Apogee Components

# PEAK OF FLIGHT

NEWSLETTER

*In This Issue*

## *Draw A Model Rocket Using Google SketchUp*

**Cover Photo: Quasar One's U.S. Army XR-7940 model rocket kit. Get your's today at: www.ApogeeRockets.com/quasar_xr-7940.asp**

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# Model Rocket Image Creation Using Google SketchUp

By Scott Wohnrade

## Editor's Note:

*Google SketchUp is a free 3D drawing program that is relatively simple to use. You can draw model rockets using it, which is what this article is about.*

*Unfortunately, drawing a rocket is not the same thing as "designing" a rocket. Designing is much more indepth, as it involves finding the Center-of-Gravity and the Center-of-Pressure, among other things. Google SketchUp does not do this. For designing a rocket, you really need something better, like our RockSim software (www.ApogeeRockets.com/rocksim.asp).*

*Even for "drawing" a rocket in 3D, RockSim is much more suited for the task.*

*So you're probably wondering, why publish an article about Google SketchUp? That is indeed a great question. The answer is that Google SketchUp excels in one area: putting the rocket into a 3D background. You can even put your rocket into Google Earth! I've done that, and it is really cool and very useful for our RS-PRO software (www.ApogeeRockets.com/RS-PRO.asp).*

*The other reason I'm publishing this article is that I'm looking for a smart programmer to convert RockSim files (xml format) into the Google SketchUp language. This would make it even faster to put RockSim designs into Google Earth and other 3D images that have cool backgrounds. If you are interested, please contact me here at Apogee Components. - Tim Van Milligan*

## Introduction:

When creating a model rocket design from scratch, sometimes pencil and paper are not enough. This is where a 3D design program like Google SketchUp really shines. In order to narrow down the scope of this tutorial we will concentrate on the general appearance of the rocket. We will draw the major rocket components; nose cone, body tube, fins and finishing, along the way seeing just how easy it is to change the design as you work through the drawing process.

## Getting Started:

The first thing you will need to do is download and install Google SketchUp 7. SketchUp comes in a couple of different flavors, a professional version which does have a cost associated with it and the free version, which we will be using.

***Figure 1: With Google Sketchup, you can add a 3D background to your rocket image.***

There is a version for both Windows and Mac OS. We will be using the Windows version for this tutorial. The features are the same for both programs; just the keyboard keys change.

You can download the software from:

http://sketchup.google.com/download/gsu.html

If this is your first experience with SketchUp, you may want to spend some time learning the fundamentals of the program. The good news is there is tons of help available. Being able to move about within the drawing and selecting the proper drawing tools is helpful for this tutorial.

This is a good link for learning the basics of SketchUp:

http://sketchup.google.com/intl/en/training/videos/new_to_gsu.html

## Nose Cone:

To start with, you will want to have the large tool set icon bar open. Go to menu option, "View\Toolbars\Large

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## Make 3D Rockets in Google SketchUp

Tool Set". Having this tool bar open makes it much easier to select the tools you will be using.

Just like building a rocket in the real world, the shoulder of the nose cone will determine the diameter of the body tube, so drawing the nose cone first is a good place to start. For this process we will use the red and blue axes to keep things in alignment. We begin by creating the nose cone 2D shape, and then use the "Follow Me" tool to create the full shape. Keep in mind for this tutorial we will be using approximate dimensions, but SketchUp can be used with accuracy and detail!

*Figure 2: Draw the nose cone.*

Begin at the axes origin and draw a 5.4" line using the "Pencil" tool in the blue direction. Press the escape key to end drawing the line.

Next select the "Arc" tool and pick the top and bottom endpoints of the line just drawn. Keeping the bulge on the red axis move it out .583 and hit enter.

Note: To make things easier, you can press the shift key while in the operation to lock the red direction.

Select the arc tool again and repeat the same process, but this time create the bulge on the left side. Draw two lines from the midpoint of the center line to the endpoint on both sides of the arc. Using the "Erase" tool, delete the center and bottom half of the arc. Your drawing should now look like Figure 2.

This completes the shape. Next we will create the path for the "Follow Me" tool directly underneath the shape. Draw a circle, the size is not important; it just acts as the path to complete the extrusion. Now click once on the surface of the circle. Now get the "Follow Me" tool and select the shape. SketchUp completes the extrusion. Go ahead and delete the circle, it is no longer needed. See Figure 3.

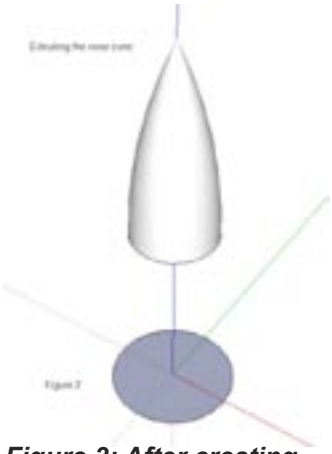

*Figure 3: After creating the 3D, delete the circle.*

Now let's create the shoulder. Orbit under the nose cone and with a good view from the bottom, using the "Push/Pull" tool; pull the bottom of the nose cone down 1.55 inches in the blue direction. Select the "Offset" tool and offset the circle of the nose cone .031 to the inside. This will create the shoulder. Now pull the new circle down to 1.166" in the blue direction. See Figure 4.

*Figure 4: Make the shoulder.*

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## Make 3D Rockets in Google SketchUp

After you extrude the nose cone and shoulder you may notice some extra faces/lines. These can be smoothed out with the "Eraser" tool while holding down the Ctrl key.

The nose cone drawing is now complete. We will still need to do one more thing and that is to make the nose cone a component. Triple click on the nose cone to select all the objects, then right click and select "Make component". Give it a name and description and then click "Create". Now that wasn't too bad, it's easier than it looks! See Figure 5.

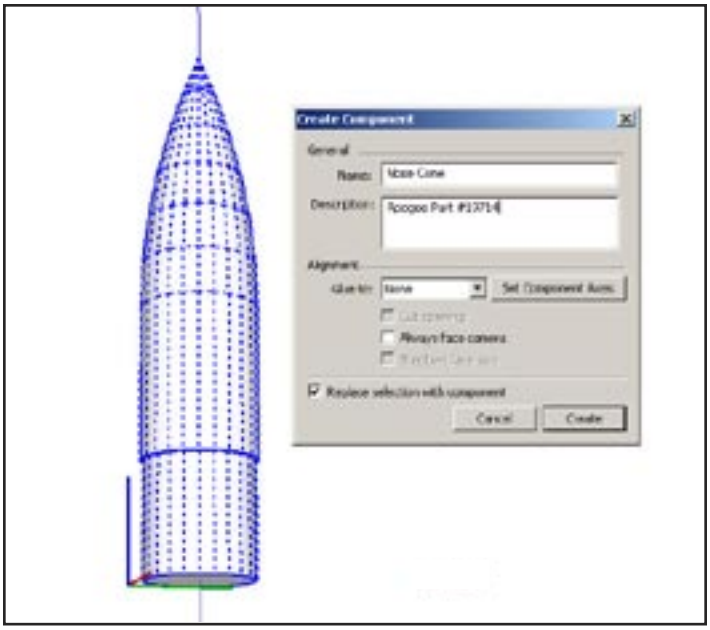


*Figure 5: Give the nose cone a component name.*

### *Body Tube:*

Drawing the body tube is really easy! Move the nose cone up in the blue direction 1 inch to give yourself some working room. Draw a circle with its center at the origin, but before clicking the second point, move your mouse to select the outer edge of the nose cone shoulder. This will create a circle with the correct diameter. See Figure 6.

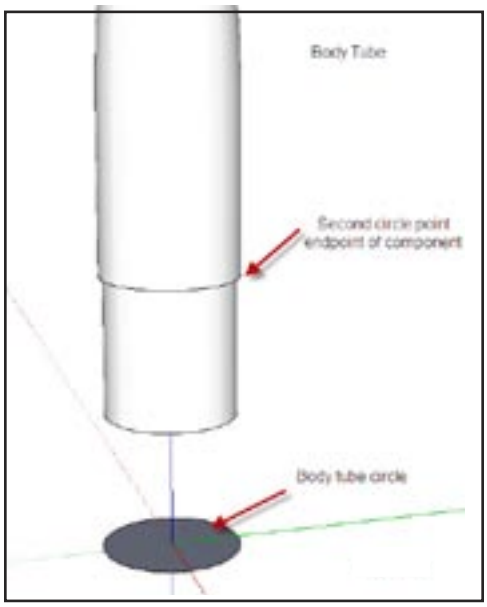


***Figure 6: Draw a circle, but use the nose cone to find the right diameter.***

Move your nose cone up 15 inches in the blue direction to make room. Pull the body tube circle up 13 inches in the blue direction. This completes the body tube. Now make it a component as described in Figure 5. You will notice that the tube has a closed top end. Just double click on it to edit the component. Click on the face of the circle and hit the delete key. Keep the tube end closed for the time being. Move the nose cone back down into the rocket by selecting the endpoint of the nose cone shoulder and end of tube. Now it's starting to look like a rocket. See Figure 7.

***Figure 7: Move the nose back down.***

Not quite satisfied with the look? How about a longer body tube? You can accomplish this in a couple of different ways. First create a body tube coupler just like a real build, then copy and move the

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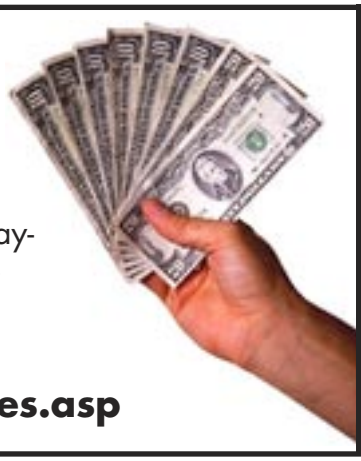

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## Make 3D Rockets in Google SketchUp

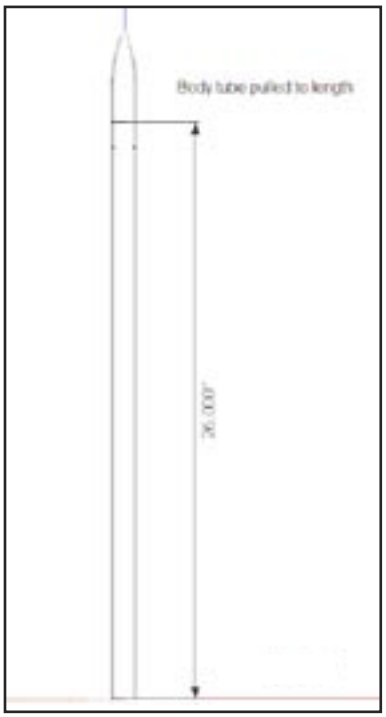


*Figure 8: Lengthen the tube.*

existing tube component into place. Second, simply pull the existing tube the length you want.

Note: Remember in order to use the pull tool you will have to place the circle face back on the top of the tube. See Figure 8.

How about scaling the entire model to three times its current size?

Select all components, and then click on the "Scale" tool. You will see green sizing grips appear around the components. To scale uniformly (without distortion) select any "grip". Hold the shift key while moving out from the center. Then type 3 for the scale factor and enter. Remember, if you don't like the results of an operation you can always "Undo". See Figure 9.

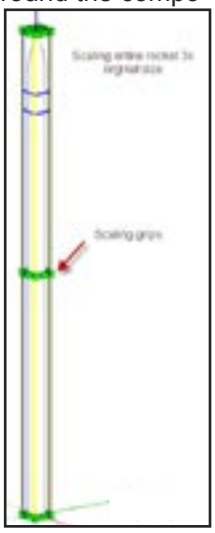


*Figure 9: Scale the rocket.*

### *Fins:*

Just like building the real model, you will need to lay out the location of the fins. This is made much easier since we can use the axis for placement of our fins. Once we have the fin located, we will draw one fin in place and use a very cool tool to copy the rest of the fins into position. Let's get started! First use the red axis and the endpoint of the bottom of the tube to draw a vertical line in the blue direction 2 inches up. This will form the root edge of the fin.

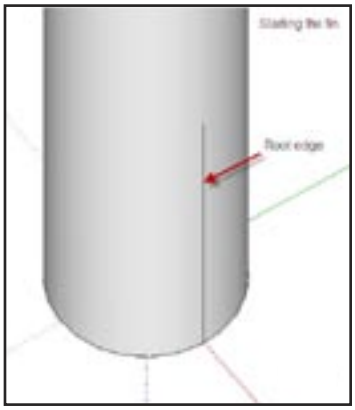


*Figure 10: Draw the root edge of the fin.*

Note: It can be tricky to find the right starting point. This is where the shift key comes in handy to lock onto the red axis as you pick the first point. See Figure 10.

From the top of the line just drawn we will use the "Protractor" tool to give us the proper angle for a construction line. Using the protractor tool, pick the top endpoint of root line, then while holding the mouse button down move the protractor until the protractor turns green. See Figure 11. Release the mouse button. Now move out along the red axis and click. Finally type 40 degrees for the angle and press enter. Using the pencil tool draw a line along the guide 2.75 inches. This will create the leading edge. Keep going with the line tool and draw a line down the blue direction 1.25 inches. Close up the fin by clicking on the bottom endpoint of the original line. See Figure 12.

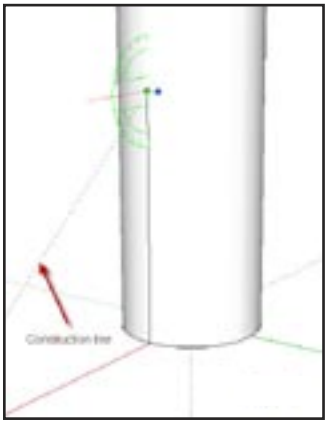


*Figure 11: Use the protractor to make the leading edge.*

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## Make 3D Rockets in Google SketchUp

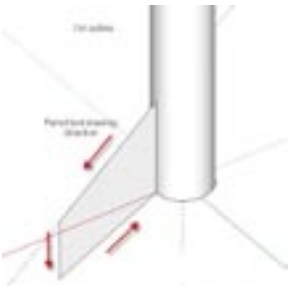

*Figure 12: Create the fin shape.*

When the fin outline is complete, use the "Push Pull" tool to give it a thickness of .097 inches. Make it a component. You will notice the new fin is not on the center line of red axis. This can be fixed by moving the fin from the midpoint on the bottom root edge to the red axis. See Figure 13.

Orbit and zoom to get a good view under the model. Sometimes orbiting and panning can be a pain. A quick way to get the desired view is to use the menu option Camera\Standard Views\bottom. Use the "Rotate" tool to create a copy of the existing fin. Select the fin and grab the rotate tool. Select the origin as the center point then press the Ctrl key. This turns on the copy function. Now the operation wants a starting point. Select the midpoint of the fin, type 360, press enter, then type 4/ enter. This will create 4 fins spaced 90 degrees apart. Thinking about going supersonic? Undo the previous operation and start again, this time type 3/ enter. This will give you 3 fins spaced 120 degrees apart.

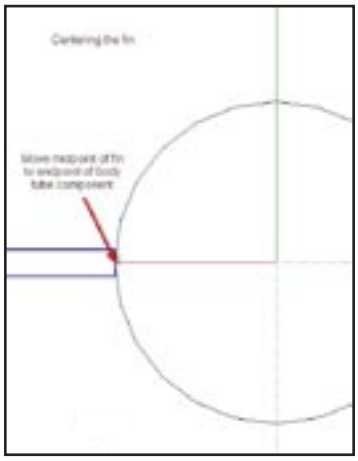

*Figure 13. Push some thickness, and re-center.*

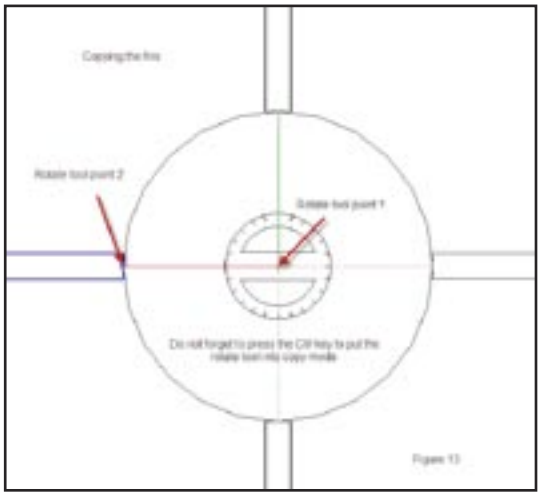

*Figure 14: Duplicate and rotate the fins to the proper locations.*

**Note:** For example, you can just type in a new value for the number of fins 6/. As long as you do not click in the model SketchUp will use the new value, very helpful! See Figure 14.

### *Finishing Up:*

When choosing a paint scheme, select the "Paint Bucket" tool. This will open the materials selection box, and then select Colors. Choose a color; it will appear in the selection window. Click on the body tube and you have instant color! There are a myriad of options for applying and editing materials. Here a few things to keep in mind for controlling the color. Fins are components, which means when you make

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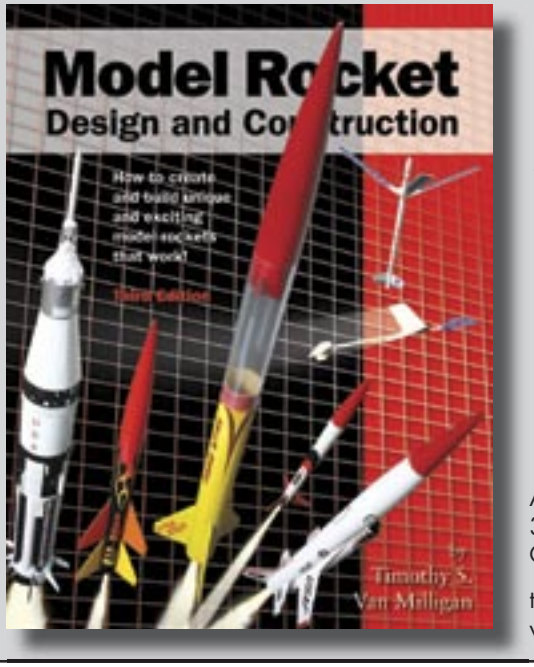


## Model Rocket Design and Construction

*By Timothy S. Van Milligan*

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## Make 3D Rockets in Google SketchUp

*Figure 15: Additional lines to create paint boundary.*

a change to one, all are affected. To change this you can right click on a fin and select "Make Unique" from the menu. To control the paint on the same object you will need to create additional lines/ faces, which will create a boundary, the stripes on the fins being a good example. See Figure 15.

### *Where to Now:*

A lot of ground has been covered in this tutorial, but once you have created a few models, creating a model is quick and easy. For the model just created here are a couple of ideas for adding some finishing touches. Create a launch lug, motor mount (just an assembly of short body tubes). You can print full size patterns, for fins and construction views. See Figure 16. Export 2D graphic files (jpegs) for import into other programs. Share your designs with others by uploading your files to Google 3D warehouse. These are just a few ideas; just like model rocketry, your imagination is the key!

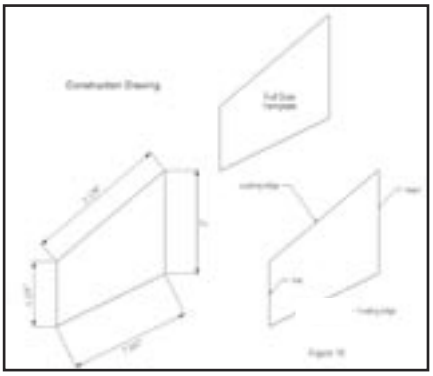

*Figure 16: Print out the full-size fin templates*

**Note**: Rocket in Figure 1 was imported to Photoshop from SketchUp where the Decal was added.