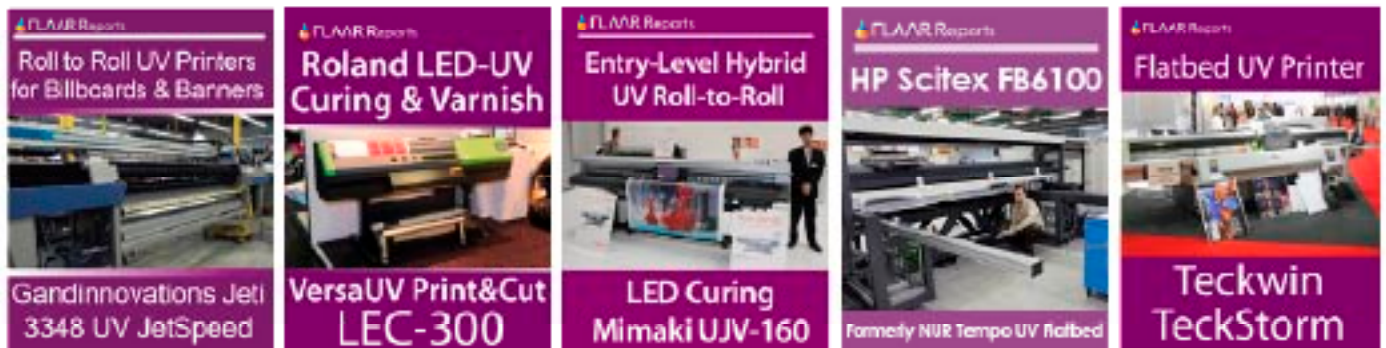
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Comments on UV Inkjet Printers at Major Trade Shows 2007-2009

<p><b>Trends</b> in UV Flatbed Printers documented at <b>DRUPA 2008</b></p>	<p><b>UV Printers</b> <b>Trends 2008</b> <b>SGIA '08</b> <b>PART I</b></p>	<p><b>Flatbed &amp; Roll-to-Roll</b> <b>UV Printers</b> <b>SGIA '08</b> <b>Part II</b></p>	<p><b>Chinese-Made</b> <b>UV Flatbed Printers</b> <b>Shanghai '08</b> <b>Trade Show</b></p>	<p><b>UV Printer</b> <b>TRENDS</b> <b>VISCOM ITALY '08</b></p>
<p><b>Trends</b> in UV printers at <b>VISCOM</b> <b>Germany 08</b></p>	<p><b>TRENDS, Part II:</b> <i>Markets &amp; Technologies</i> <b>UV-cured printers at</b> <b>ISA 2009</b></p>	<p><b>TRENDS, Part I:</b> <i>Analysis One by One</i> <i>of the UV-cured printers</i> <b>ISA '09</b></p>	<p><b>UV Market</b> <b>TRENDS</b> <b>Observable at</b> <b>FESPA Digital</b> <b>Europe 2009</b></p>	<p><b>TRENDS</b> in 2009 <b>Analysis One by One of</b> <b>the UV-cured printers at</b> <b>FESPA Digital Europe</b></p>
<p><b>TRENDS</b> of UV-Cured Wide-Format Printers <b>Shanghai '09</b></p>	<p><b>UVCOMBO</b> <b>FLATBEDS</b> <b>Shanghai 2009</b></p>	<p><b>TRENDS IN HYBRID</b> <b>STRUCTURE UV PRINTERS</b> <b>Shanghai 2009</b></p>	<p><b>UV Roll-to-roll</b> <b>Observable at</b> <b>Shanghai 2009</b></p>	<p><b>UV Flatbed</b> <b>Printers</b> <b>at APPPEXPO,</b> <b>Shanghai '09</b></p>

UV Printers Manufactured in China, Korea and Taiwan

<p><b>Chinese UV</b> <b>Inkjet Printers</b> <b>2009</b> <b>Comprehensive</b> <b>FLAAR Inventory</b></p>	<p><b>Chinese UV</b> <b>Inkjet Printers 2008</b> <b>Comprehensive (Complete)</b> <b>FLAAR Inventory</b></p>	<p><b>UV Printers</b> <b>Manufactured in</b> <b>Korea 2009</b> <b>Trends, Markets</b> <b>&amp; Applications</b></p>	<p><b>UV Printers</b> <b>Manufactured in</b> <b>KOREA 2008</b></p>	<p><b>List of UV Printers</b> <b>Manufactured in</b> <b>Taiwan 2009</b></p>
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