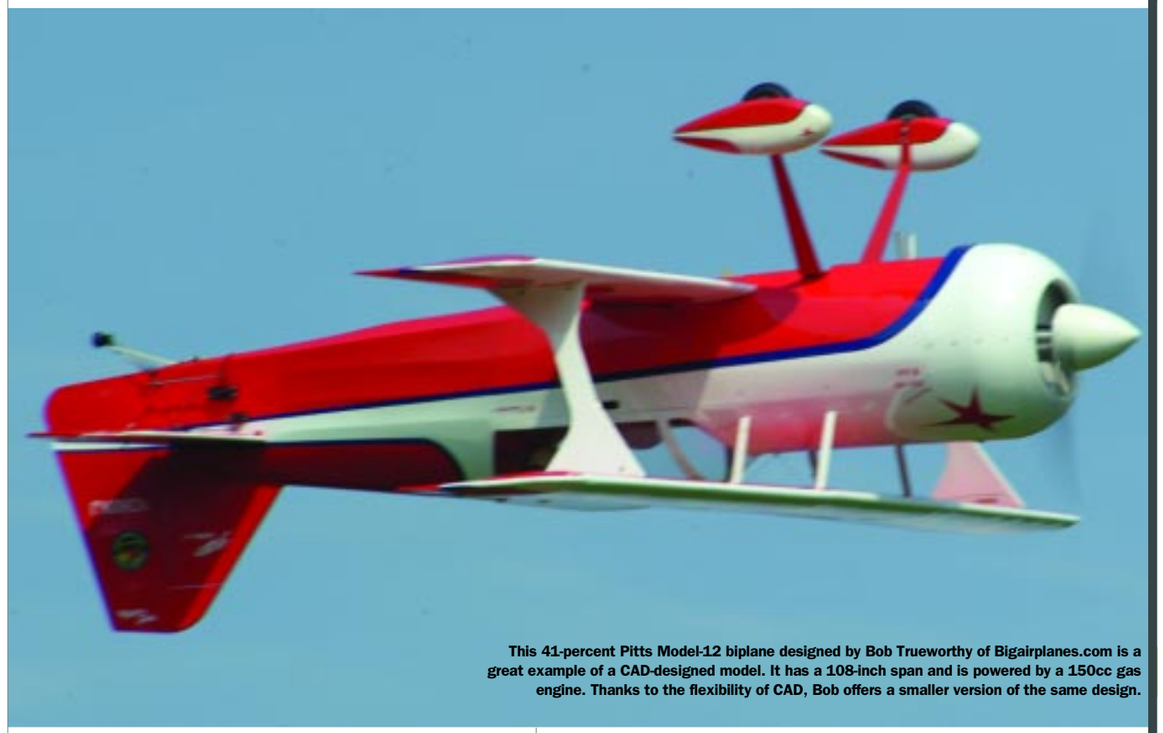
CAD: FROM 3-VIEWS TO PLANS

BY GERRY YARRISH>PHOTO BY JERRY SMITH



This 41-percent Pitts Model-12 biplane designed by Bob Trueworthy of Bigairplanes.com is a great example of a CAD-designed model. It has a 108-inch span and is powered by a 150cc gas engine. Thanks to the flexibility of CAD, Bob offers a smaller version of the same design.

THE NUMBER OF CAD-DESIGNED MODELS on the market today is amazing. The days of developing specific tooling and dies to cut kit parts are all but gone; these processes are being replaced by laser cutting and CNC machining. Modelers also use their PCs to draw their scratch-built beauties. In the September issue, I talked about using CAD and the basic drawing tools included with it. Several readers had questions, and I address some of them as we look more closely at the techniques used to transform scale 3-view drawings into construction plans!

PLAN DEVELOPMENT

At this point, I assume that you know how to use your CAD program and can create the basic geometry needed to develop model plans. I also assume that you have chosen a 3-view drawing and have scanned it into an electronic image file. This is where the fun begins!

CHECKING 3-VIEWS

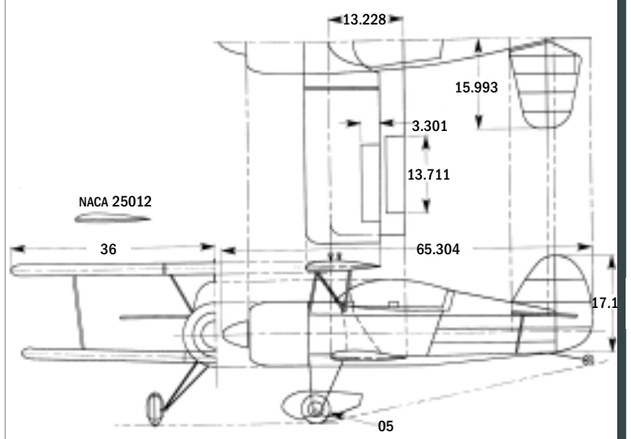


FIG 1 This is my CAD drawing of a 72-inch-span Pitts Model 14. Reference lines are shown to match up height, width and length of the top, side and front views.

WING DEVELOPMENT

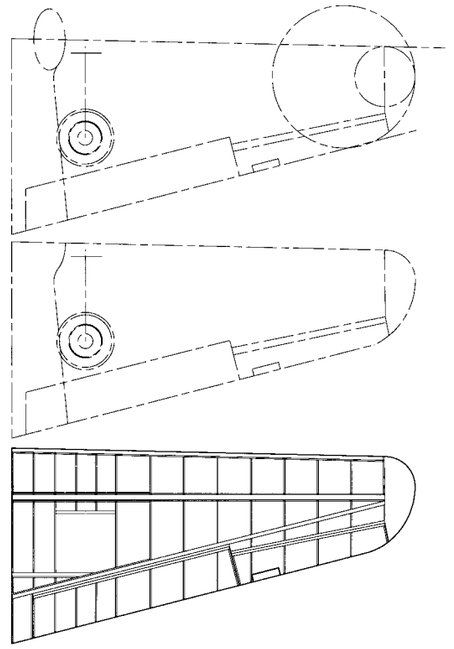


FIG 2 In this wing-development drawing, you can see the three basic steps. First you trace your drawing using basic geometry, and then you delete unwanted segments, and finally, you add the internal details. Everything is done in full-size.

FUSELAGE REFERENCE LINES

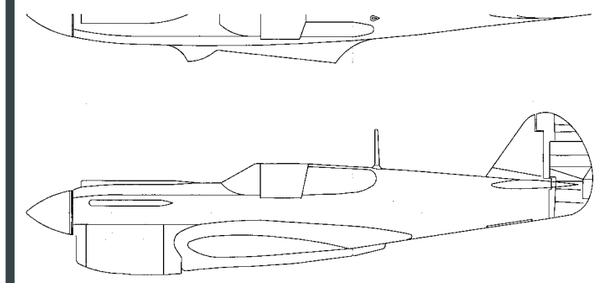


FIG 3 The fuselage side view and half top view are used to determine the height and width of the fuselage cross-sections. The references lines show the cross-section locations.

The process always begins with importing your image file and saving your CAD document. Next, use the zoom function to enlarge the fuselage side view to the width of your screen. Draw a centerline through the middle of the prop shaft, and extend it to the tail. Now trace the fuselage's long gradual lines using the curved-line or "Spline" tool. Also, wherever possible, use the Circle and/or Ellipse tool to create crisp, well-defined curves. Do the same for the top views of the fuselage and horizontal stabilizer. Now trace one wing panel; note that most of the lines are drawn with the Straight Line tool. Usually, the wingtip will be the only place requiring curved lines. Finally, trace half of the fuselage front view.

From here, you may be tempted to begin adding formers, ribs and other internal details, but wait! There's one more thing to do. Compare the side and top fuselage views and make sure that they are the same length and that the wing and stabilizer locations coincide. If they don't, decide which view is correct and adjust the other view to match. Also check the wing and stabilizer top views, and make sure that they match their placement in the fuselage side view. More times than not, there will be minor discrepancies in even the best-drawn 3-views. Before adding any internal details, make sure that your basic top-, side- and front-view elements all match in height, width and length!

DRAW TO FULL-SIZE

Once everything matches, but before you draw the various reference lines, use the Enlargement tool to adjust your drawing to the size you want your plans to be. The most obvious dimension to use here is the wingspan. Once you have enlarged your drawing, save the file. Also save a copy of the file and use it as a backup in case something happens to your original.

From here, you can add internal details and draw them in full scale. In the Wing Development drawing, you can see that I have drawn a P-40 Warhawk wing panel using straight lines for the leading and trailing edges, and I used the Circle tool to develop the wingtip's shape. Since the drawing is full-size, I added a 3/8-inch-wide leading edge, an 1/8-inch sub-leading edge, a 1/2-inch-wide main spar, a 3/8-inch-wide secondary spar and 3/32-inch ribs. Servo and landing-gear details have also been added—all in full-size. All that would be

FORMER DEVELOPMENT

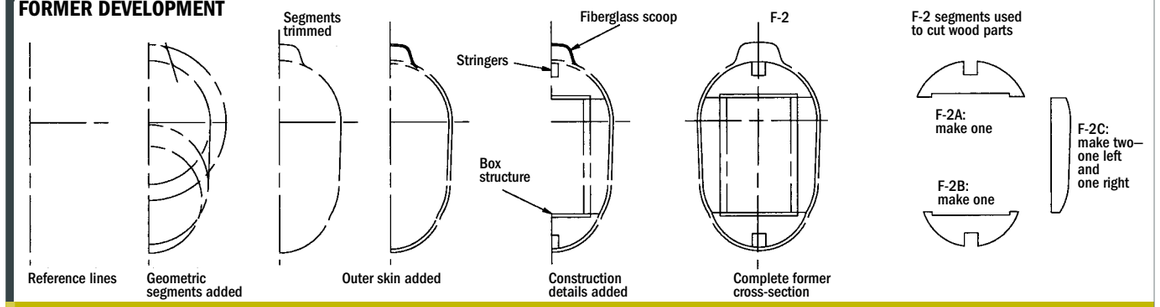


FIG 4 Here's the development of a basic fuselage cross-section and the finished former.

required now is to develop the airfoil and to size it using the wing top view as a guide to develop all the ribs.

> … work only on one side of the centerline and use the Mirror Image tool …

FORMER DEVELOPMENT

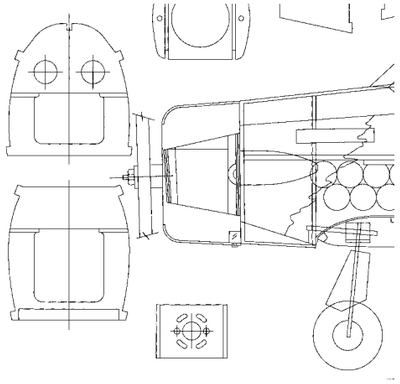
To accurately develop former shapes, it is important to start with a scale drawing that has at least a few of the main fuselage cross-sections shown. Begin with the top view (horizontal) and side view (vertical) reference lines and their relative positions to the fuselage centerline. Now combine the reference lines to form the overall height and width of the cross-section's front view. Next add the basic geometric shapes and trim away any unwanted parts. What's left is the outline of the cross-section. To define the former, add an offset line inside the outline to represent the thickness of the fuselage sheeting—typically, ⅛ inch. Now you can add the internal structures such as stringers and doublers. Define the former segments and again, delete any unwanted lines to show the finished former. Do this for all the cross-sections. To develop any additional formers, you have to do some plotting using the known cross-sections as a guide. But I'll show how to do that next time! Remember my CAD rule: work only on one side of the centerline and use the Mirror Image tool to complete your symmetrically shaped parts.

Developing your model-design skills is all part of the fun and challenge of using a CAD program. Until next time, grab that mouse and keep on practicing.

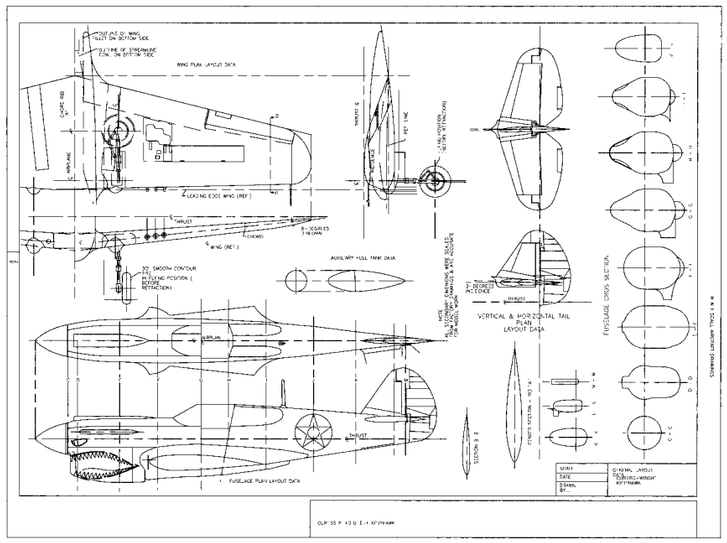
FILE CONVERSION

SO FAR, I HAVE DESCRIBED HOW TO use CAD to trace over your imported image file to produce your plans' geometry. A great way to speed this process and to eliminate tracing errors is to convert your image file directly into a CAD file. An image file such as a bitmap, TIF, or JPG, etc., is made up of many tiny black and white dots, or pixels, and is saved as a raster file. CAD documents are saved as vector files, and they contain the "X" and "Y" coordinate information (start and stop locations) for all the line elements in the drawing. You can use a conversion program, or you can send your scanned image to a company that offers a raster-to-vector conversion service.

DesignPresentation Associates offers a raster-to-vector conversion service, and I have used it several times. This company can take any hand-drawn sketch or scanned image and convert it into any other type of file that you may want. For our situation, that would be either a .DWG or a .DXF format. Simply scan your drawing, send your image file via email and, in a very short time, you'll receive your vector file ready to be imported into your CAD program. Once it's imported, you can save the file and enlarge it to the drawing size you want. The service costs about $50 for a standard, single-page, 3-view conversion, but considering the time this service saves, it's a great investment. You can check out what DesignPresentation Associates has to offer at designpresentation.com, or you can email Gene Kang and ask for a quote: gene@designpresentation.com. Give Gene a try. I know you will love the results.



This is a small section of a set of plans that was converted from a raster to a vector format. DesignPresentation Associates did the conversion in a day.



This converted Wylam P-40 Warhawk scale drawing is another example of DesignPresentation's raster-to-vector conversion service. It represents a big savings in drawing time!