# A Basic Flight Simulator in Excel #7 – *plotting the landscape, creating a joystick dial, custom formatting the joystick, creating a Reset button and a Throttle scroll bar*

– This section starts by charting the landscape and formatting the chart.

– A semitransparent joystick dial is created and introduced behind the joystick chart as sprite in an additional background chart.

– The reset button is upgraded and a special throttle scroll bar and throttle macro are created. In the end all the controls will be grouped and placed at the bottom of the landscape chart.

– The background chart behind the joystick will later be used to display other instruments such as a speed indicator, an altimeter, heading, pitch and roll indicators, a rate of climb display, etc.

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by George Lungu

Plotting the landscape:

- Copy the worksheet Tutorial_6 and rename the new one Tutorial_7.
- In the previous tutorial we created a 2D scatter chart based on the data from range B81:B8080 for x and E81:E8080 for y.
- Readjust the scale for the x axis to [-10,10] and for the y axis to [-7,5] then delete both axes and gridlines.
- Create a reset button and assign the *Reset* macro to it.
- Increase the size of the chart and give it roughly a 10x6 form factor. - Change the chart background to black or a color you like and now you can take it for a virtual trial flight by resetting it and then clicking on the center of the joystick chart to start the macro.
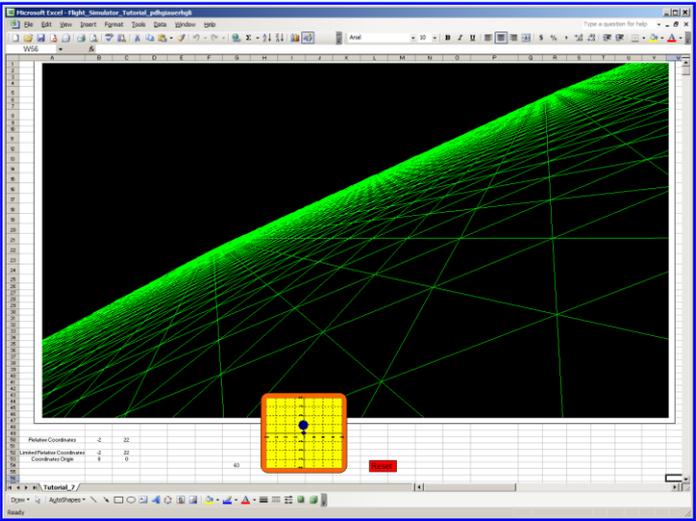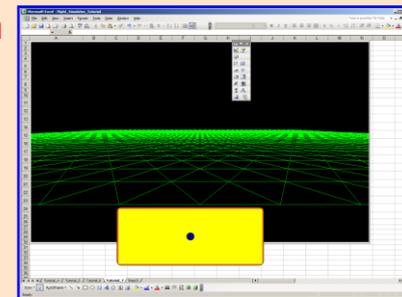
Formatting the joystick chart:

- Right now, the joystick chart takes data from the range B32:C53.
- De-assign the macro after you set the joystick a little offset so you can format the chart.
- Click the center point once then wait 2 second and click it again. The cursor turned into a cross. Choose a red marker for the center of size 8 and repeat the operation for the other end of the joystick (the handle) choosing a blue circle of size 20. You can of course choose the colors and sizes you like but a small red pivot point for the joystick is useful in referencing (zeroing) the joystick neutral at the start of the macro.
- Make sure y-axis has a scale of [-100, 100] and the x axis a scale of [-250, 250]. Delete all the gridlines and chart axes.

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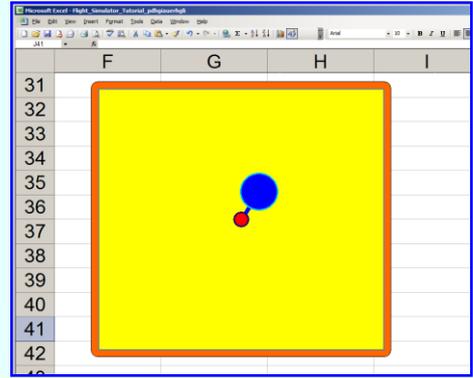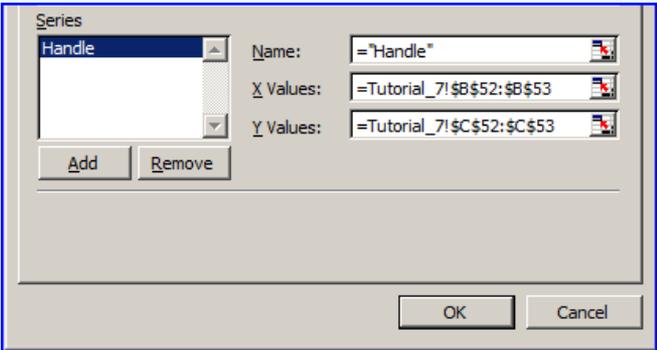
Resize both the landscape chart and the joystick chart:

- Bring up the "Draw" menu (View=>Toolbars=>Drawing) and click the white arrow within the palette to get into drawing mode (the cursor will change from a cross into an arrow).
- Double click the landscape chart => Size => change "Height" to 7" and "Width" to 11.7"
- Double click the joystick chart => Size => change "Height" to 2" and "Width" to 5". We need to oversize the width of the joystick chart so that we can add a instrument panel integrated into this chart.

Create a dial for the joystick chart:
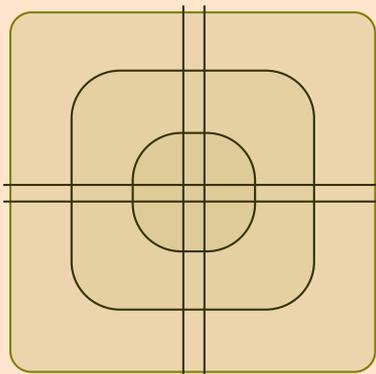
- Using the Draw menu create a semitransparent dial that will be displayed on a chart twin with the joystick chart placed under, aligned with and grouped with the joystick chart. I created the shape on the left using the draw menu.
- There are three rounded squares overlapped on top of each other. The bottom square is 1.8" and has a transparency of 85%, the next one is 1.2" size wise and it has a transparency of 94%. Finally the top rounded square has a side length of 0.6" and a transparency of 94%.

alignment

-The line segments are all of minimum width and all have a length of 1.85".
- You need to align all these shapes carefully knowing that when you select any of them you get some round white markers which are placed exactly on the middle of their sides. Try to align these markers of the squares with a cross chosen arbitrarily in the worksheet made out of cell borders.
- The lines will serve as guidance for the joystick for certain maneuvers when we need to have pure pitch adjustment or pure roll adjustment. Align these with care, making sure the spacing between each pair is the same.

alignment

**alignment**

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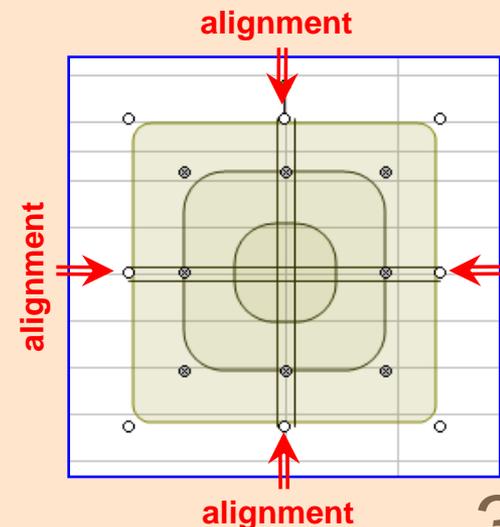
Two options in adding the joystick dial as the background of the Joystick chart:

- In Excel we can use sprites (pictures attached to data points) for certain things that can translate but do not need to rotate. Instrument panels are an excellent example.

- Besides being computer resource hogs slowing down the model, the problem with the sprites is twofold, first is that they do not rotate so if we need to create rotating instrument needles (or arms) we need to use a lot of sprites, one for each angle of the needle which can make the model sluggish plus there are labor intensive to produce.

- Another problem with the sprites is that they are technically curve markers and all the curve markers always lay on top of any of the chart curves at any time. We can change the order of the markers with respect to each other (using: Format Data Series => Series Order) but the sad truth is that creating a needle and rotating notches out of curve segments will always result being placed behind the dial sprites.

- There are two solutions to this problem:

>   *1.*   We can create a picture mostly out of transparent or translucent shapes, include few dials and after grouping everything together save the picture and use it as a background in the joystick chart. It's needless to say that the chart background will always be behind any curves subsequently added to the chart (rotating instrument needles and notches), which is what we need in our case.

>   *2.*   We can create a twin chart, let's call it background chart and use several pictures of the control panel dials as sprites (which we can move around in any position we need). We can choose a "Pattern => Area => None" for both the Chart Area and the Plot Area if we need to be able to see through the control panel and we could even draw the dials translucent (which is cool). At the end we need to stack the joystick chart on top of the background chart and group everything together. The joystick chart must also contain the needle curves and it must absolutely have the plot area and chart areas missing (transparent) so that the dials are visible under the rotating needles. Despite being more resource intensive the advantage of this method is versatility (we can have many pre-programmed instrument panels configurations that the user can choose on-the-fly). We will use this latter case for our model.
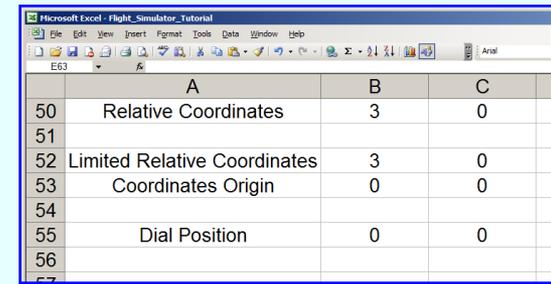
Create a better looking Reset button:

- I acknowledge Peter Bartholomew for some of the ideas used here.

- In the draw menu choose Auto Shapes => Basic Shapes => Rounded Rectangle.

- Drag draw a rounded rectangle and adjust the side (using the yellow handle) so that it becomes a half circle.

- Double click the shape and adjust the size to: height=0.26" and width=0.58" then change the color to red and remove the border (Colors and Lines => Line Color => No Line)

- Choose a crescent from the Auto Shapes menu and drag draw it. You need to adjust the form factor so that it matches the edge of the first shape you drew (make it a bit smaller).

- Change the color of the crescent to yellow with about 70% transparency and no line (border)

- Copy the first shape (red shape), decrease its size a bit (22", 55'), make it brown and add some transparency (70%)

- Click the text box from the Draw menu, then select the rectangle and type "Reset"

- With the shape selected change the text color to white from the "Font Color" icon in the "Formatting" menu on top of the page, then using the "Format Auto Shape" menu change the alignment to Center + Center.

- Now overlap the three shapes in the order: A (on bottom) => C (middle) and B (top) and then select them all and then group them to obtain D. Use the "Order" submenu in the "Draw" menu to achieve this. You might need to adjust their sizes to obtain a good looking button. Make sure none of the shapes has a border (Double Click => Format Auto Shapes => Colors and Lines => Line Color => No Line).

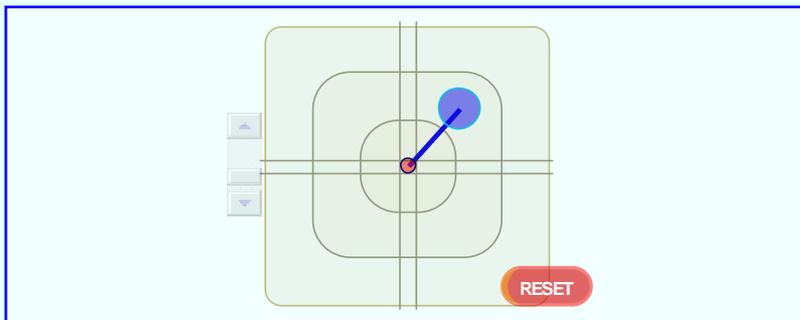- Select the group => Right Click => Assign Macro => "Reset" and then delete the old Reset button.
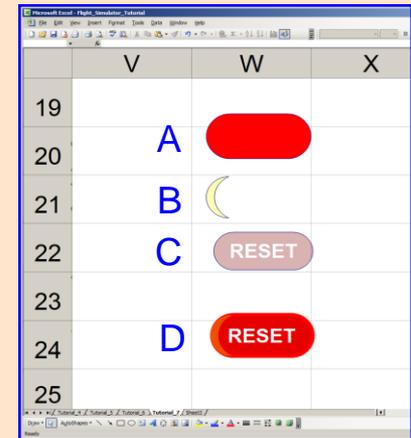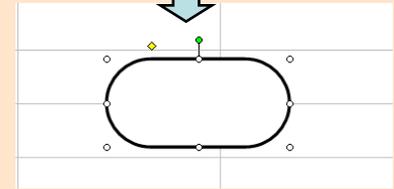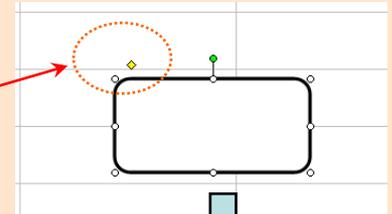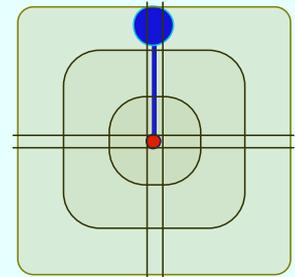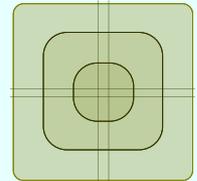
Create a dial chart identical in size with the "Joystick" chart:

- We need to create a data point for each of the sprites used. In our case we have just one sprite for now, so we create a data point in range B55:C55.
- De-assign any macro from the "Joystick" chart so we can work with it. Copy this chart and in the new chart replace the series "Handle" with the series "Dial Position" taking data from B55:C55.
- Select the grouped joystick dial shape (snapshot to the right). Holding the "Shift" key down go to Edit => Copy Picture = As seen on the screen => OK. Go to the new chart and select the central displayed point (there is only one data point (0,0) then hit Paste.
- Make sure this chart has the size 5 x 2 and also getting in draw mode (with the cursor an arrow) select the new chart => Draw => Order => Send to Back.
- Assign the old Joystick chart the JoyStick macro and then bring the old Joystick chart on top of the new chart (use the cursor in the "Draw" mode to select the chart) and carefully adjust its position exactly on the top of the new chart until the red dot base of the joystick lever falls in the center of the crosshairs. After the proper positioning select both charts (using the same arrow cursor – draw type cursor) and Draw => Group
- Create a scroll bar named "Throttle_Control" with parameters min=30 and max=1 (min-max inversion is not a mistake since we need to increase throttle settings by raising the cursor). The scrollbar will be connected to the following macro:

```
Private Sub Throttle_Control_Change()
[Throttle] = Throttle_Control.Value
End Sub
```

[Throttle] is a named cell and it's placed in cell P83. Both charts, the *Reset* button then the *Throttle_Control* toolbar will be grouped together and placed at the bottom of the *Landscape* chart.

	A	B	C
50	Relative Coordinates	3	0
51			
52	Limited Relative Coordinates	3	0
53	Coordinates Origin	0	0
54			
55	Dial Position	0	0
56			