

Calibrating your printer, screen, and scanner

Posted by Zathros, [Sep 27, 2011](#)

Leif Ohlsson has generously given me permission to post this here. I thought it was a very interesting a tutorial, loaded with good information on how to Calibrate your printer, screen, and scanner, so your models come out looking like they do when you are viewing them on your Monitor, or Scanning them.

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This little thread is for Gil Russell, who already years ago, way back in the days of Papermodelers.net, pointed out that I should do something like what I now finally have found it necessary to attempt - calibrate the whole chain from scanner, over screen, to printer - and do it by iteration until the result was acceptable.

Those of you who may have followed the build log of the DHC-1 Chipmunk know that I ran into serious trouble scanning the original printed kit. Scans which looked good in the scanning preview, and good enough in Photoshop, when printed turned out to be overlaid with a kind of greyish hue, making the colors look as if they were seen under an inch of dirty dishwater.

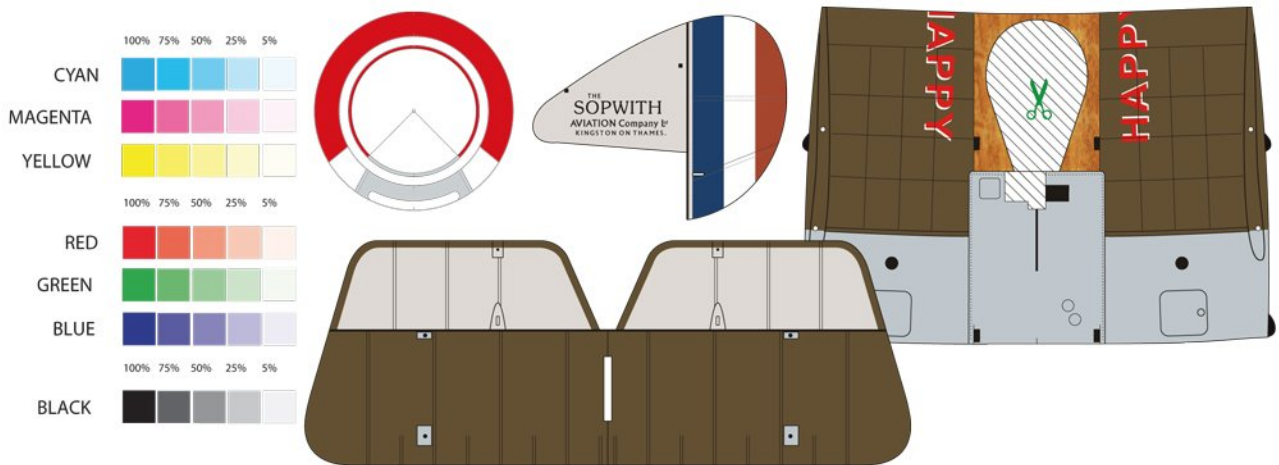
[Not good.](#)

I solved it temporarily by turning up the brightness in Photoshop, and was satisfied enough with the prints produced to build the model. But fundamentally this was a deeply unsatisfactory situation. There must be a way, I thought, to calibrate scanner and printer so that the prints looked like they did on the screen, and the scanner produced a scan which, when printed, looked like it did on the screen.

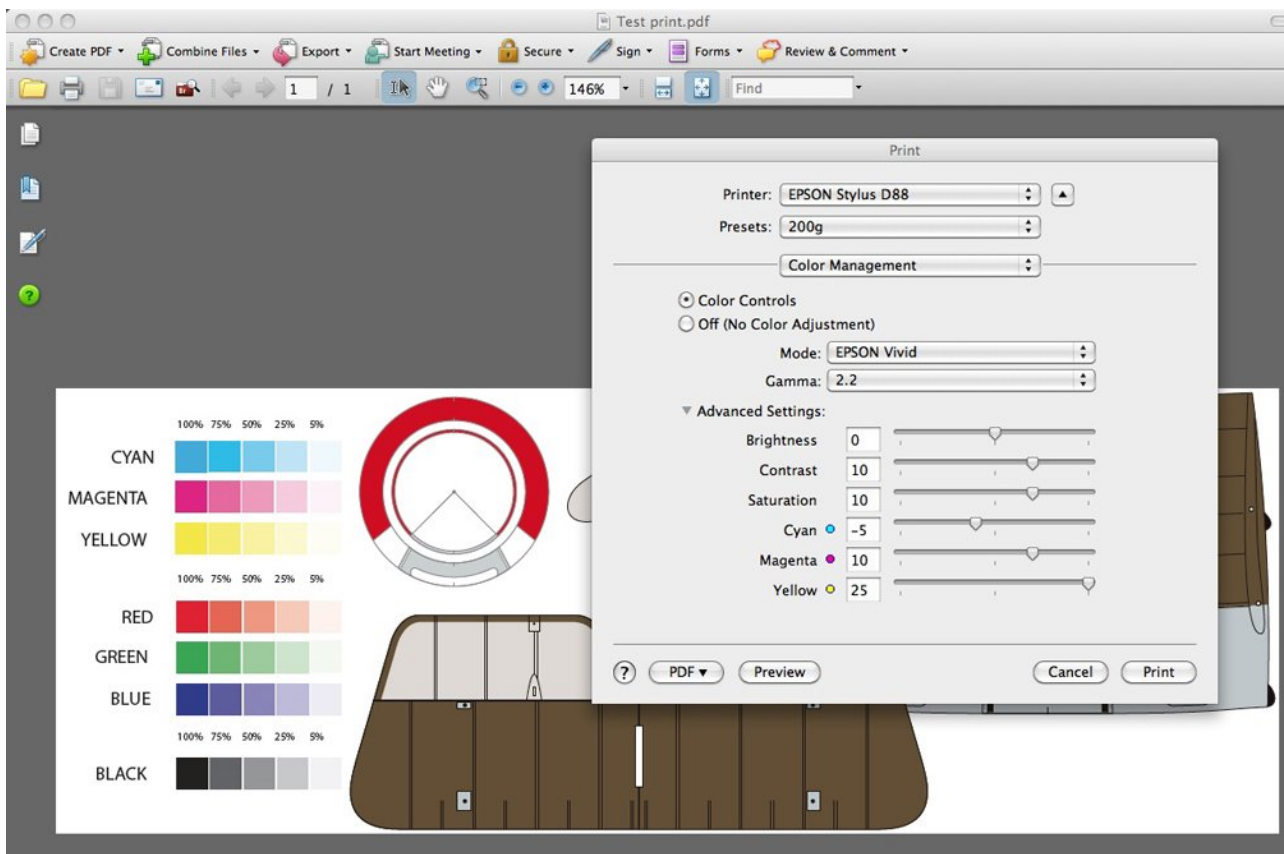
If you are very eager to know just the advice I could give after trying to solve this problem for myself, jump to the end and summary of this introductory tale. What follows now is a perhaps rather lengthy description of the crooked road i took to get there...

My starting point thus was that I was satisfied with what the screen looked like, and it seemed logical to start with how to make the printer print what the screen showed. (As it turned out, this was a faulty supposition, but more of that later, in the order I came to understand it.)

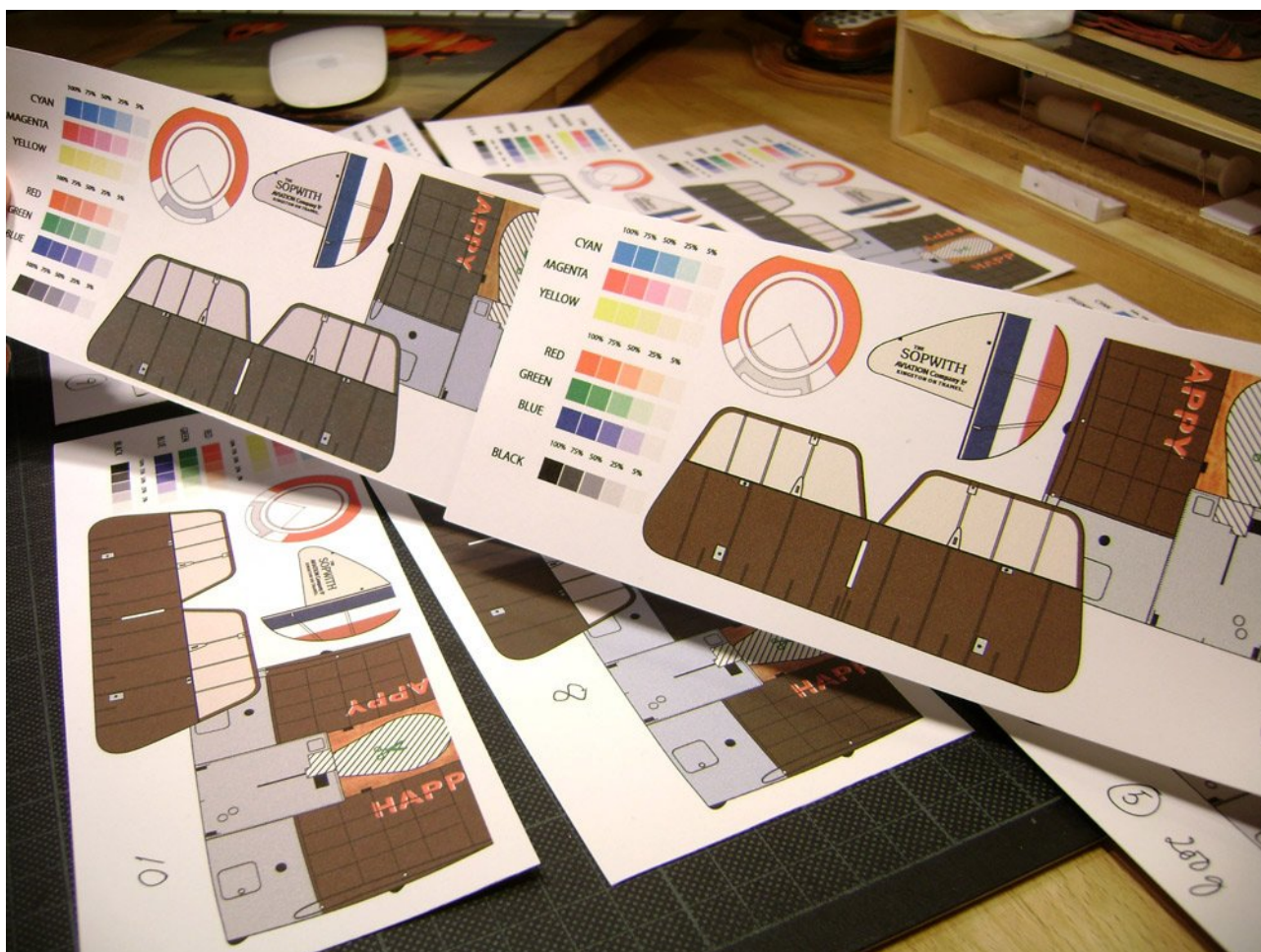
For testing, I made up a simple little test print sheet. (The size of it is 210 x 81 mm, which corresponds to the surplus paper strips I get when making my long sheets, "L3" 420 x 216 mm, from regular A3.)



I now started to print this little sheet, juggling the printer controls for color calibration, brightness, etc. In my setup they look like this, if you bring out the "Advanced" features. You should be able to get something similar in your setup (but don't go running there just yet; it might not be the ultimate solution...):



At this point, you must understand, I was acting on the supposition that my screen was alright (since I was satisfied with what documents and photos looked like on it), and that the printer had to be adjusted to produce an output similar to what the screen showed. As it were, I ran up a sizeable amount of test prints:



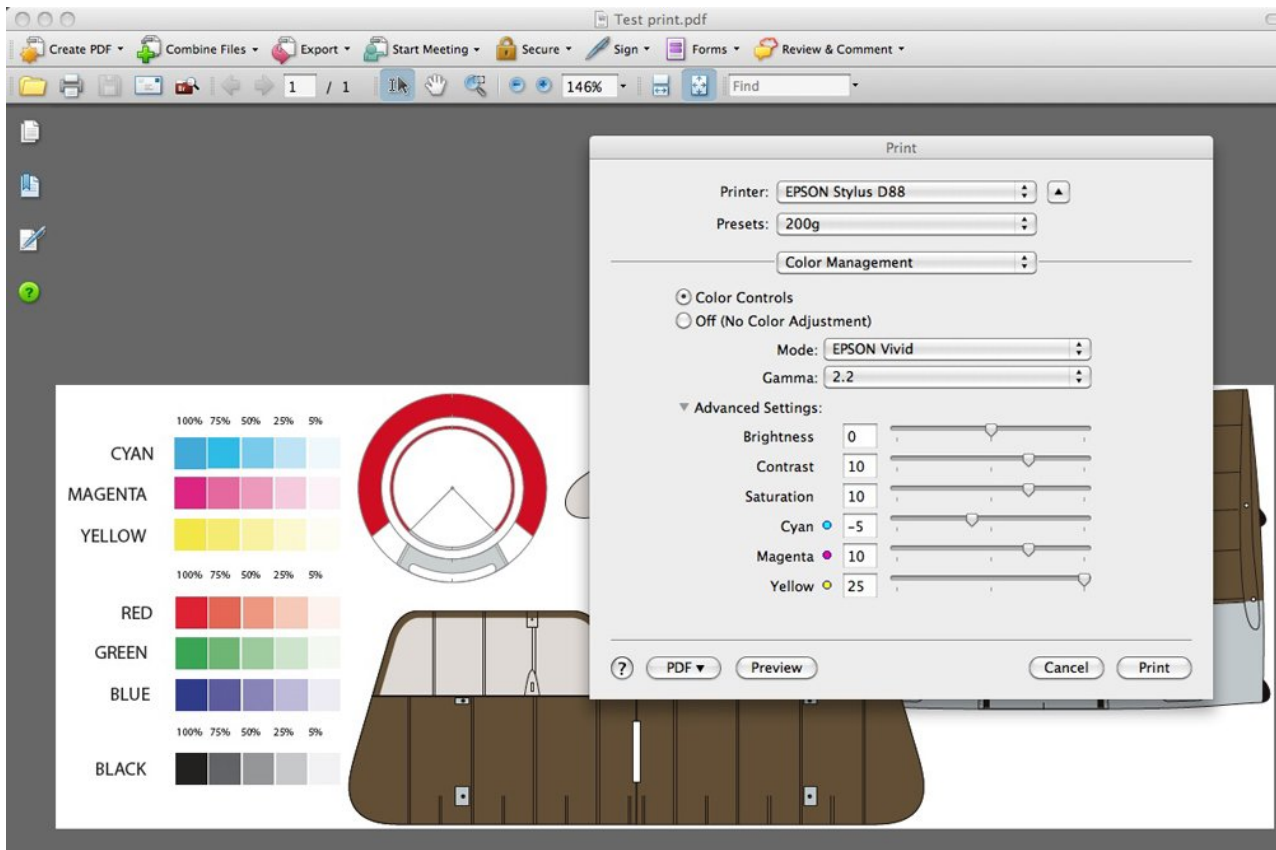
Then something strange happened. By sheer accident (fortuitous, indeed), a number of ordinary paper slips had sneaked their way into my heap of surplus strips. Must have come from me cutting down some ordinary paper A3 sheets at some time or other. The print-out on this kind of regular offset paper looked much better than on my thick 200g supposedly inkjet papers!

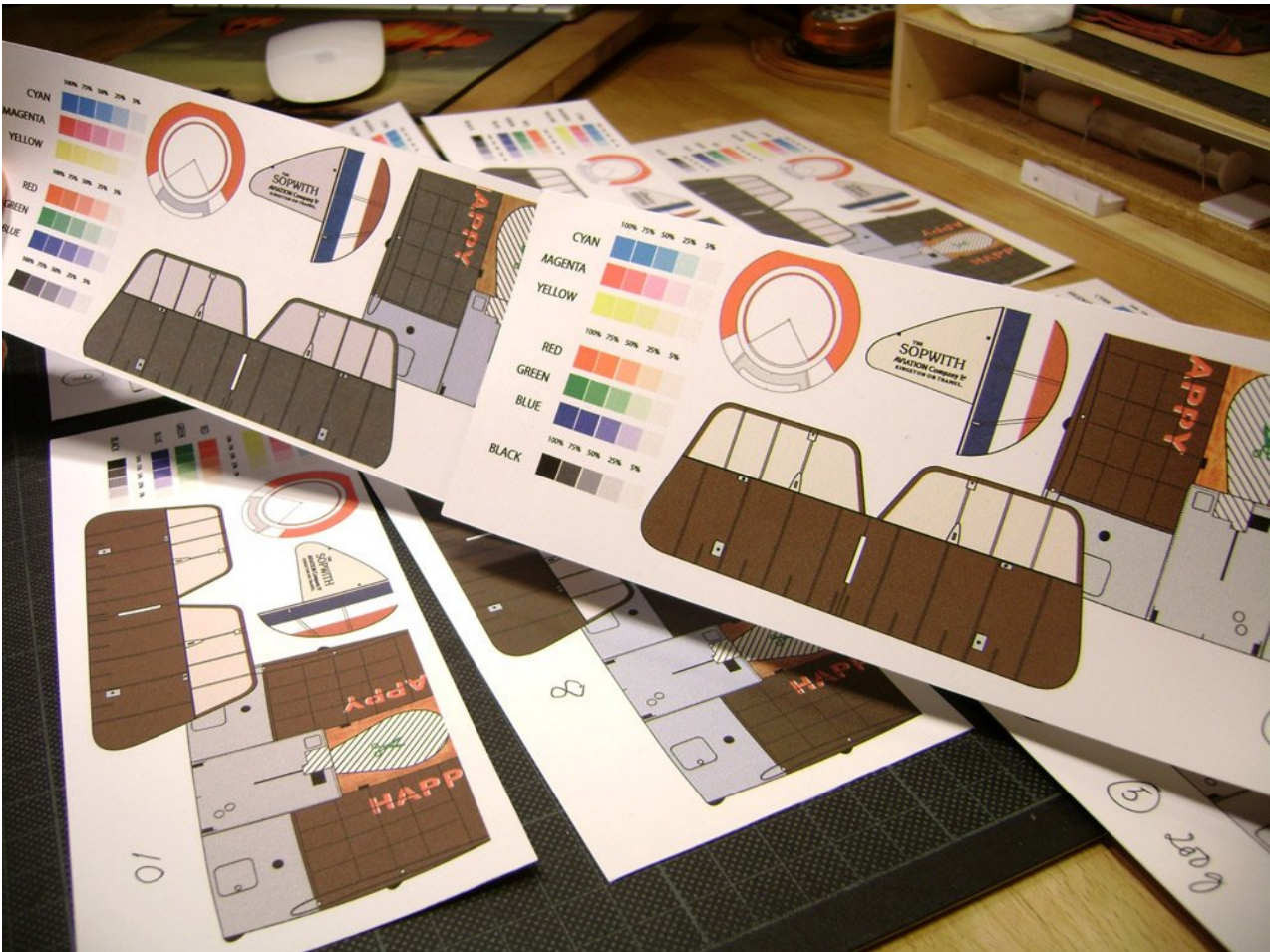
So far I had worked on the assumption that my inkjet paper would best be described as "Epson Matte" in the print out menu, and therefore set the printer to that. The difference when printing by mistake on ordinary paper was amazing - much clearer, much more yellow than I could achieve by adjusting the printer.

Even if it isn't totally logical, I therefore tried the same setting with but changed the paper quality setting to "Plain papers" - and the result was much better, also on the inkjet paper. Another three attempts at changing variables actually went over the top, making the print too light, too yellow. So I reverted to the settings arrived at by accident.

Test printing a full set of the model convinced me that everything was still over the top - too much yellow, too much red, everything too bright and saturated. After that, it was a matter of working myself backwards, to a neutral setting for everything, except the new choice of "Normal paper", even if it really was inkjet, or at least coated paper, I was printing on. That now became my standard setting.

At this stage, I was thus back at a perfectly neutral printer setting, with the difference from my earlier practice that paper quality was set to "Plain papers", even for my thick 200g coated paper.





Enter "Colorsync"

At this point I recalled some very short advice by Wilfried, stating that trusting Colorsync always had produced acceptable results for him.

Now, this for me represents a murky area. So far, Colorsync had mostly appeared as a nuisance when opening documents in Photoshop or Illustrator, the computer screaming incessantly about an embedded color profile this, and another one that did not match the color profile of the document, and what did I want to do? Mostly I just OK'd what the programme suggested by showing one button of two or three as being checked.

Obviously, this was not the way to treat Colorsync. Following Wilfried's hint, I looked through the computer's tool programmes, and certainly, there was something called "Color Sync tool". That, however, seemed far above my competence and furthermore did not seem to contain any serious adjustment options at my level.

So I searched, and read up on what Color Sync really is. Turns out it's a very useful thing. By allocating what's called a color profile to each document, the idea is that the color management will be appropriate throughout a chain of applications, such as a camera, a computer, an application, and a printer.

To do this, however, it is essential that Color Sync is allowed to do so uninterrupted. Which means it should be turned on, of course. Which I hadn't for my printer, since I believed that I could do a better job manually than the computer. Which I couldn't.

So the next and final step for the printer was to turn Colorsync on. Which automatically disabled all those "Advanced" controls I had been fiddling with in vain. From now on Colorsyn would do the job. The only option left for me was to choose between three different profiles for the printer - one "Epson IJ printer", one "sRGB IEC something", and one "Automatic". I printed test copies of all three:

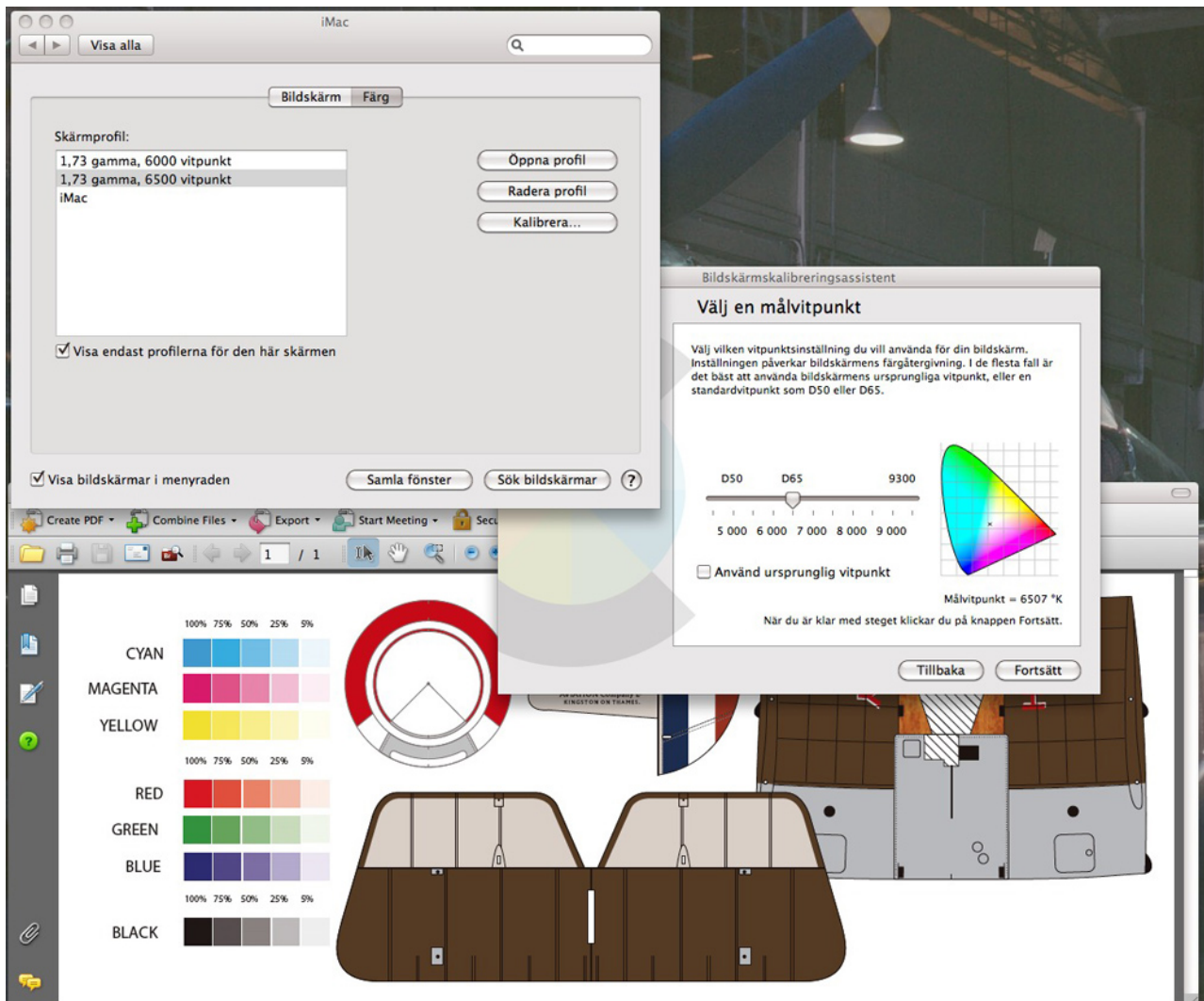


Screen calibration

Getting the printer to produce an output I could trust, the next discovery was that my screen may not have been the absolute norm of correct color rendering, as I had thought until that moment. The prints displayed a distinct yellow-red, light tan hue on the lower area of the stab, simulating clear-doped linen. This was nowhere to be seen if I viewed the test sheet on the screen.

So now I had to try to make the screen render an impression of the test-print sheet which looked like the printed part. Not the way or the order I had thought things should have progressed.

Using the screen adjustment tool with "Expert mode" checked - as was recommended on several websites - was no child's play. I worked back and forth with the levers for brightness and color, which had to be manipulated repeatedly through a number of iterated steps. But every attempt proved to be worse than the original setting.



What really made a difference that I could accept, and be happy about, were three separate adjustments:

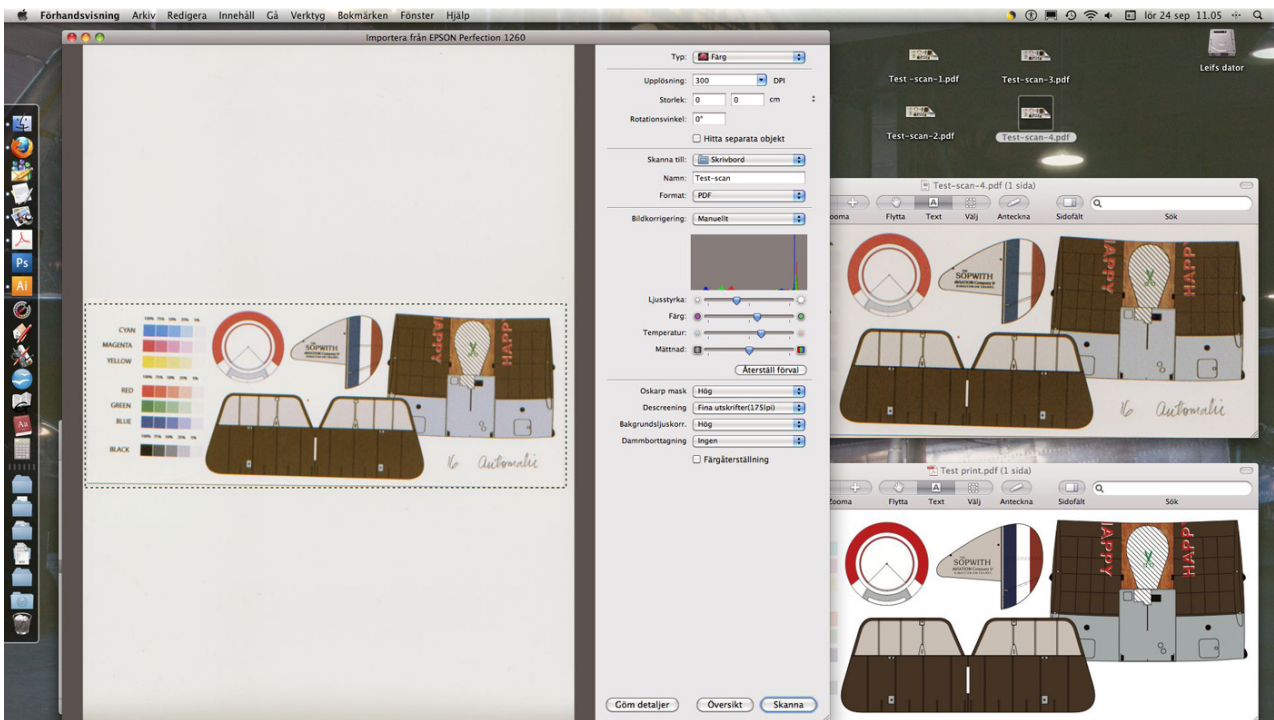
- 1) Reducing the brightness of the screen to some 75 percent. One website recommended making all colour adjustments at only 60 percent brightness, but this I cannot live with (old eyes, I suppose)
- 2) Changing the gamma value from the pre-set 2.2 to something which was called the "original" value of 1.73. Why the preset value differed from some "original" one I cannot explain, and neither do I know what a gamma value is, other than that it has something to do with contrast.

3) Changing the contrast of the screen until the light tan clear-doped linen part of the test print sheet showed up most clearly. The contrast adjustment was made in a separate panel for help to visually impaired (I imagine). This is what helped the most, and I think it ought to be standard in the screen adjustment panel. In fact, no manual mentions it, and I only discovered it by total chance.

Making these three changes my screen now displays colors much like the printed test sheet, while still retaining an overall impression when displaying images that is equal to, or better than before

Scanner calibration

Next, I took the printed version I was happy with, and stuck that into the scanner. The idea now was to make test-scans of the already printed part, and print those scans again. Adjustments to be made until the printed scans were as similar as possible to the original printed part.



Above you see: left - the scanner adjustment panel, top right - the scanned image as displayed afterwards on the screen, and bottom right - the original test print document, the printed version of which is laying in the scanner.

I'll make a long story shorter here by saying that I started with making a number of scans, and compared the scanned (but not yet printed) output onscreen, much like you see it above. Adjustments were made between each trial scan in "brightness", "color", "temperature" and

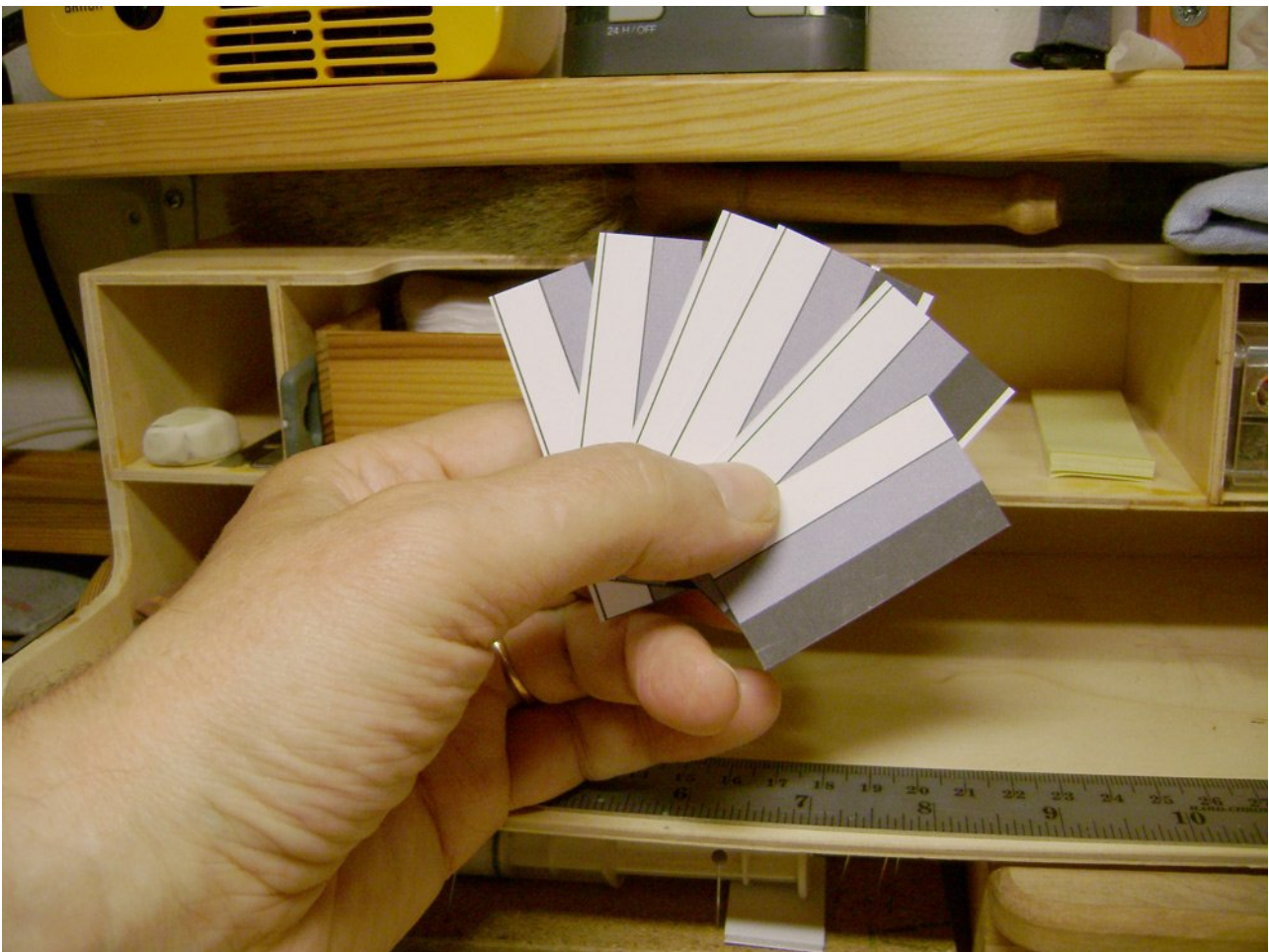
"saturation", until I was satisfied with how things looked on the screen. All three versions were reasonably similar - on the screen.

This scanned version I now printed. Since the final scan adjustments had produced something which looked like the original document on the screen, and I had already calibrated the printer and screen to replicate each other, as close to "what you see is what you get" as I could come, expectations were for a good print result.

This, however, was not to be. The printed result was similar to what had started this whole investigation - there was a greyish hue over both background and colors. So had everything then been in vain?

Final solution - black-grey-white test strips glued to original for scanning

Everything was definitely not lost - I had calibrated my printer, as well as my screen, and the control over the scanned output was within reach, but for the adjustment of the background grey. My final ace in this deck of calibrating cards was drawing up a number of strips in Illustrator (use any graphic programme, vector or bitmap, which can designate adjustable shades of black, grey, and white) consisting of one strip of 100 percent black, one strip of 50 percent grey, and one of white.



These strips were then printed, and cut out. The idea is to cut out a small strip containing all three shades and glue it onto each original to be printed in the future. There is always some clear spot which will accommodate such a small strip, cut right across the black, grey and white.

After scanning, I will run each and every scan through Photoshop and correct the image by sampling the white point, black point, and intermediate (50 percent grey) point. This is done in a panel for adjusting brightness. Henceforth, this will be my new regime for scanning.

Printing two copies of the test sheet scanned with my previously arrived at settings, I subjected one copy to adjustment in Photoshop before printing, while the other was printed uncorrected. The result was most satisfying:



Above, you will see the uncorrected scan in the left background, while the corrected version is in the foreground. In the background right is the printed original. This is the copy that has been scanned, and then printed again for both the uncorrected and corrected versions. With the pen I am pointing at the little black-grey-white strip glued to the original. The scanned and re-printed version of this strip is pointed at with the red pincers in the lower left foreground.

Note the following:

The uncorrected version in the background left retains the greyish hue which was part of the problem to start with.

The corrected re-print of the original print in the foreround has no such greyish hue, and a good similarity in colors to the original print in the right background. It is definitely less sharp at the edges, which I believe mostly is due to applying the anti-moirée setting in the scan. This I deem to be unavoidable in scanning.

This completes my attempt to calibrate scanner-screen-printer for the moment. As a note to myself, these are the settings I applied in the scanner (as a hint to what kind of settings you might want to look for):

Brightness: -20%

Color +15%

Temperature +20%

Saturation ± 0

Unsharpen mask - High

Descreening - Fine 175 lpi

Background lighting correction - none

Summary - what I learned about calibration

This is the short version of the lengthy notes above:

Printer:

- Set to "Color Sync".
- Check which setting for paper quality renders the truest prints in your own opinion.

Screen:

- Reduce brightness to some 60-75 percent.
- Check if a lower gamma-point setting than 2.2 will give more true rendering.

- Check if contrast adjustment will give a truer rendering.

Scanner:

- Include a black-white-grey strip on every original to be scanned.
- Adjust for correct white point in a graphic programme by sampling the scanned test print in the appropriate panel of your graphic programme.
- Make adjustments in the scanner panel of brightness, color, temperature and saturation to render the truest result when finally printed.

This is how many testprints it took me to arrive at the advice summarized above:



I think there are 22 cards in this hand. Well worth it, since I now feel more confidence in the tools I work with so much. With the experiences recounted here, you should be able to get away with far less.

Leif

.....From Zathros: I would like to add a useful link that I have used before and was posted by a member who's name I have not asked for permission to use:

<http://www.normankoren.com/makingfineprints1A.html>