

Scanning 'theshadow' way

Scanning old model aviation plans began several years ago as an off-shoot to my aero-modeling interests. I acquired a huge collection of modeling magazines from a club mate. I had to share this treasure trove with other modelers but how? SteveWMD was tossing about ideas on RCGs of starting some type of plan archive online. A five year, to date, relationship began! I am self-taught in all the required skill sets. This includes PC construction (Heathkit H8 was my first), graphics use (raster and vector) and, of course, model aviation construction and flying.

Scanning old plans gives me a sense of giving back to model aviation, from which I still derive much pleasure. I can appreciate, having taken four years of mechanical drawing (pre computer era), how the old masters designed their creations and then left us drawings so that we can duplicate their work. When I work at 400 percent magnification, on an old plan, I feel the designers are looking over my shoulder. I only hope they approve!

I have used the following steps over several years of scanning. They are by no means final or definitive, but they are quite repeatable and generally result in a very useable plan. Experiment with the software and try new ideas with each scan. Always improve your techniques. When a person posts suggestions (especially someone who makes/made a living at the task) take notes. The beauty of using software is everything can be undone. Hit 'Undo' and try a different approach until pleased.

Basic Requirements:

A relatively robust computer, a solid OS, as much RAM memory and as many large/fast hard drives as possible. Graphics software is memory intensive. Use a quality high performance graphics card. Generally, if your PC can smoothly run a flight sim, you should have no performance issues. Minimize the background software allowed to run (some Led Zep playing in the background is OK). If things get 'boggy' and the hard drive light is constantly blinking, memory overload is occurring. Geriatric computers will be frustrating or impossible to use with most graphics software.

Quality flatbed scanner with a removable top lid. Look for highest optical (1200 minimum) resolution, not a software derived resolution (interpolated). Use glass cleaner regularly on the scanner surface to minimize adding noise. Scanner accessories should include three pieces of paper faced foam board (1/2 inch thick). Cut one piece to the full size scanner glass and two more at magazine page size. The smaller pieces are useful for scanning those pesky mid-magazine pages without cutting the page out. Use one up close to the bind and the other on the second half, holding down the foam board with 2-3 pound weights. The different heights can then be easily scanned. Black paper or foam behind a thin (see the print through the other side) pages. This cuts down on noise artifacts coming from the back side by absorbing reflected light.

Create and follow a work flow! The deeper you get into a plan's restoration the more layered steps are completed. Did I scan initially at the highest resolution? Did I sharpen and denoise at the last step? Did I clean the entire plan? ...

Nice bells and whistles to have.

Although a mouse can be used, a graphics pad is infinitely more useful. These input devices make the scanning and restoration job a real pleasure.

Solid State Drive. Use this exclusively for your graphics 'scratch drive', this will allow graphics software to run most efficiently.

What I use: This system is antiquated by today's standards but rock solid!

Intel Core i7 2600 cpu @ 3.40, GHz ASUS CG 8350 motherboard 32GB

fast RAM, NVIDIA GeForce GTX 460 w/4095 MB graphics memory, Wacom Intuos PTK 640 graphics tablet, Intel 112 GB SSD, 3 External Hard Drives, Windows 7 Pro 64 bit,

Mustek A4 2400 dpi flatbed scanner, Sony 21 inch 1920X1200 monitor, PDF Creator Pro

2400 dpi Step

I first scan at 2400 dpi, grey-scale. Scanning in color is sometimes useful but will create huge file sizes. Adjust scanner controls for optimum contrast and brightness. My scan criteria, I want to see the paper fibers and ink drops at line corners!

A bit about scan resolution:

My over simplified analogy is.... look at the airliner overhead with the unaided eye. You view an aircraft with a single, blurred contrail (300 dpi). You view the same airliner with low power binoculars you see multiple contrails (each engine) and a distinct tail (1200 dpi). You view the same airliner with your father's German (don't touch!) binoculars and you see the windows, airline logo and Aunt Mary, on her visit to you, waving at the window (2400 dpi). The bottom line, the higher resolution will capture more data that can be now removed at your discretion. The old computer axiom GIGO (garbage in garbage out) still prevails!

I use photoshop (PS) and scan directly into the program using the scanner software. The scanner's native capture mode creates a 300-500 mb bmp file for an 8X11 page. We will never have this much data again, from this point forward we will start shedding digital information. Much of this 'shedding' is done by the software. This is evident when saving the .bmp to the PS's large image format, .psd. Compare the raw scan file size with this new .psb file and you see we have already tossed a large amount of data. Typically we will now be in the 100-300mb range for the same 8X11 page. PS does a fine job of preserving the important data.

Verify we are in grey scale (GS) mode, now is a good time to get familiar with layers. PS will only let you perform some of its magic on a layer, not the original image. Make a duplicate layer of the background. Hide the background and straighten/crop the visible layer, using guides and the Edit drop down/Rotate command. Make the ruler visible with View/Ruler and move the rotate center indicator to the plan border corner. You can now rotate around this new center point. When satisfied, flatten image and discard the hidden background. Save and name this .psb file 'original'. A second copy, 'saved as 'working copy' will be the one we work on. If all efforts go badly we always have the original backup.

Now begin paying close attention to the line quality. Zoom in on an area of tight parallel lines and fine detail. Select Image Adjust/ Contrast and Brightness adjust making paper fibers a light grey. Concentrate on making the middle of the line black. If the black line starts blooming back off a bit. Little grey fuzzies at line edges will soon be turned white so don't worry about them.

PS has a multitude of 'Filters' but I use only a few, and very sparingly. Over applying filters will cause muddy, blurred detail. Filters/Sharpen/Smart Sharpen is now used to define the line work. Gaussian Blur is selected. If the lines appeared 'doubled up' try motion blur. Print registration errors were introduced. The Motion Blur filter may minimize or even eliminate this problem. Pay close attention to lines like plywood striations, space between control surfaces (made up of small closely spaced parallel lines) and the like. Move the Max amount and Radius sliders to optimize the black line. Back off on the radius if the grey spaces and background noise start going black. View the plan at full screen size. Sometimes on high magnification the work area looks great but another area lost line quality.

Go to Image Adjust/Threshold, move to a higher magnification and adjust setting to clear the grey background noise to white and thin the line work. View the overall plan and make sure any all-black areas (tires, titles etc.) don't get too spotty with white noise. Back off on threshold if this occurs. We are manually controlling which greys will be white and black. Compromise is another, much used, tool introduced here.

The overall 8X11 inch plan should now look fairly good. The filter Noise/Dust and Scratches or Median can be used to remove light noise spots and smooth line quality a bit. This filter will rarely be used with a radius above 1 and a threshold of 1 on the sliders. Watch small areas such as the inside of the letter 'A' and watch what happens. This filter if used excessively it will 'round' out acute angles and blur line work creating a very muddy thick drawing.

1200 dpi Step

We will now reduce the 2400 dpi image (still as .psb) down to 1200 dpi with Image/Image Size - resolution 1200 with Bicubic Auto selected.

View at full screen size and repeat the Smart Sharpen, Threshold and Noise steps, striving for thin, clean black lines.

Scale plan to full size. This time we drop down Image/Size and use the Pixel Dimension section. I prefer to use Percent for pixel dimension. Drag two guides to the printed scale bar or any dimensioned part such as a wing, wheel or even wood. (There is less error when dragging the guides to the same edges of a scale bar (left edge at 0 and left edge at 1) than trying to guesstimate the centers. Drag the upper corner of the ruler over one guide (this resets zero point at the guide) and read the PS indicated measurement. If this is a half inch (assuming a 1 inch item indicated on the plan) enter the pixel percentage of 200 or twice the size. Reset the zero point and the 1 inch plan dimension should now match the PS ruler of 1 inch. Image/ Image Size drop down should now show full size (e.g. 8X11 now e.g. 24X36). Strive for accuracy on this step.

Pixel Polishing- Steve and I agree this is an almost Zen like, relaxing process, erasing little random black spots into oblivion! I prefer to thoroughly clean and touch up the plan at 1200 dpi full scale. Use only the pencil tool at the most round and hard settings for all repairs and only black and white. Enlarge the plan to a comfortable size and start at a corner. Drag guides to surround your work area so you don't lose track of areas cleaned.

I manually remove all noise, staple holes, rips, tears etc. over the entire drawing with a white pencil. Then I will repair broken/faded lines etc. with a black pencil. Then I go back again and clean all print and dimensioning. This step can be time consuming but improves the plan readability and overall quality. Jumping around will only be frustrating as no one step will get finished and you will forget what you did.

600 dpi Step

Reduce from 1200 to 600 dpi following all the steps done before (sharpening, threshold and noise). Optimize each step, again, for best line quality. The lines should be getting nice and thin and black. Under high magnification you may see few grey bits about. You can deal with them at any time. We are approaching our goal of a 2 color (black and white) plan.

Check to see if the plan can yet be saved as a PDF by selecting File/Save As/pdf. If the plan size exceeds a certain pixel dimension in either length or width this won't be permitted. Most plans (except 1/4 scale or sailplanes) will usually convert to a pdf at 600 dpi. If PDF save as is denied we must further reduce the plan resolution to 400 or even 300 dpi. The Smart Sharp, Threshold and Noise sequence will need to be done for each reduction. When saving to pdf is permitted, change the image mode to black/white bitmap and save as a PDF.

A word about creating PDF s in PS. Create a Save to Preset with no compression. Compressing in both PS and another PDF program will create readability problems in the final product. I named mine Outerzone Submit.

Your finished plan file size will now be in the order of several hundred KB to around a MB or more for a large model plan. We started with a scan of 500 mb and have gotten it down to a few hundred kb and quite clear. Take this pdf to your local print shop, tell them to print it at full size and you will have a very usable, full size plan.

Post Cleaning Checks

Pitfalls of magazine plan scanning -

They were really meant to interest you in buying the full size plan printed from master copies. Most magazine plan previews are quite accurate though, but all need checking. Some are 'squished' (aspect ratio not 1 to 1 in height and width) to fit a page layout. Sometimes your eye can spot this (an oval wheel) but not always. Even on single page plans with wing halves in two positions, I will make a selection of one wing, copy, drop the copy over the first section and compare.

Create a layer of the second page and paste it over the first, right click on Blend/Darken in the Layer/Options. The layer will be super-imposed over the first. Move it around checking both scale bars (should be identical) wing, rib and former sizes should fit etc. Wing joiners and spars should all line up with holes in fuselage or root ribs. Adjust any errors by rescaling incorrect pages.

Text/Article Scanning-

I scan all text in PS at 600 dpi (color if present) and set PS to save as 300 dpi, uncompressed, pdf (another saved preset I call Outerzone text). A single 600 dpi page, with color, will be in the order of 10 mb to 20 mb in file size. I use PDF Creator Pro for final optimizing and bundling of these multiple pages. The resulting total, multi-page text/article pdf will be 1 mb to 2 mb in size. Steve's earlier servers had size constraints but this is no longer a factor.

Using PDF software for final packaging -

PDF software will have settings for 'optimizing', create multipage pdfs, rotating etc. Use caution when creating your final pdf to send to OZ. Duplicating 'optimization' steps in two pieces of software will cause problems, over compression is one. Both programs will do their best to remove white areas. Duplicating this in two programs results in 'ghost text'. Rotate all pages to view the same way! Optimize for 'Fast webview'. PDFs contain a lot of unseen data. Remove all deleted content, metadata, bookmarks etc. Some software name this 'Inspect'. This will create the smallest size pdf with readable, clear text to accompany your plan.

Recheck your finalized pdfs (plan and text) before sticking on postage stamp and sending to Mary and Steve!

A low resolution scan, crooked, edges and middle lifted and blurry, line gaps between sections and unreadable text is not useful to a modeler. Some plan scanners seem to consistently use this format, without ever improving their techniques. The jpg format is fine for a 'soft human face' photo compression. This is what jpg was designed for, but not plan scans. Converting a scan to the jpg format will result in a muddy, pixelated plan. The result, is rarely, if ever good. Calling these scans 'optimized' won't change the poor quality.

Restoring old model aviation plans shouldn't be a contest of quantity but of quality!

....and that's the shadow's way of scanning. Some will ask 'why not skip all the middle steps, use PS's shortcuts and clean at 300 dpi'. I have tried all iterations of this process and am very satisfied with the results. When a modeler posts their completed model pictures and comments 'everything printed out, fit and flew fine', my effort has been greatly rewarded.

Computers are powerful tools but software can remove the 'human factor' sometimes needed for optimal results.

Regards, 'theshadow'