

Black and White Printing with
Epson-Noritsu Advanced-Dye-Based Inksets
Epson 1400 Eboni-4 + Noritsu-Epson

www.PaulRoark.com

10-2011 (update 2-2012)

This PDF outlines information relating to using the Noritsu-Epson inks for B&W printing. In addition to general information, the use of these inks in the Epson 1400 in conjunction with the Eboni-6 inks is covered in detail.

A. Noritsu D700 Inks & B&W Printing Options

1. In General

The Noritsu D700 series inks are made by Epson¹ and are sold in large, 500 ml Epson-Noritsu cartridges that are accessed with a bottom-fill adapter just like all the other Epson carts.² The Noritsu D700 printers are used by the “dry lab” printing industry. The Epson-Noritsu dyes are being widely distributed – even through eBay.³ See Appendix A, below, for a partial list of suppliers.

The Claria and Epson-Noritsu D700 black inks appear to be the same inks. I have used them interchangeably and in mixes of the two inksets for months now with no evidence that there are any differences.⁴

¹ See http://global.epson.com/newsroom/2008/news_20080421.html with regard to the Epson-Noritsu connection. "TOKYO, Japan, April 21, 2008 – Noritsu Koki Co., Ltd. ("Noritsu") and Seiko Epson Corporation ("Epson") have reached a basic agreement to establish a broad business alliance designed to further consolidate and develop their printing equipment businesses. ... (2) Roles in the alliance: [1] "Dry" minilabs and industrial printers [2] Noritsu will be primarily responsible for product design and production. [3] Epson will be primarily responsible for developing inkjet device technology, software, and inks.

See also http://en.wikipedia.org/wiki/Photographic_developer -- In March 2006, Noritsu and Fuji announced a strategic alliance. Noritsu now manufactures all of Fuji's photofinishing hardware. (I personally suspect that Fujifilm sells the same inks to its dry labs [tests look very similar and other evidence exists] and also makes the Epson inks. It's one large "alliance.")

² The modified bottom fill adapter works on the Epson-Noritsu carts just like on the Epson inkjet carts. See <http://www.paulroark.com/BW-Info/Modified-Bottom-Fill-Adapter.pdf>

³ The prices appear to be set at \$187 for new Noritsu 500 ml carts, regardless of reseller. (See appendix A for a list of some suppliers.) Epson 1400 Claria carts are about \$16 discounted at www.Atlax.com. Thus the Noritsu ink is probably about 1/3 the cost on a per-ml basis, but I'm not sure what the 1400 Claria cart capacity is.

⁴ See <http://www.paulroark.com/BW-Info/Noritsu-Claria-BO-Lab.jpg> for a comparison of the Lab A and B of the black inks from the two inksets. Note that the Noritsu dry-lab system does not use the dilute LM and LC inks. I have diluted the Noritsu M to make an LM, and there is a very minor difference between it and the Claria LM in terms of its Lab B.

These inksets are composed of advanced – on the molecular level – dyes.⁵ Appendix B, below, is a reproduction of an Epson description of the advanced molecule. Epson Claria inks have been tested and are more lightfast than some third party color pigments⁶ – good enough for most uses. For example, Wilhelm Research rates the inks on Epson Premium Glossy paper as having a display life under glass of 98 years, with dark storage in excess of 200 years.⁷

For the most archival fine art, I intend to stay with 100% MIS Eboni carbon on matte paper; 100% carbon pigments make the most stable B&W digital inkjet prints by far.⁸ However, for high impact, glossy cards, brochures or other output, the advanced dye materials can make outstanding prints – the best for high gloss output. Dyes do not suffer from the surface artifacts – bronzing and gloss differential – of pigment inks on glossy paper. The only visual negative to the Noritsu dyes in comparison with the best pigments is that the dyes do have some metamerism under fluorescent lights. The amount is far less than older style dyes or the dyes I’ve seen in even the newer HP dye prints. I do not consider it a significant problem.

While matte paper is not my main target with this inkset, I’m finding that some papers benefit markedly from the cooling effects of addition some Noritsu inks to an Eboni image. The matte paper’s dmax can also be optimized with this advanced black dye.

The Noritsu 500 ml carts cost \$187. While this is less than the Epson or HP inks in the usual wide format carts I buy, and much less than inks purchased in small carts, it probably is a barrier to the use of these inks for some users. For comparison, a pint (473 ml) of inks from MIS usually costs about \$50.

Note that the mix I recommend uses some magenta to tone the lighter, dilute inks. To avoid the cost of buying an entire \$187 Noritsu magenta cart, an Epson 1400 Claria magenta cartridge will suffice as a source for this ink. One could also, of course, just use the black ink from a Claria 1400 cartridge to at least test the approach. However, for one who is going to do significant printing it’s much less expensive to purchase the Noritsu black ink cartridge.

There are a number of possible B&W workflows that can be used to print with these inks. QTR with the OEM (standard) color Claria inkset is at one end of the spectrum, but for the best images, some ink mixing or diluting is necessary. I will outline several mixing formulas further below. With MIS Associates/Inksupply.com now premixing and selling the clear base, diluting the black ink is now very easy.

⁵ “The ink used in the D703 has an improved molecular structure so it is able to withstand light and ozone, thus producing prints that boast excellent image permanence. *Inkjet technology was provided by Seiko Epson Corporation.” See http://www.desktopdarkroom.com/noritsu_d703.html. “With Claria photographic ink, the dye molecules contain more atoms, tightly bonded together – so the molecules can better resist the effects of light and ozone. To make the molecules even stronger, they are protected by atomic shields and aggregated into dense clusters.” See http://www.ink.epson.com.au/pdf/Claria_photographic_Ink_overview_1_0.pdf at page 4.

⁶ See <http://www.aardenburg-imaging.com/documents.html> at Aal&A_Summary_2009

⁷ See <http://www.wilhelm-research.com/epson/RX595.html>

⁸ See <http://www.paulroark.com/BW-Info/>

2. The Black Only Printing Option – Using QuadToneRip

Using the 1400 with standard OEM inks and a black only (BO) setup can, of course, print reasonable B&W on the 1400. The Epson driver does not support BO printing. So, QTR is needed.⁹ In the past I've made a number of QTR profiles that allow this on the 1400 and other Claria printers. Some printers may be better than others at doing a good job with black only. I found BO printing, particularly if toned with the LM ink to neutralize the negative Lab A, to be OK for my high contrast, small images on brochures. However, when making large prints with my 1400 I have found unevenness in some areas with BO printing. Additionally, in plain skies BO printing can be a bit rough.¹⁰

For a full tutorial on printing B&W with standard Claria inks in the Epson 1400, see <http://www.paulroark.com/BW-Info/1400-Claria-BW.pdf>.

3. A Variable-Tone Inkset Option

The Noritsu black ink by itself prints with a low Lab A – that is, greenish. The extent of this problem varies among papers. So, the variable-tone inkset approach was to allow profiling to offset this negative Lab A. This also allowed me to see what monotone mix would best handle the bulk of the papers that were best suited to the dye approach.

Matte papers print with the strongest green tones, with Hahnemuhle Photo Rag being among the greenest. It needs a full 26% magenta, 74% black mix to neutralize the negative Lab A. This is too bad, because HPR is capable of achieving a dmax of just over 2.0 with this inkset – the highest matte dmax I've ever measured.

Another paper that achieves a very high dmax (1.8+), and better tone, is Red River's Premium Matte Plus.¹¹ Its deep blacks, good tone, and very good price make it the matte paper I use the most with the dyes.

While most matte papers have weak blacks with these dyes, the real target of the Noritsu-Epson dyes is glossy paper. As such, for monotone inkset options, 13% magenta to 87% black is the mix I use. If I do want a matte print from this inkset, the Red River Premium Matte paper noted above prints very well with a 13% blend.

I have successfully tested a Noritsu variable-tone inkset on the Epson Photo R220. This old but excellent hextone dye printer has been a reliable test bed for the development of B&W inksets for most of the 3 picoliter Epson printers, including the K2 and K3 series. In short, these results will probably scale easily. See <http://www.paulroark.com/BW-Info/N-BW-VT-1-220.pdf> for more information on this variable tone option.

⁹ See <http://www.quadtonerip.com/html/QTRoverview.html>

¹⁰ Note that it is possible to switch between a standard color 1400 setup and one that mimics the Epson K3 approach by swapping out 2 inks when very good B&W is needed. In a B&W printing mode, the Claria C and LC are replaced by diluted K (similar to LK and LLK) inks. QTR is needed to print this setup. I do not intend to further develop this approach at the present time.

¹¹ See http://www.redrivercatalog.com/browse/60lb_premium_matte_plus.html

Taking the success of this variable tone approach to the Epson 4000 wide format printer is my next effort. I will report my findings and workflow notes at <http://www.paulroark.com/BW-Info/4000-Noritsu-BW-Variable-Tone.pdf> .

4. “EZ” Setup with WorkForce Printers

I am having good success with the WorkForce 30 and an “EZ” type setup similar to what has been used with the C88 line for years. See <http://www.paulroark.com/BW-Info/WF30-BW-Dye.pdf> for a full write up of this setup.

The WF 1100’s 13” paper capabilities and sale price of \$130 make it a printer that should be of interest to those who want 13” paper and the easiest, least expensive setup. The native Claria printers are probably technically better for these inks, but the high speed text printing of the WorkForce line, the low price, and the ease of operating and maintaining an “EZ” ink setup might have significant appeal to many. See <http://www.paulroark.com/BW-Info/1100-Dye.pdf> for a full write up of this approach.

5. The Eboni-4 Plus Noritsu 2K Combination

The Epson Stylus Photo 1400 is a native Claria, 1.5 picoliter printer that is a favorite of many photographers, including myself. It is my standard printer for Eboni-6 (“Eb6”) inks and matte print width sizes 13” or below.

Because I prefer glossy gallery brochures to the matte paper versions, I have often had this printer filled with a combination of Eb6 and a glossy, cool ink that can print these brochures. I call this approach the “Eboni-4 Plus” (“Eb4+”) variation.¹² In the Eb4+ variation, MIS UT14 C and LC can be used for glossy printing or for toning matte prints for cooler tone than 100% carbon can reach. In the past I’ve also used HP PK plus a diluted HP PK for these purposes, and that combination is no doubt the most lightfast. However, the job of glossy printing is now going to the Noritsu inks. The combination of Eboni and Noritsu inks allows outstanding matte 100% carbon fine art prints as well as excellent glossy prints.

Below I provide the ink setup for Eboni-4 Plus when the Noritsu-based inks are used in the C and LC positions. With the Eb4+ setup if I want 100% carbon matte prints I use QTR. If one wants to use the Epson driver and achieve a 100% carbon pigment print, simply plug the Eb6 C and LC carts back into the printer. Then the Epson driver and ICCs are available.

¹² See <http://www.paulroark.com/BW-Info/Eboni-4-Plus.pdf>

Eboni-4 Plus Noritsu Ink Setup

K = Eboni

C = Noritsu K¹³ (or Claria K)

LC = 30% (87% Noritsu K + 13% Noritsu [or Claria] M blend) + 70% Clear base¹⁴

Y = Eb6-Y (2% Eboni)

LM = Eb6-LM (6% Eboni)

M = Eb6-M (18% Eboni)

This Eboni-6/Noritsu K2 is a very efficient use of the printer's capabilities. I have seen no evidence of incompatibility between the Eboni-6 and Noritsu inks. While a full Noritsu-based B&W inkset could be smoother, this simple 2-ink combination is working very well in my 1400, with very good smoothness and no microbanding.¹⁵

B. Printing Workflows and Tones With Eboni-4 Plus Noritsu in the Epson 1400

1. Glossy Paper

Printing matte paper with Eboni-4 is covered in detail at <http://www.paulroark.com/BW-Info/Eboni-4-Plus.pdf>. In general, QTR is needed to print the 4 Eboni positions by themselves. To get the MK to print with the Epson driver always requires all the ink channels to be involved. For those who want to print with 100% carbon using the Epson driver, the Eb6 C and LC need to be plugged back into the 1400.

The profiles for the prints discussed here as well as for other Eboni-4 arrangements can be downloaded from <http://www.paulroark.com/BW-Info/Eboni-4-Plus-Profiles.zip>.

a. Epson Driver

Because the 1400 is a native Claria printer, the ink limits are appropriate for the Noritsu inks. Unlike when cooled, blended pigments are used in the C and LC positions, the Noritsu ink produce an excellent dmax on glossy papers when the Epson driver is used, often in excess of 2.4. No dmax of less than 2.1 has been measured.

¹³ Noritsu Ink D700 series black, #H086075.

¹⁴ See <http://www.inksupply.com/product-details.cfm?pn=PR-CLEARBASE-PT> ;

The clear dilution base is as follows:

- 10% glycerol,
- 10% Kodak Photo Flo,
- 10% Dow Butoxytriglycol,
- 1% Edwal LFN,
- 69% distilled water.

Dow Butoxytriglycol™ is \$50/quart from Chemical Marketing Concepts [Dow] at 860-354-2278

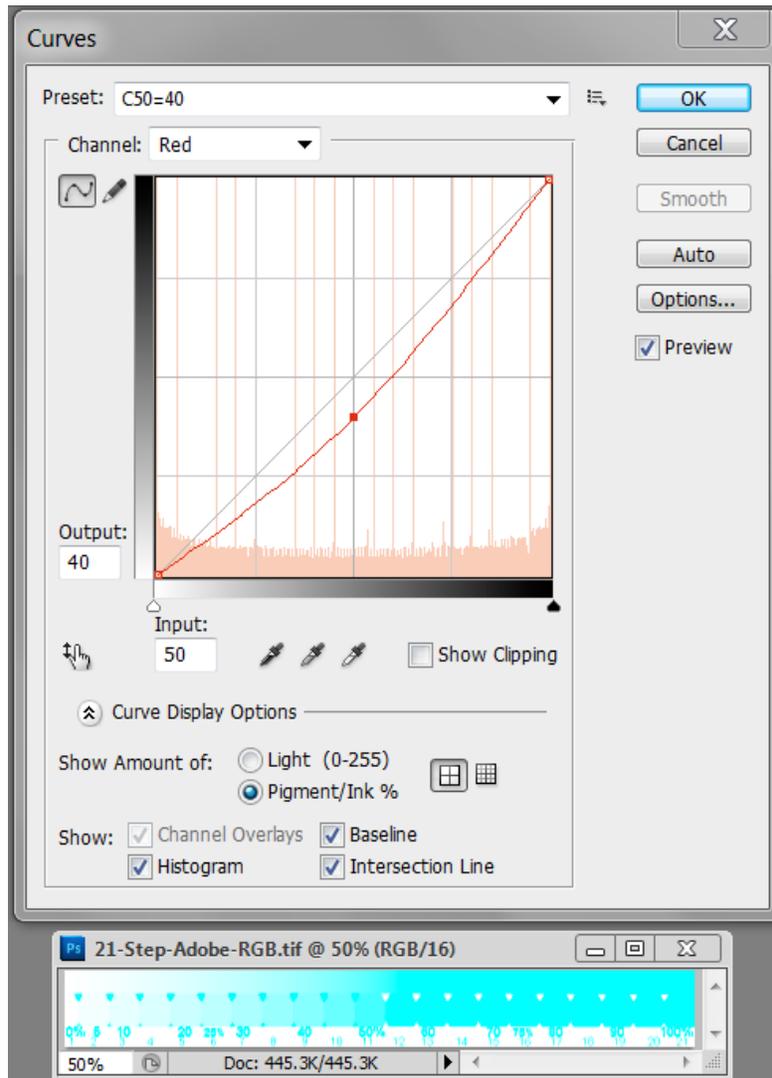
(See http://www.dow.com/products/product_detail.page?display-mode=tds&product=1123830&application=1120800 for technical information on the Dow Triethylene Glycol Monobutyl Ether [aka Cas # 143-22-6]; see also page 17 of

http://www.dow.com/PublishedLiterature/dh_0032/0901b80380032bc8.pdf?filepath=oxysolvents/pdfs/noreg/110-00965.pdf&fromPage=GetDoc) See <http://www.noritsu.co.jp/english/msds/pdf/d701/ENA/MSDSH086075-00-01-NA-E.pdf> for the Noritsu

MSDS.

¹⁵ With high resolution scanning I can detect microbanding with any Epson printer output. I inspect test strips wearing 2 reading glasses on top of each other and with very good light.

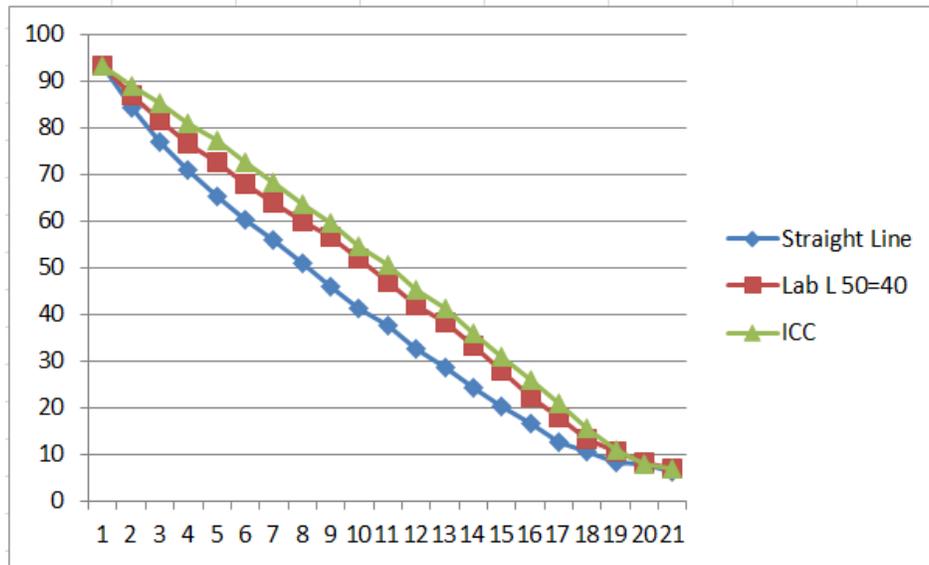
To print just the C and LC inks, the Photoshop image adjustment curves are used. The Green and Blue curves, which control the magenta and yellow inks, are used to turn off these Eboni matte inks. To do this, simply pull them down to be at 0 through the entire range. They'll end up being horizontal. That leaves only the Red curve, which controls the Cyan inks, as a straight line from 0 to 100. With this diagonal, straight Red curve, the image will be a bit darker than ideal. To get the print closer to ideal, set a point in the middle such that the 50 input has a 40 output, as shown below.



The Photoshop curve could be adjusted more to make a better output, but the goal is to make a curve that is closer to ideal and, more importantly, to make one that has no sharp turns in it that will interfere with QTR's Create ICC-RGB from linearizing the results accurately in the context of making an ICC. The goal is to make an ICC that then prints very well, and this simple curve appears to do that.

The screen grab, below, compares the Lab L values for a 21-Step Adobe RGB file printed, first, with just the straight line curve, and, second, with a curve that sets the center point to (50, 40). Third, the output

for a grayscale, Gray Gamma 2.2 workspace, 21-step file is shown that was printed with the ICC made from the “50=40” output. What does not show below is that the straight line curve had a somewhat abrupt turn from 90 to 100 that caused Create ICC-RGB’s linearization algorithm to produce a less than perfect ICC output. The single point, “50=40” red curve has cured this problem for all glossy papers profiled.¹⁶

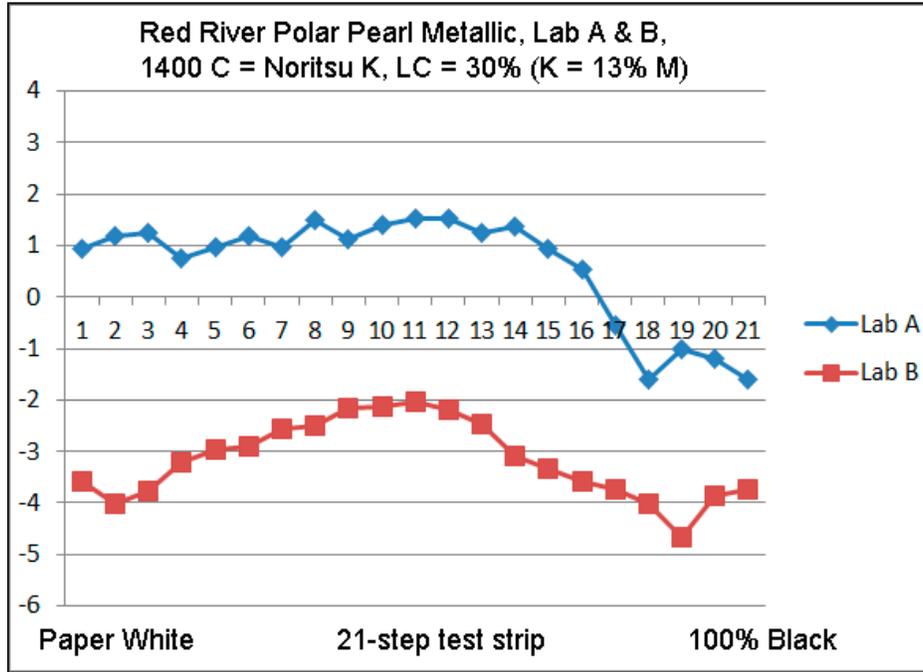


The target image tones for the papers includes having a Lab A (red/magenta positive, green negative) that does not dip more than one Lab A unit below the paper white through the 50% midtone. If the Lab A dips too much, it cannot be increased with this inkset as mixed. More magenta would need to be added to the LC blend. If the Lab A is elevated more than one unit, the print will have what some refer to as a “selenium” tone. If the Lab A increase is too much, it can be cured by using QTR, which is discussed below.

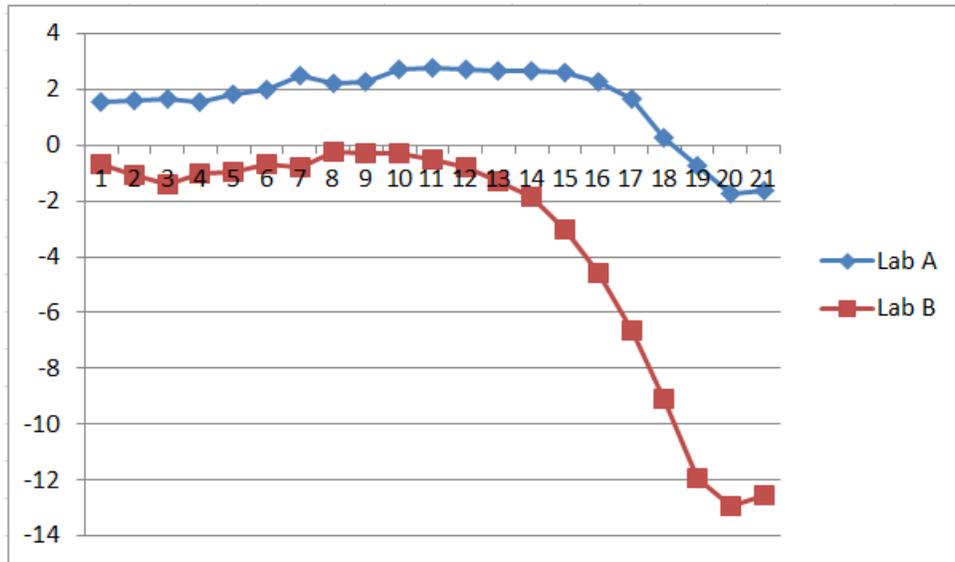
The Lab B (yellow positive, blue negative) values for glossy papers are typically cool – a negative Lab B. With most papers they rise somewhat in the midtones and then dip at the black end. They look good on the papers that have been tested so far. The only paper that I have tried that did not look appropriate was Museo Silver Rag, which has a warm, non-brightened paper base. The cool inks on the warm paper seemed a bit less pleasing.

¹⁶ The paper used for the graphs was Red River Premium Gloss. I most often use Red River’s 7x10 Premium Gloss or Polar Pearl Metallic scored card stock for my B&W cards. See <http://www.redrivercatalog.com/cardshop/scored/53premgloss.htm> and <http://www.redrivercatalog.com/cardshop/scored/66-polar-pearl-metallic-framecard.html>. The Red River papers I’ve profiled and recommend so far include Premium Gloss (53 lb.), Polar Pearl Metallic, Arctic Polar Gloss and Luster, and Premium Polar Satin. Ultra Pro and Premium Gloss DUO were had a slight greenish tint, such that I do not recommend them with this inkset. Profiles are at <http://www.paulroark.com/BW-Info/Eboni-4-Plus-Profiles.zip>.

The graph of the Lab A and B values for Red River Metallic are shown below and are rather typical for the RC type papers.



Canson's Baryta paper makes an interesting looking image and has a finish that some think looks more like a fiber silver print. See the graph of the Lab A and B values, below.



Cool shadows are typical of the lightly selenium toned silver prints I made in the past.

b. QTR Rip

With QTR one can control the individual ink positions – for example, C and LC – separately. The ink limits can also be set with more control.

One option opened up with this additional control is the ability to use a Black Only QTR profile in conjunction with a partitioned LC-C profile. The toned LC and stock K then give control over the Lab A values of the prints.

2. Matte Paper

For the most archival, lightfast fine art or where permanence is a top priority, I've emphasized "carbon on cotton." Not only did I move away from dyes when I detected them, I even moved away from color pigments.

On the other hand, there is no doubt that the best carbon plus color blends can make very good prints, and there is a large market for cooler B&W images on a greater variety of papers.

The Noritsu inks in the Eboni-4 Plus arrangement have turned out to be a very interesting option. Not only are the Noritsu cool inks able to make a more neutral or cool print tone, but the Noritsu K with Eboni can increase the d_{max} of some papers significantly.

a. Red River Aurora

The Red River Aurora Art White¹⁷ has always been a good value. However, it was warmer than I like with Eboni-6 inks, and the d_{max} was in the mid 150's. When Eboni-4 and Noritsu are printed together it prints with a neutral-cool tone and has a d_{max} in the high 1.60's. This transformation is done with inks that have tested as better than many pigments. I would expect Eboni toned with HP pigments to be more lightfast, but the Eb4+Noritsu option is probably as good as most of the dedicated, blended B&W inksets, with a better looking glossy option than any of the other alternatives. The print tone is graphically shown below.

¹⁷ See <http://www.redrivercatalog.com/browse/aurorawhite.html>

Appendix A

<http://serranorey.com/222-noritsu-dry-supplies.html> (FL)

http://www.imagingspectrum.com/noritsu-d703-digital-dry_photo_printer-d703.html (TX)

http://www.desktopdarkroom.com/noritsu_d701_ink.html (FL)

<http://www.sgaimaging.com/catalog/printers-scanners/noritsu-compact-inkjet-printers> (GA & FL)

<http://www.southpointphoto.com/productcart/pc/viewPrd.asp?idcategory=115&idproduct=1064> (TX & TN)

<http://www.fotoclubinc.com/Departments/Printer-Media/Noritsu-Media/Noritsu-D701D703D1005-Inks.aspx> (Santa Fe Springs, CA)

If one purchases on eBay, be sure to check the expiration date of any cartridge being sold for less than \$187.

Appendix B

Epson Claria Dye Technology

This is a copy of page 4 of an Epson PDF, original at:

http://www.ink.epson.com.au/pdf/Claria_photographic_Ink_overview_1_0.pdf



Light and ozone break the bonds and cause fading

Why colours fade

Two principle causes of fading are exposure to light and ozone.

Colours can fade when exposed to ordinary light, because light can weaken or break the bonds that hold the atoms in the dye molecules together.

Those same bonds can also be destroyed by ozone and other oxidized gases in the atmosphere.

Less durable dye ink is vulnerable to damage by light and ozone because dye molecules get damaged causing colour fading.

The difference Claria photographic ink makes

With Claria photographic ink, the dye molecules contain more atoms, tightly bonded together – so the molecules can better resist the effects of light and ozone. To make the molecules even stronger, they are protected by atomic shields and aggregated into dense clusters.

Claria photographic ink

Dense clusters of stronger molecules – fewer weak points allowing high light and ozone resistance.

Molecules form a dense cluster – less vulnerable to attack of ozone

More atoms, tightly bonded together – making molecules stronger against light and ozone

Atomic Shields - protect molecules from ozone

