# Scale Matters

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# Cessna 152: Instrument panel


Photo of a full size Cessna 152 Instrument panel

## Scale Instrument Panel Project

I am currently building a Model Design Cessna 152 which has a wingspan of around 3.6 meter. This size model aircraft calls out for scale detail. As an example a 3.6 meter wing if void of any surface scale texture will look like a surf board.
As I build each section of the aircraft I search the internet for pictures that provide detail to assist me in replicating the full size aircraft. I store this reference information so that I can continue to refer to it and add to it as I build the model.

When adding scale detail I am always mindful of the following:

1) The scale detail must not compromise the structural integrity of the aircraft.
2) The scale detail must not significantly add to the weight of the aircraft.

On the Cessna 152 the instrument panel provides a good opportunity to add detail that will help characterize the aircraft. This will also hopefully draw any potentially interested observer into having a really good look at the aircraft and enjoy the experience.

## The following takes your step by step through the process.


Cessna
Cessna
Cessna
DIGITAL PHOTO FRAME


WARNING
BEFORE STARTING ENGINE, ENSURE
SEATS ARE LOCKED IN POSITION
BENDIX KING
122,70
120,80
120,80
120,80
COMM
STBY
NAV
STBY
PULL TEST OFF
CHAN
PULL 25K
PULL IDENT
TIMER
MODE
ALT
Cessna
DIGITAL PHOTO FRAME
VERTICAL SPEED
UP
CABIN AIR
PULL
PULL


WARNING
BEFORE STARTING ENGINE, ENSURE THAT SEATS ARE LOCKED IN POSITION
CAUTION
SPIN RECOVERY
DIGITAL PHOTO FRAME
Cessna
PARKING BRAKE
LIGHTER
CARB HEAT
PRIMER
MASTER
OFF
BOTH
START
ON
OFF
PITOT DOME NAV STROBE BCN TAXI LDG
LIGHTS
ALT
FUEL IND
BCN PILOT
STROBE LTS
LDG LTS


PARKING BRAKE
LIGHTER
OIL TEMP
OIL PRESS
MASTER
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BOTH
OFF
START
ON
OFF
PITOT
DOME
NAV


WARNING
SPIN RECOVERY
DIGITAL PHOTO FRAME
CARB HEAT
ON
PULL
LIGHTER
CABIN AIR
ALT
FUEL IND
BCN PILOT
STROBE LTS
LDG LTS
INST LTS
NAV DOME
ON
OFF
PITOT DOME NAV STROBE BCN TAXI LDG
LIGHTS


## Step One: Blank Instrument Panel

I used the above detailed picture of the full-size Cessna 152 instrument panel as the reference for the instrument panel for the scale model. I often used the PC application Corel Draw to do this:

a) Open a new CorelDraw drawing and Draw a rectangle in CorelDraw that represents the overall dimensions of the available space in the model for the instrument panel.
b) Import into this drawing the image of the real aircraft instrument panel.
c) Resize the real aircraft image until it fits within the boundaries of the rectangle that had been previously draw.
d) Use the drawing tools within CorelDraw you can place circles and rectangle in the positions over the backdrop of the real aircraft instrument panel and adjust them so their size matches the size required for the instrument cutout.
e) Once you have done this step you can then delete the real aircraft image leaving only the cut out details for your scale blank instrument panel.
f) This file becomes the template which you can either printout to 1:1 scale and use to curt out manually your blank instrument panel or use this CorelDraw file to control a laser cutter to manufacture the blank instrument panel. The blank instrument panel can be make from Perspex, balsa or plywood depending on the application.
g) Once you are happy with fit of the blank instrument panel you can move onto he next step

Trial fit of the blank instrument panel in the model aircraft.

**Step 2: Instrument Face Artwork**

The next step is to generate the art work for the required instrument faces. Again I use CorelDRAW for this step.

a) Open a new CorelDraw drawing and use the load function to load in the bitmaps or the images of the required instrument faces that you had previously searched for and found on the internet and saved. Arrange them in any order and the position is not critical.

b) Using the circle tool in CorelDraw, place circles down and adjust their size for the required diameter for each instrument face. You can place as many circles down as you need, their position on the sheet is not critical. I usually colour the circles bright yellow as this will highlight and mark the cut line for my scissor when I finally cut out my masted dash sheet.

c) Place each circle over the individual bitmap or image of each instrument face and then resize the bitmap or image of the instrument face to match the size of the yellow circle. The instrument faces will now be the correct size for your scale dash.

d) You can spend as long as you like with the standard CorelDRAW tools to sharpen edit or modify each instrument face to your requirements and personal taste. The more time you spend editing the image the better you will get at making sharp instrument faces. These instrument faces become a library which can also be resized for any other instrument panel that you may like to make. After editing the instrument faces you can select each of the instrument faces and group all the editing you have made so that the instrument face can then be scale as one piece. If it needs to be edited again just select it and ungroup the selection. One of the thing I do in this step depending on the scale/ size of the instrument panel is to edit out the needles from my instrument face. This make the instrument face look

much better when adding the active instrument needle as described below in susiquent steps..


Individual bitmap or image of the tachometer in the Cessna 152, the image on the right has the needle edited out and you may be able to just see the yellow circle used as the cutting guide.

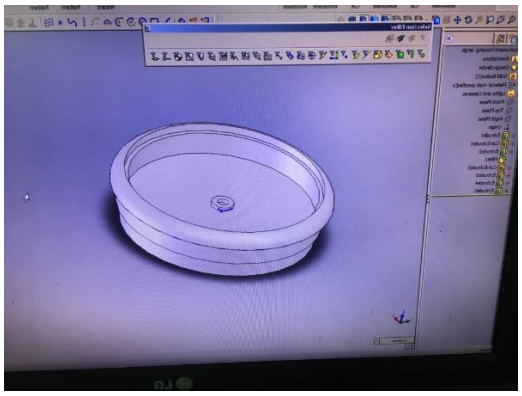
This is how the finished instrument face artwork looks once ready for printing and cutting out.

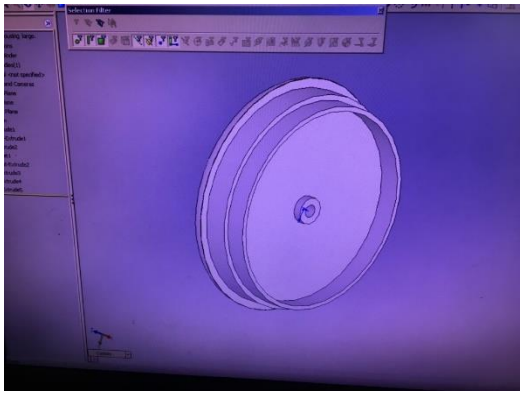
## Step 3: Designing and 3D printing the Instrument Body

Using a Computer Aided Design Package (CAD) I then draw up the design of the instrument body which will then be 3D printed to form the main instrument body housing. This part can be draw to the scale required for your current project say 1/3 scale and saved as an STL file. If you require a different size instrument body for another project this can be easily scaled accordingly using you 3D printer driver software.

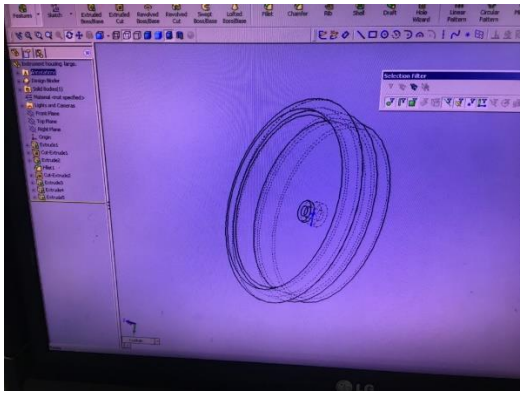
a) The design of the Instrument body is straight forward and contained the following elements:
   - The instrument body needs to be the correct diameter to fit nicely into the holes what were previously put into the blank instrument panel.
   - The instrument body needs a front bezel that replicated the bezel in the original instrument and that has a lip in which the Perspex clear instrument window can sit in.

- The instrument body needs sufficient depth to allow the inserting of the printed instrument face to look natural and sufficient depth for the needle movement if this is to be added.
- The instrument body needs to have a centre shaft to enable the inserting of the bearing bush for the needle movement.





**Front and back view of the CAD instrument body design**



**Transparent view of the CAD instrument body design**

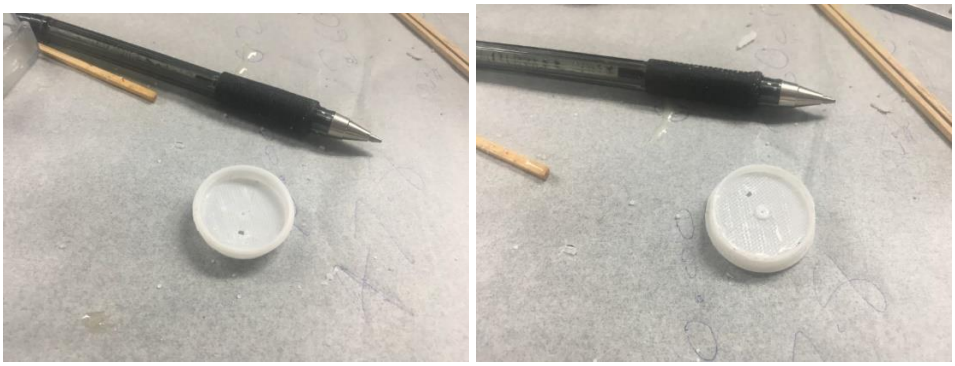
b) Once you are happy with the design, the designed can be saves and exported as an STL file that will be compatible with the 3D printer process.

The STL blank instrument design can then be fabricated on the 3D printer. I print the instrument body with front face facing up.

I print the instrument body using ABS. Black ABS can be used for black instrument bodies so you don't have to paint front of the Bessel.

If am going to back light the instruments I will use white ADS to allow the light to shine through the instrument body from behind. In this case the front bezel will have to be painted black.

**White ABS instrument bobies with their bessels painted black**



**Front and rear view of the 3D printed instrument body with support structure removed**

## Step 4: Adding the Instrument artwork to the instrument body.

a) The instrument artwork previously generated in **step 2:** is printed and each instrument face is cut out using fine scissors. These instrument faces are then glued inside the instrument bodies. I use white wood glue for this step as it dries clear.

## Step 5: Active instrument movement *(This step can be omitted if you are not going to make the instrument needles move).*

a) The centre shaft hole can be drilled out to allow for the inserting of the bearing bush for the needle movement. The bearing bush is simply a miniature dolls house eyelet see https://www.eyeletoutlet.com
Eyelet outlet have some really interest stuff, don't show the better half…

Instrument body with the bearing bush inserted for the active needle movement

b) The instrument needles are made from bent fuse wire that is passed through the bearing bush to the front to form the needle arm and bent at the back with a small loop to which a blob of solder is added to act as the mass of the pendulum. The angle of the needle with respect to the pendulum can be adjusted so that the needle arm rests in the required position for each instrument.

c) I either glue to the fuse wire needle arm a needle craved from abs plastic to replicate the original instrument needle or glue a previously cut out instrument face to the fuse wire to replicate an instrument movement like artificial horizon or level indicator. If done carefully these scale dials will simulate the movement of the real instrument.

Front and rear view of the instrument body with the fuse wire installed to form the needle and pendulum movement. Note before this the stage the instrument face artwork should be glued in but it is omitted hear for visual clarity.

**Step 6: Adding the instrument clear face.**

a) I fabricate the instrument clear faces using clear thin Perspex and I usually laser cut then as I can make the all at once using the previously generated CoreDRAW files. It is just as easy to do them manually by cutting then out of clear shirt box type clear plastic using fine scissors.
b) The instrument clear faces are then glued into the instrument body using canopy clue, white wood glue will also work.

First image: instrument clear face after laser cutting with the protective plastic still attached.

Second image: Instrument clear face inserted into instrument body, instrument artwork not installed just for clarity.

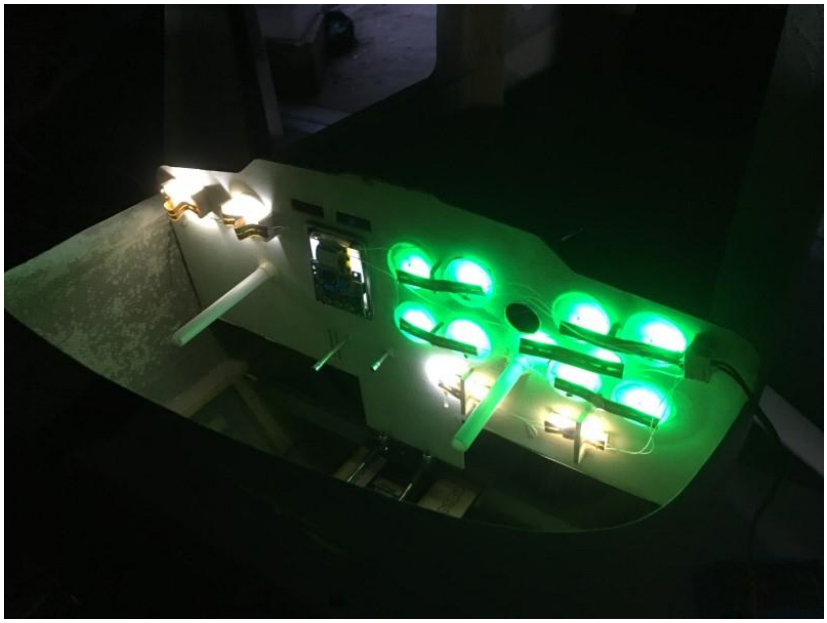
A range of instrument completed and ready for installing into the blank instrument panel.


**Close up of two instrument with active movements. Both these instruments have part of the center of the instrument face glued to the needle mechanism.**

## Step 7: Adding additional details.

a) Items like warning or information labels can be simply be drawn up using a range of computer tools and printed and glue to the instrument panel to add additional detail.
b) Switched and knobs can be designed using CAD and then printed or fabricated manually to add additional detail to the instrument panel.
c) With this instrument panel for my Cessna 152 I added back lighting to provide another level of detail. If there is any interest in how to do this I can provide more details if required.
d) The control yoke have also been designed and fabricated, I am currently looking at having them move using servos.


**Nearly completed Cessna 152 instrument panel with additional 3D designed and printed parts such as switches and knobs.**



**Back side of instrument panel showing the LED back lighting.**

**Back lighting of the instrument panel from the front Pilots view.**