FS Design Studio

Making an Aircraft - Tutorial Part I, by Ron Anderson

About these Tutorials

Since it first appeared in March 2000, users have been taking advantage of the many new features that **FS Design Studio PRO** puts into the hands of aircraft designers for crafting some very attractive fleets. But having a robust design tool that supports many features can get in the way of learning to make your first aircraft.

Ron Anderson recognizes this challenge and has responded to users' questions and requests by developing a series of step-by-step tutorials for making aircraft with **FS Design Studio PRO**. He has cordially allowed us to reproduce his material here. Ron's four-part tutorial begins below.

To begin your project you will need a couple of things. The first thing you'll need is a picture or pictures of the Aircraft you want to build in .BMP format. You don't necessarily need 3 views, just a good side shot and maybe some additional shots from different angles that will give you an idea of the basic shape of the plane. For your first project, concentrate on learning the basic steps involved in shaping tubes, moving points, rotating parts and splitting polygons from the shapes you refine. Accuracy will come with subsequent projects. One other item that will become important in time is a list of specifications for your Aircraft. Dimensions are most important at this point, especially overall length and width as well as wingspan and sweep.

To begin, open FSDS and familiarize yourself with the tool bar and menus. I'll leave the explanation of these up to the help files at this point. The very first step is to make yourself a folder in the FSDS directory where you can keep your project, for demonstration purposes I will use a Cessna 185.

Photo by Shawn Miller   http://www.Airliners.net

Since this is a tail dragger I suggest you use your Photo Editor and rotate the image 13 degrees right so the fuselage will be horizontal when you use it in FSDS as a backdrop. Copy and paste this image to the Cessna 185 folder you just made in the FSDS directory if you like as you can follow along. I would also suggest you make another folder in the Cessna 185 folder called parts to keep all the parts you'll save along the way in. The next step is to click on the Side window in FSDS, it's the one at the lower right. Select View, Backdrop, Insert from the Menu, browse to the Cessna 185 image and select it (after you have rotated it). Now we need to scale the Backdrop image so the approximate length of the fuselage is 25 ft (I chose 25 ft because I don't have true dimensions for this plane but it works for demonstration purposes and you now see the importance of having dimensions). To scale this image you select View, Backdrop, Scale from the menu and in the distance line type in 25, then on the Side window in FSDS click on the rear of the fuselage and the nose of the fuselage behind the spinner (the spinner is a separate part, all we are going to do is shape the fuselage for now). Now select File, Save as and name your Project Cessna 185. This will save the settings for the Backdrop so it will load already scaled. I would like to give you some pointers on how to save the Project file at this point. I have 2 Project files, one will be my working file and one will be used for production. They are the same with one exception. In the working Project file I leave the Part Smoothing turned off (this is the Gouraud Shading that your 3D accelerator card will use to smooth the polygons). I do this to expedite the turning of the project in the Perspective view and to allow me to see each polygon and it's respective points. The importance of this will become clearer as we begin to smooth out the rough edges of out Aircraft. So at this point create another Project file by Saving it as Cessna 185 working.

Now let's begin building the fuselage, select the tube from the tool bar. If you choose to use the menu, select Part, Insert, Tube. Make the radius 2, the length 25 (we'll use a 16 sided tube to keep this project simple), 8 sections, uncheck the closed ends and set the structure long axis as Z. You'll see the tube inserted at 0x, 0y, 0z.
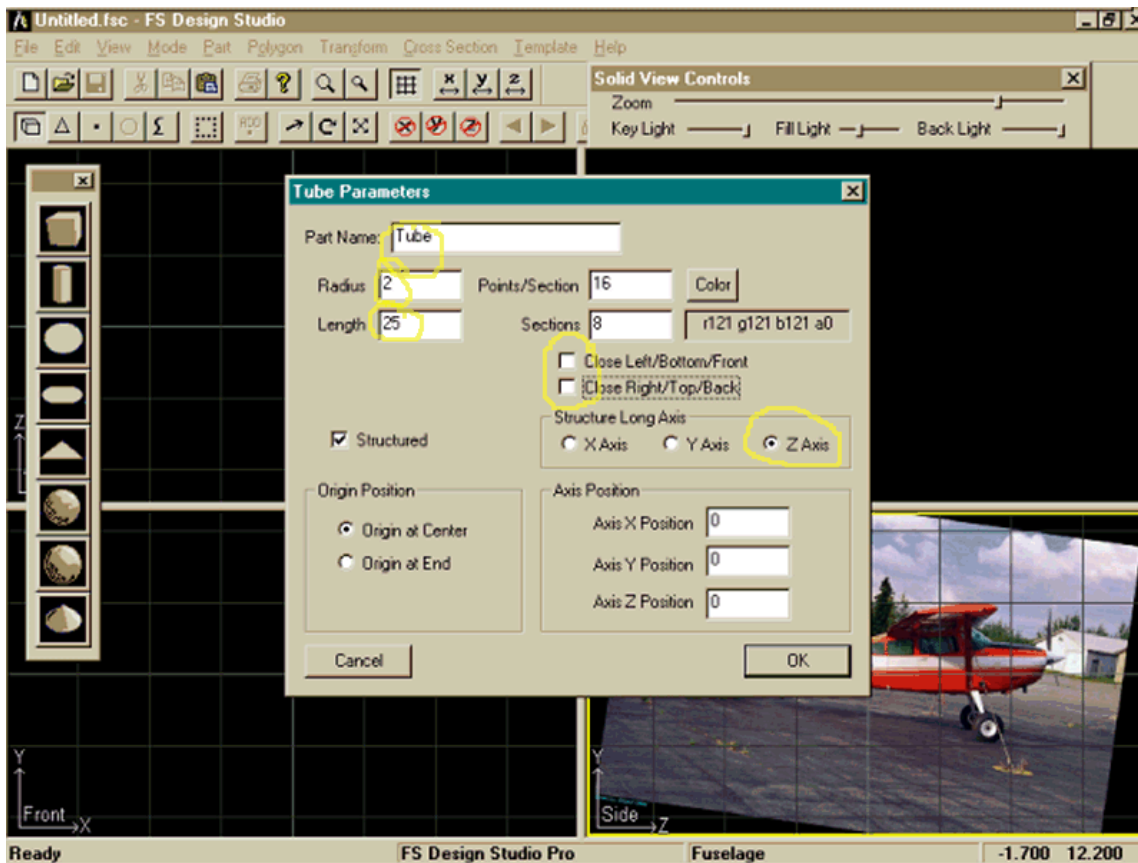
Now we can center the Backdrop by selecting View, Backdrop, Center from the menu. And clicking on the image of the Cessna 185 in the Side window until you have it centered approximately where it should be to have the ends of the tube line up with the nose and tail of the Aircraft. Don't worry about being too precise with centering, We can adjust the position of the tube as well. To move the tube we can select the Move Mode by pressing the move button down and restricting the X axis.
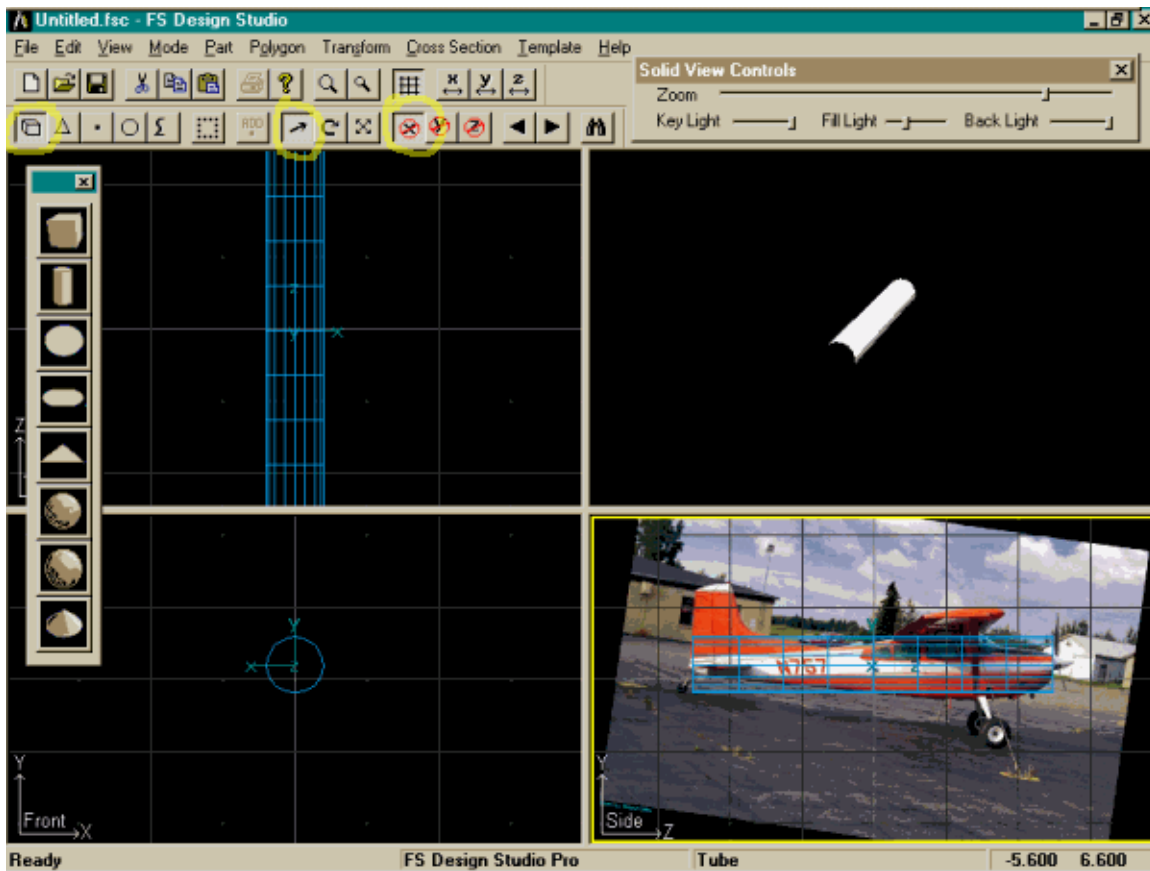
Now let's shape the tube to conform to the picture and make our fuselage. The first step is to make the tube the diameter of the largest part of the fuselage. To do this select Scale Mode and restrict the Z axis. Then drag the cursor left and right while holding the left mouse button down over the side view until it matches.
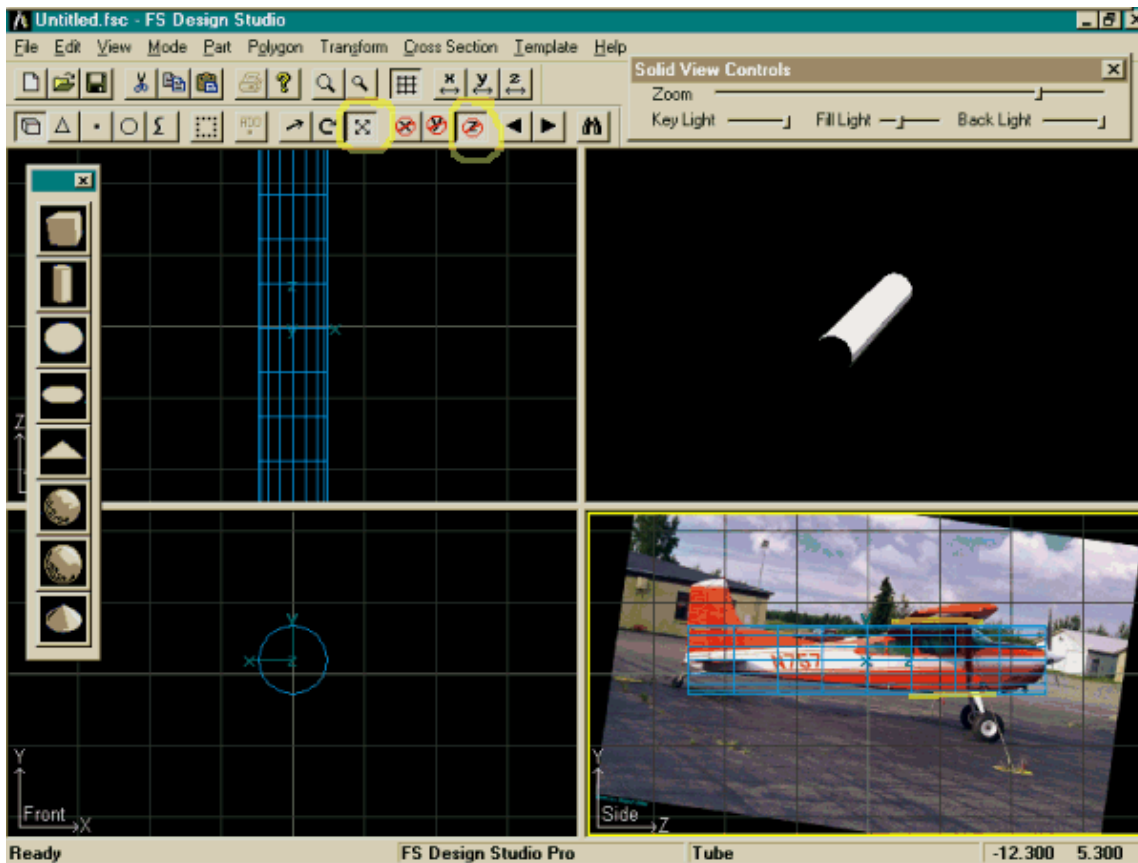
Now let's move some Cross sections out of our way to shape the rear section of the tube to match the tail of the fuselage. To do this select the Cross Section Mode, the Scale Mode and restrict the X and Y axis. Then using N for next and P for previous or by clicking on the next or previous buttons, select the 4th from the left Cross Section and move it to the right until it's next to the rear side window, do the same with the 3rd from the left and 2nd from the left.
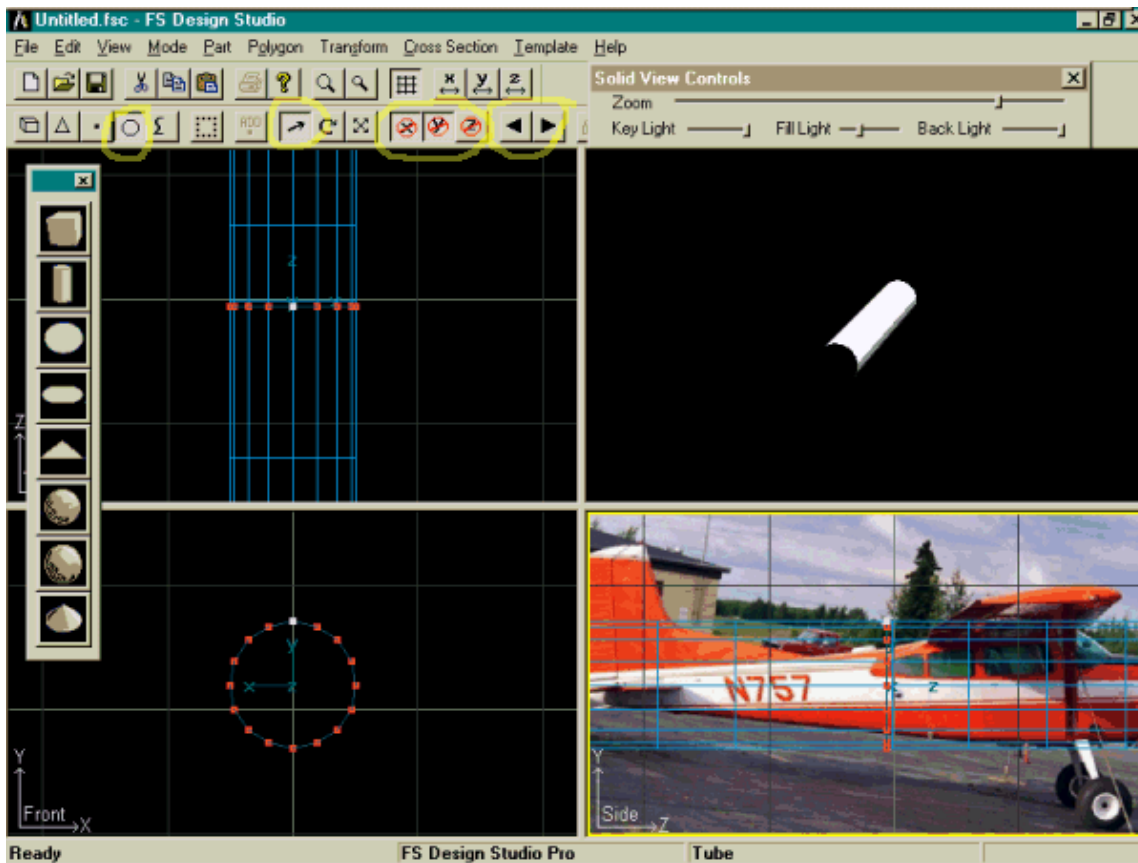
Once you have moved the cross sections out of the way we can begin Scaling them to conform to the fuselage shape. We only have a side view of the plane at this point so we are mainly concerned about making the side view look right. Begin by selecting the Scale Mode and restricting the Z axis, then drag the cursor over the side view window to scale the far-left cross section down to a size that matches the backdrop fuselage.
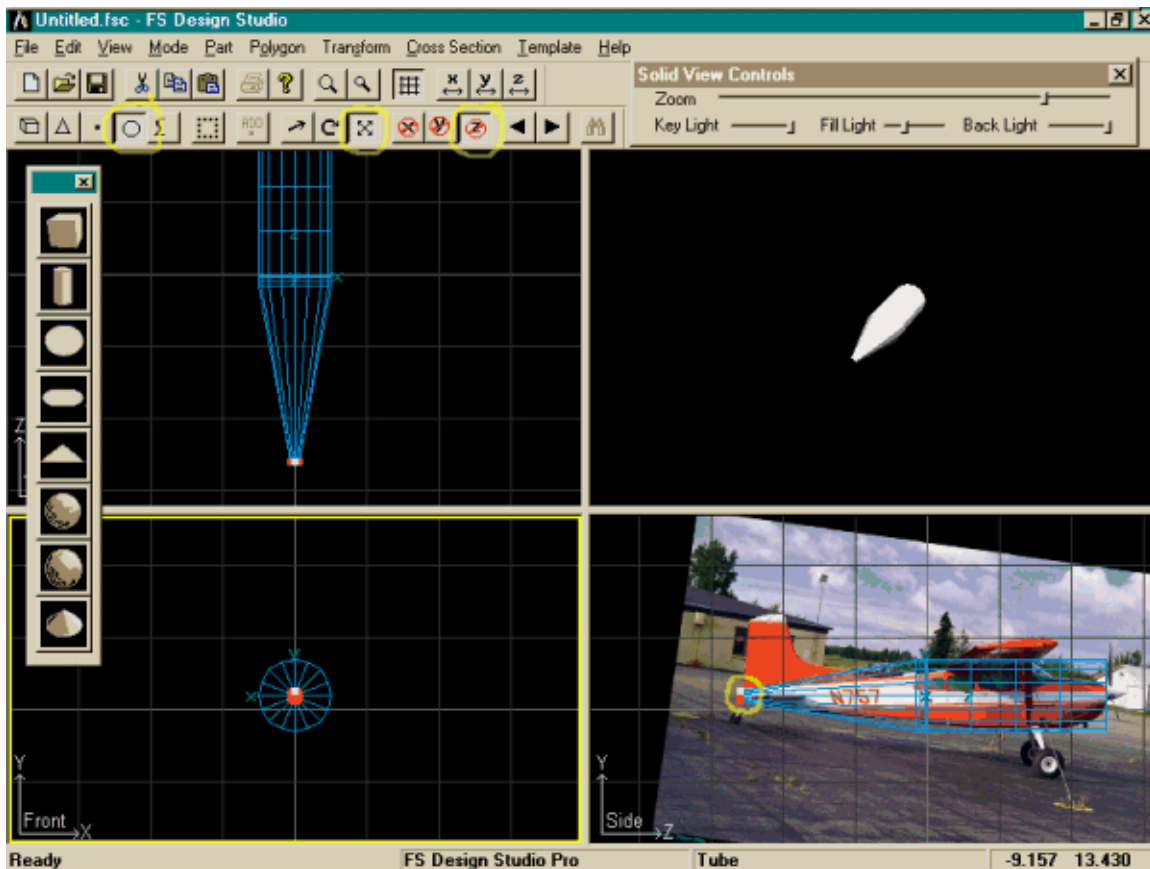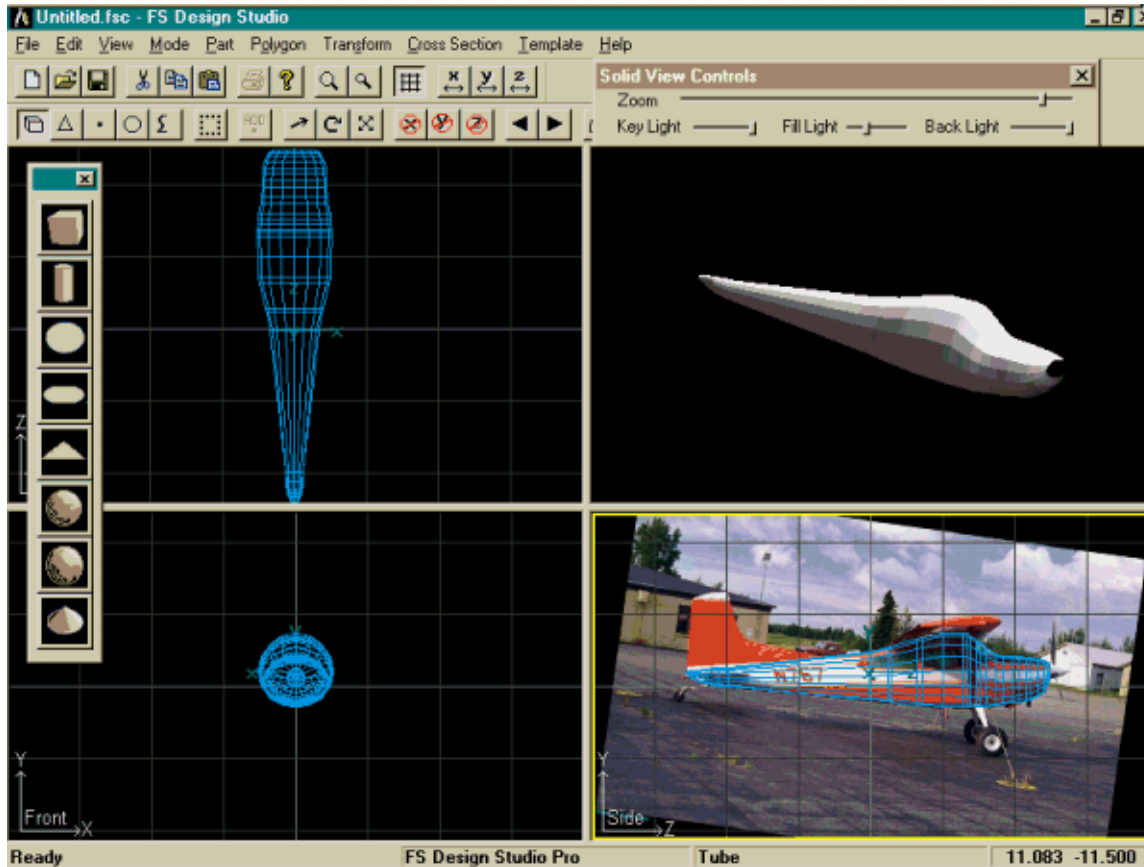
As you can see, the tail section of the fuselage is beginning to take shape. Note that the Cross Section is still rounded in the front view window. If the fuselage tapers back to a flat sided fuselage like this does and many larger jets do, you can restrict the Y and Z axis and flatten the Cross Section from side to side or widen it if that is called for. Familiarize yourself with these restrict buttons and how they affect the shape of Parts and Cross Sections. This is all explained in the help files if you are in doubt at this point. At this point we need to Scale the next 4 Cross Sections to conform to the Backdrop fuselage shape. Using the next button select each one and Scale it as you did with the previous Cross Section until it conforms to the Backdrop fuselage shape. Before you get too far, we can move some of the Cross sections into place to make the Window Posts along the sides of the Aircraft. Select the Move Mode, restrict the X and Y axis and move the Cross Sections into place. If you need to add Cross Sections to frame the windows select Cross Section, Insert cross section from the menu. They will be inserted half way between the selected and the previous Cross Section. Don't be too concerned about where they end up along the fuselage, as you have already learned, you can Move and Scale them as needed to achieve the desired shape. Remember to restrict Movement or Scaling in order to do this as needed. As you make adjustments to this Tube we need to save our work occasionally just in case something goes wrong.

I want to touch base here about how to save the parts because this will become important as we begin Splitting Parts from our fuselage and wing to make Windows, Doors, Flaps, Spoilers and Ailerons. Select Part, Save and browse to the parts folder we created earlier in the Cessna 185 folder. Give this part a name such as Fuselage 1 and save it. This not a Project file it is only a Part. When we are ready to add the Parts to our Project file we can select them as needed. By saving the Part we can always go back and edit them separately, without any other parts displayed or just selective parts displayed in order to make the parts fit together better. After we have shaped the tube into our

Fuselage we will save the Part again. This will be the starting point for many steps later on such as making Windows and Doors, Cowl Flaps, Gear Doors or anything that should conform to the Fuselage shape.

Once you have Inserted, Moved and Scaled the Cross Sections to make the basic shape of the Fuselage it should look something like this.


Now you have the basic shape of the fuselage with window posts and as you can see, cooling intakes on the engine cowl. I have Inserted, Moved and Scaled the Cross Sections to make some of the compound curves that will occur where the windscreen meets the fuselage and where the window posts will curve to make the rounded corners. It's important to have enough Cross sections to make these corners now because we will begin Splitting the fuselage into sections in the next step to allow us to move individual points around to refine the window shapes. I began by making the Side view conform to the shape, then restricted the Y and Z axis to shape the Top View to approximate the Cabin and Cowling. Save the part by selecting Part, Save. Don't be too concerned with it being perfect because in the next step we will make it smoother and adjust the contours. If you'd like to see what the polygon smoothing will do to your part, right click on the Perspective View and select Part Properties and turn Polygon Smoothing. Then using your cursor you can turn the part and see how good it looks so far. Remember that this is only the first of many steps to the finished product. Now turn off the Polygon Smoothing and we'll move on.

Select Polygon Mode by pressing the button shaped like a triangle. Now select the Selection Tool from the Tool Bar, it's the dotted square button and drag it over all the polygons on the left side of the Z axis in the Front View. The polygons will turn yellow when selected. Select Part, Split Part from the Menu and then select the Part Mode

Button and Save the part by selecting Part, Save from the Menu. Name it fuselage right.
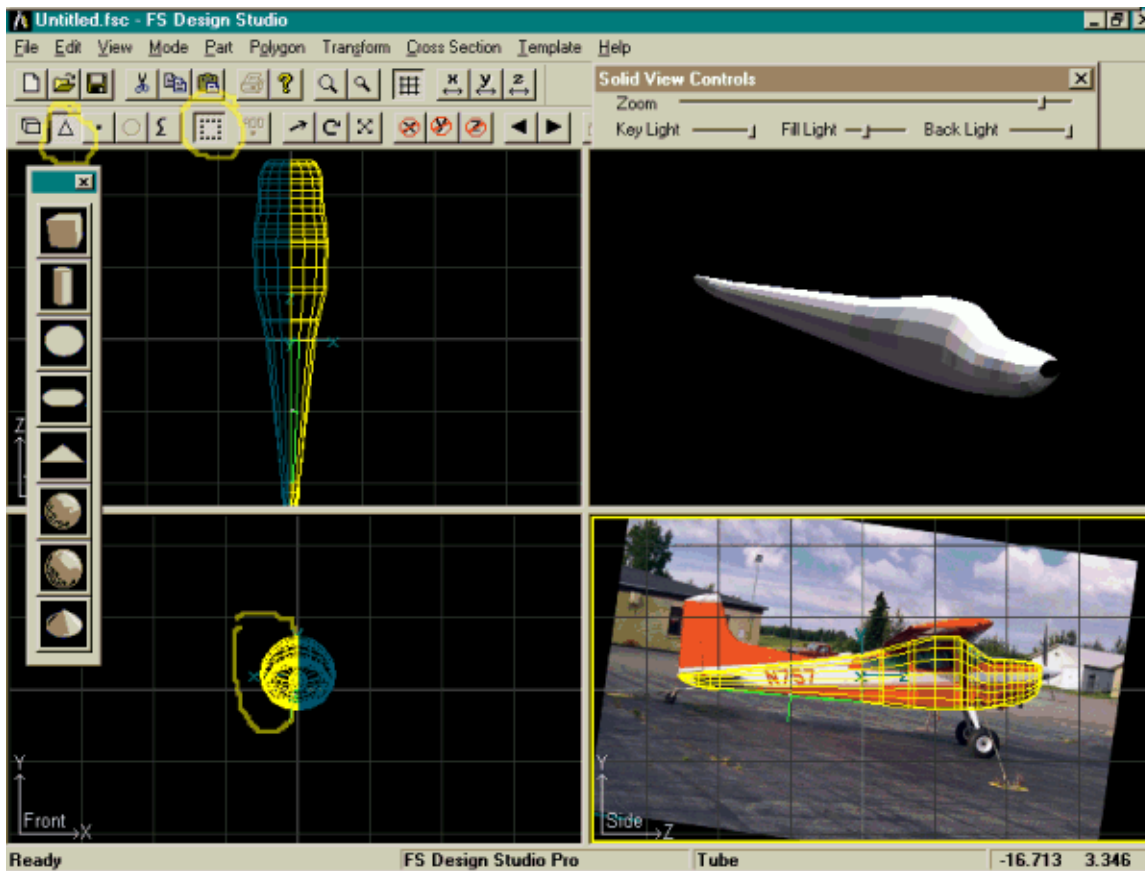
Now select Part Mode and select the left side of the fuselage by using the "N" or "P" keys or by using the Next or Previous Buttons. Select Edit, Cut or press Ctl X to cut the left side of the fuselage. Since some of the fuselage is squared on this plane we need to refine the fuselage shape at this point. To do this we need to select Point Mode and using the Select Tool we can select individual points and move them or we can select several points to move them together. Let's begin with the rear section and drag a few points together to make the transition from the rounded section to the squared section at the cabin. As you do this notice the affect it has on the Perspective View. Continue selecting points and square the cabin area until the shape looks good to you. Then work on the Cowling, it is broader at the top and rounded at the bottom. Using this method we can make complex shapes from a simple tube. Remember to save the part occasionally. I suggest saving it as "Fuselage Right A". Once the fuselage is the right shape we can begin moving points to form the Window frames and curves at the corners. Try not to move the points too far and get the lines too out of parallel. This will cause textures to become distorted. If you can't make the windows from one polygon don't worry it will look ok in the end. You may have to expand the view and zoom in occasionally during the Point moving process to get the shape just right and yes it will take time so be patient. To center the Part in the window you right click on where you want center to be and select Center from the pop up menu. To Zoom you can ues the Zoom Buttons or press "I" for Zoom in and "O" for Zoom out. Save the part often and if you make a mistake just cut the part and load it from your last save.
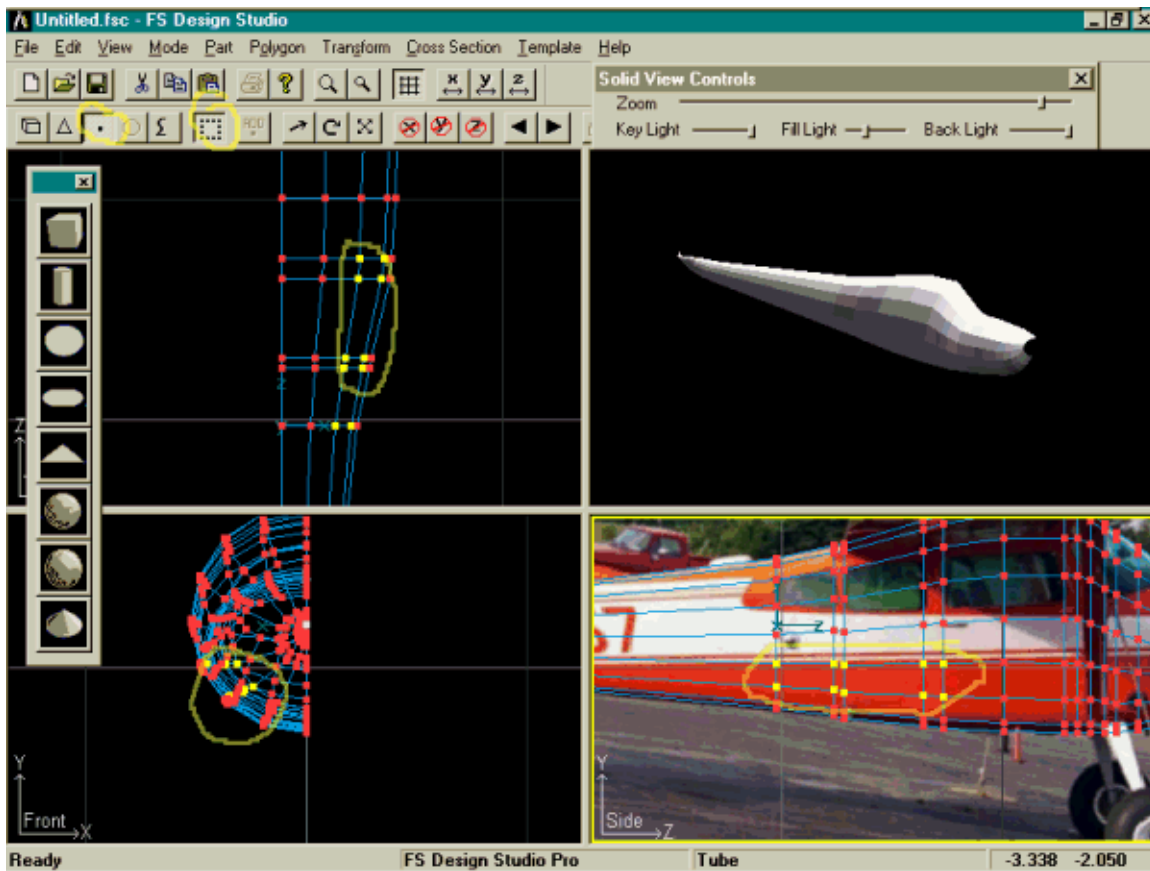
When you have finished moving all the Points around your fuselage should look something like this. Be sure you save the Part once you have a satisfactory shape.
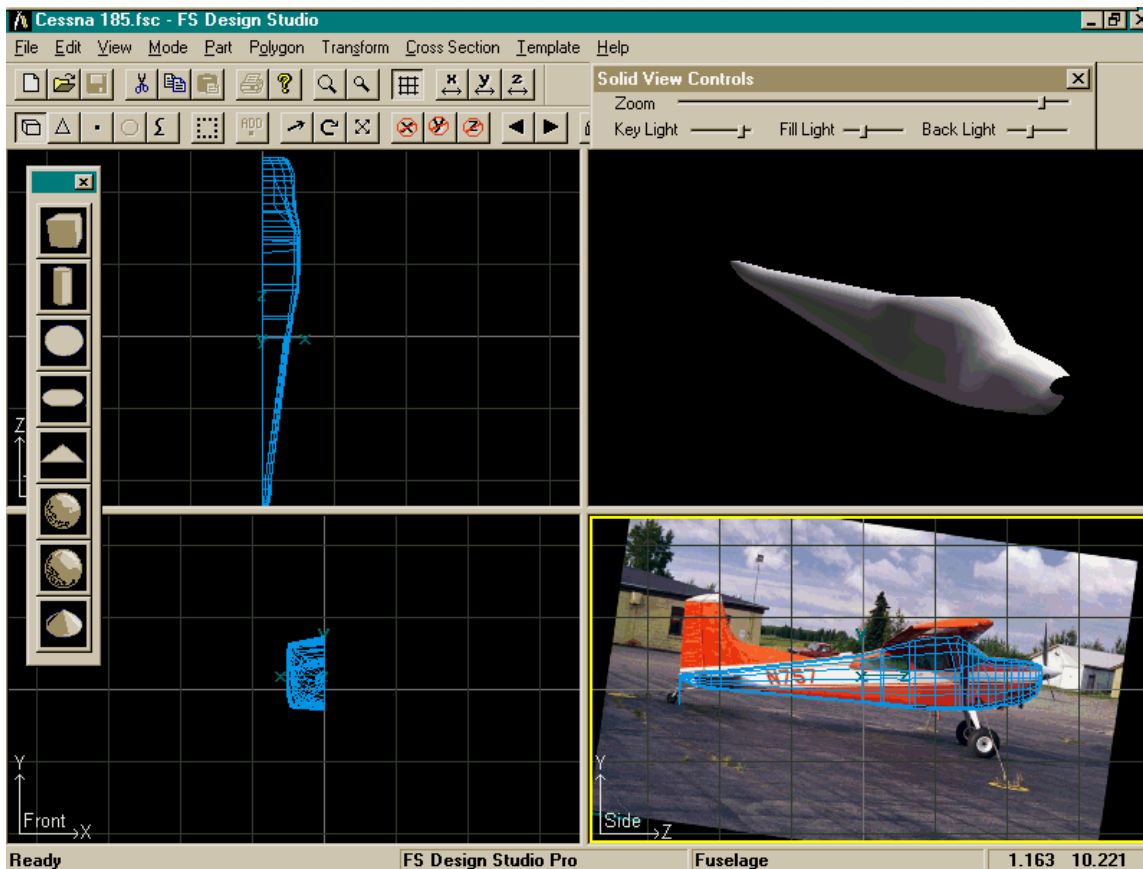
Right click on the Side View select the Part Properties and turn on the Polygon Smoothing.

As you can see, I have left the windows simple in shape to speed up the process of making this tutorial, by adding cross sections to the complete Fuselage prior to Splitting the right half, you can make much smoother curves at the window corners. As you can see the windows have now taken shape and all we have to do is Select the Polygons and Split them from this Part. So select the Polygon Mode, the Selection Tool and drag it over the Polygons that make the windows so they turn yellow. We don't want to Select the window framing and to avoid this we can click the center of each window polygon to make it the active ploygon (you'll know it's active because it will turn white and have the visual direction flag sticking out of the center of it), then press Shift S to select it. Once you have selected all of them they will be yellow for the non current and green for the current one. Then select Part, Split Selected.
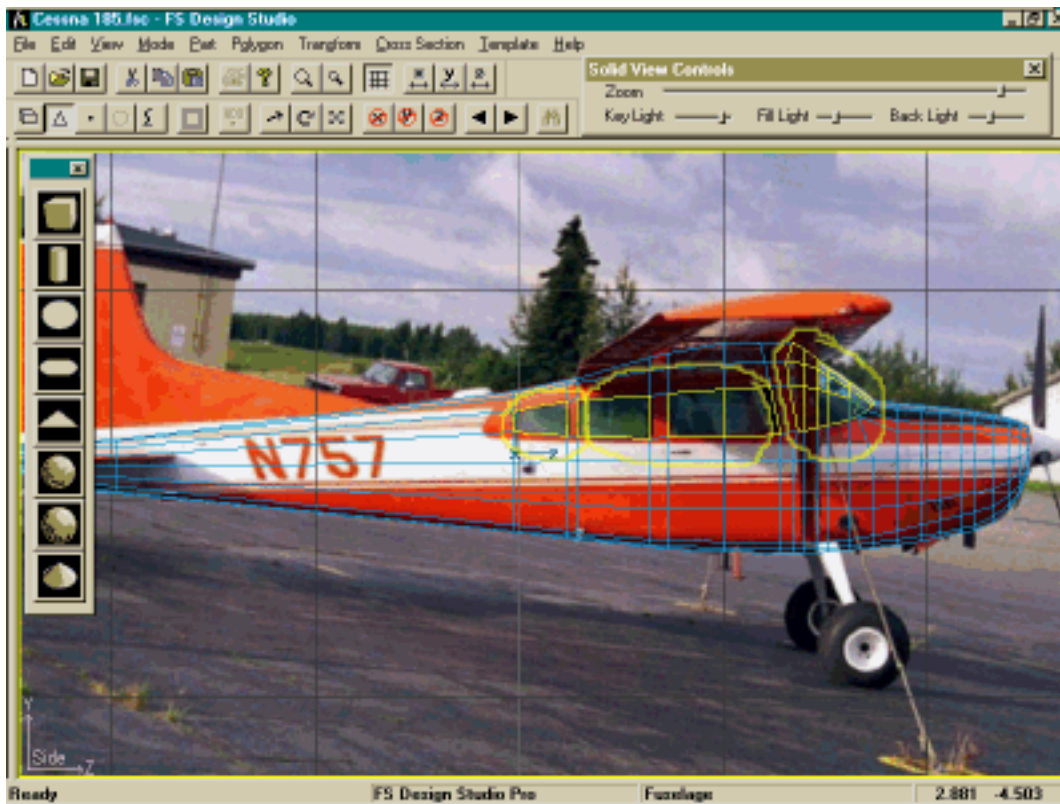
Right click on the screen, select Part Properties and set the color and set the transparency level. The transparency level is explained in the help files. Then save this part as Windows Right. You have just made a see through Cockpit for your Cessna 185, comgradulations! Next select Edit, Check Parts and FSDS will fix all the non planar Ploygons that resulted from our moving the points around. Once this has been done save the Windows as "Windows Right NP" indicating you have performed the non planar fix. Select Point Mode and use the Selection Tool to select individual Points and adjust them as needed to smooth the windscreen in the Perspective View. Press N and select the fuselage which has had the non planar fix applied if you clicked yes to the question to fix all parts. Save the fuselage as "Fuselage Right NP" indicating you applied the non planar fix to it. Now to make the left half or our fuselage. Control C will copy the current part, Control V will paste it. So do this to the fueslage and then select Part Mode, select Transform, Flip Y, select Transform Rotate Z 180. The Right Fuselage you just pasted will be duplicated on the left. Press Shift S to select the left and right halves, select Part, Join Selected, Select Part, Snap to Scale to eliminate the duplicate points and save the new joined fuselage as "Fuselage NP". Do the same with the windows. Once you have joined both halves save the Project. At this point you can save your working project with the Poly Smoothing turned off and the Production Project file with Poly Smoothing turned on.
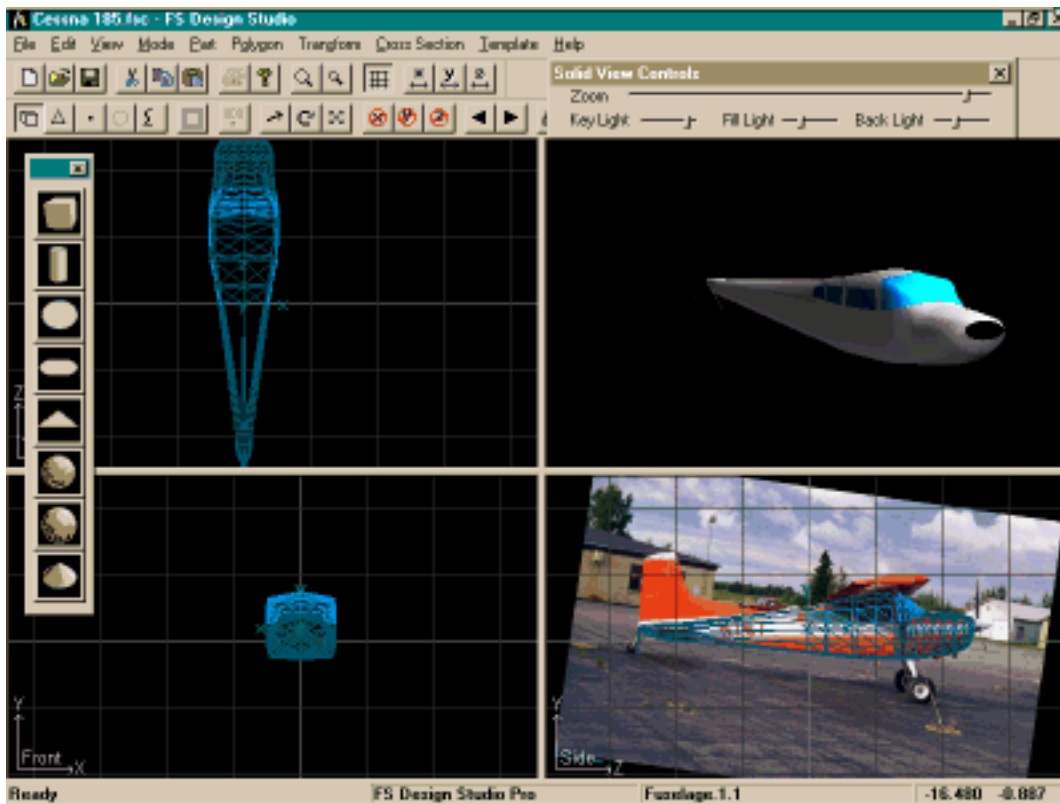
At this point we need to make the inside of the cabin so you don't see through the fuselage when looking through the windows. Using the "N" and "P" keys, select fuselage NP and press "Ctl C" to copy it then press "Ctl V" to paste it. We will want to Split the Tail section from this and make bulkheads at the rear and front of the cabin. To do this select Polygon Mode and the Selection Tool. Drag the Selection tool over the Polygons behind the rear windows. Then select Part, Split Part then select Part Mode and "Ctl X" to cut the tail section, we don't need it.
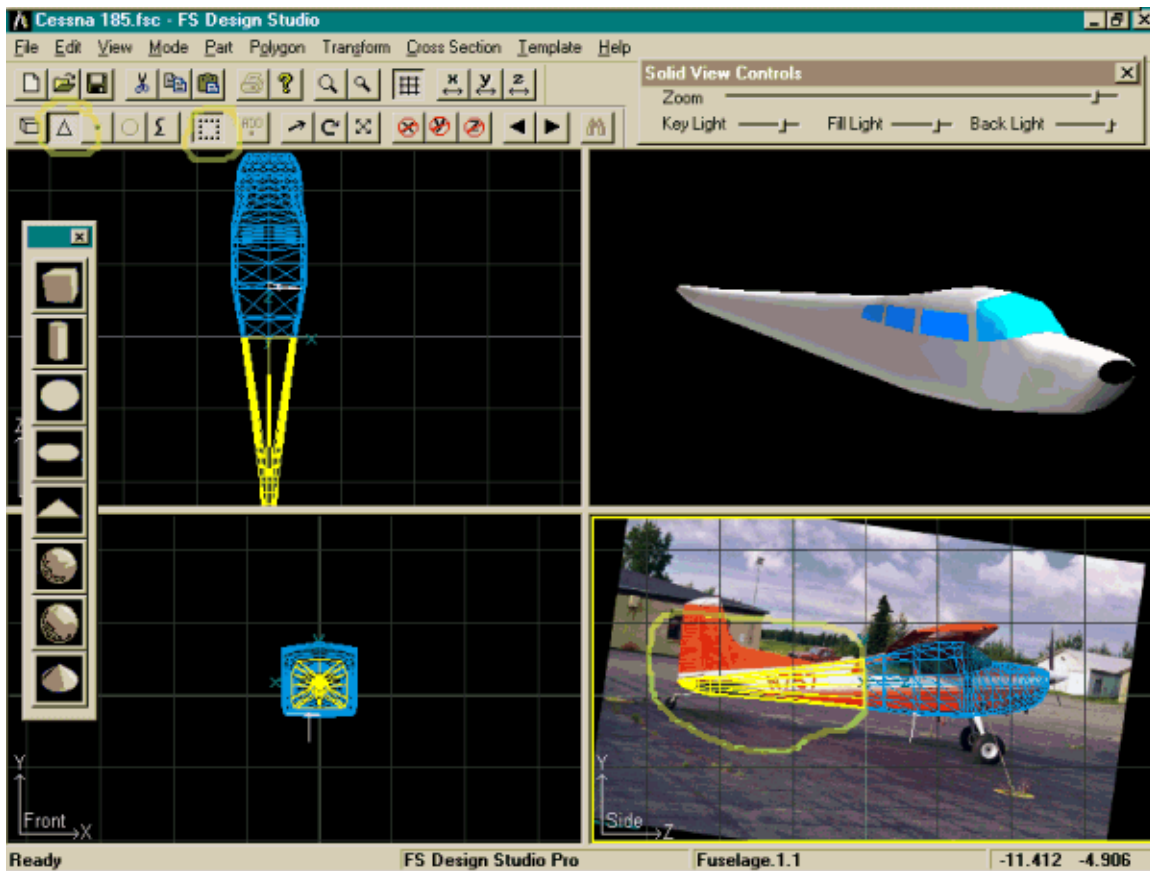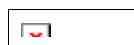
When you have done this you will have just the cabin and cowling left to use as the interior part.
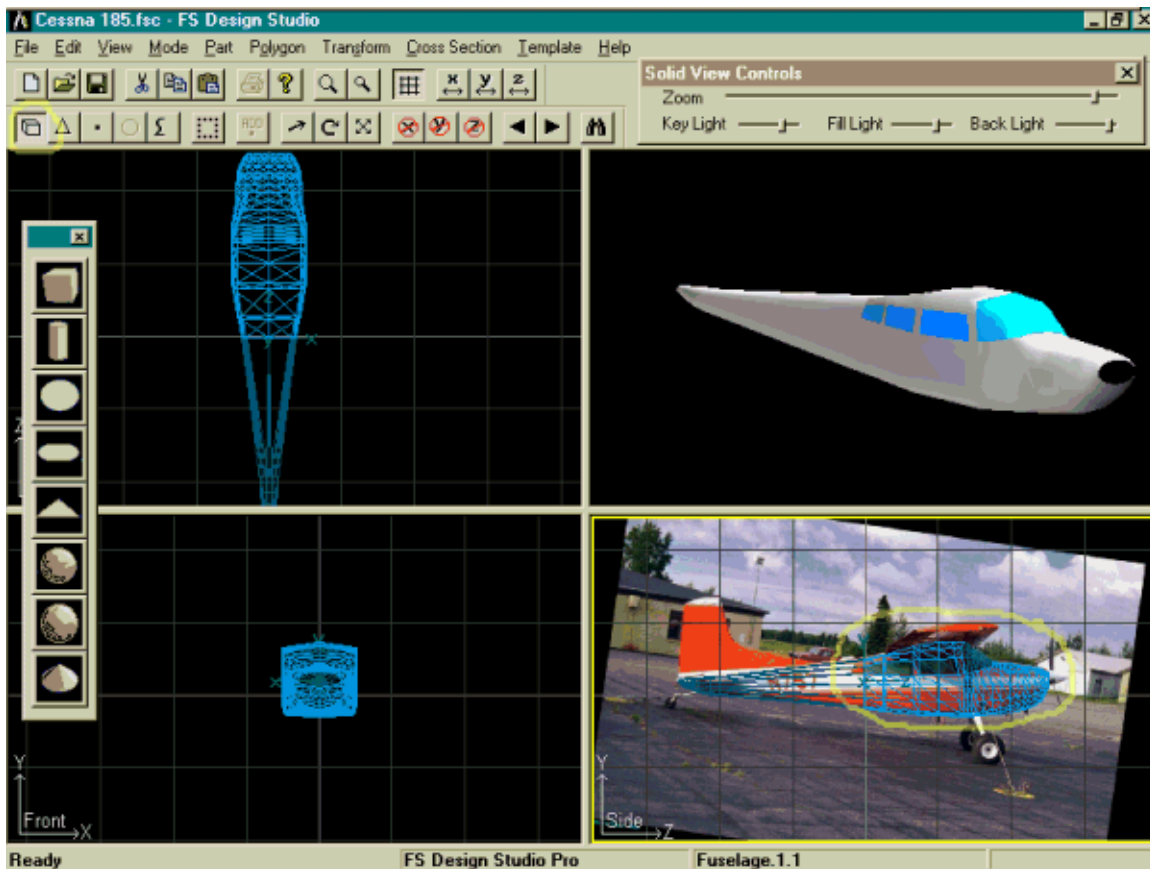
You'll notice that we can still see through the fuselage so select Poly Mode and press "A" to select all the polygons. Then select Polygon, Flip/All Selected. Now you can see the window posts through the windows. Notice the direction of the polygon visual flag as you flip all the polygons and that the cowling is also solid looking, but if you rotate the Perspective view you can still see all the way through the fuselage behind the rear windows and through the cooling intake in the cowling. We can eliminate this by making a bulkhead at the rear of the cabin and at the front of it (a firewall behind the engine). To do this we select Point Mode and use the Selection Tool to select the points on the right rear of the cabin.
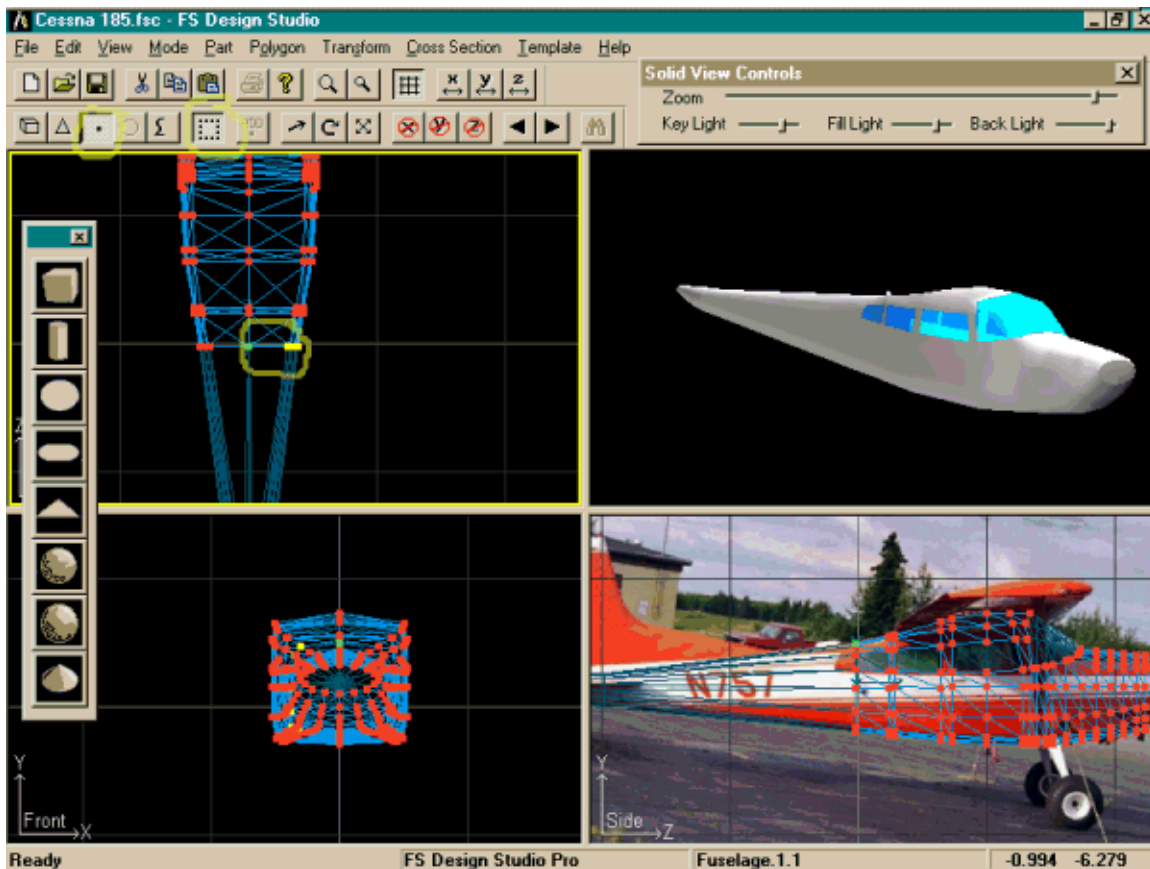
Then select Polygon, Make Polygon. (You might be wondering why we only selected half or the points at the rear. It's because we flipped and rotated the left half of the fuselage into place before we joined the 2 halves and the polygon would twist to reflect this if we selected all of the points.) Now press "Shift S" to select this polygon and select Part, Split Selected. Then select Part Mode and press "Ctl C" to copy the part and "Ctl V" to paste it. Now select Translate, Flip y, Translate Rotate z 180. Select both of these parts by using "Shift S" and join them as we did with the fuselage and windows. Be sure you "Snap to Scale" to eliminate duplicate points. Once you have a complete rear bulkhead, select it by pressing "Shift S" then using the "N" and "P" keys select the cabin and press "Shift S" to select this part. Then Select Part, Join Selected and again "Snap to Scale" to eliminate duplicate points. Now rotate the Perspective view and you can see that the cabin interior now looks solid. Make sure the polygon view flags are pointing to the interior prior to joining the bulkhead halves. Remember to save the Cabin Interior as you move through these steps so if anything happens you will have saved your work. Now take these same steps to make the front bulkhead (firewall behind the engine) except you will want to mirror the polygons on this one so it is visible through the windows and through the cooling intake. Then join the front bulkhead to the cabin as we did with the rear bulkhead and save the Cabin Interior as a part and save the Project files.

Part 2