Technical Note: GPS/GNSS Simulators

Environmental Modeling

Background

The value of a GPS simulator is to generate RF signals corresponding to real-world scenarios for comprehensive testing from the bench. In addition to features such as multi-path and interference conditions, Orolia's GSG series GPS/GNSS simulators can simulate signal obscuration via Environmental Models starting in application software version 6.1. Environmental modeling allows the simulated satellite signals to be blocked by objects placed along the route. Applications of this feature include urban canyon scenarios, tunnels, etc.

Tools

Support for environmental models in GSG simulators is via compressed keyhole markup language files (kmz) popularized by Google Earth. A simple way to create these files is with the tool SketchUp available from Trimble Navigation. Download and install SketchUp from sketchup.com. The rest of this document describes SketchUp Make 2014 but older versions have been tested.
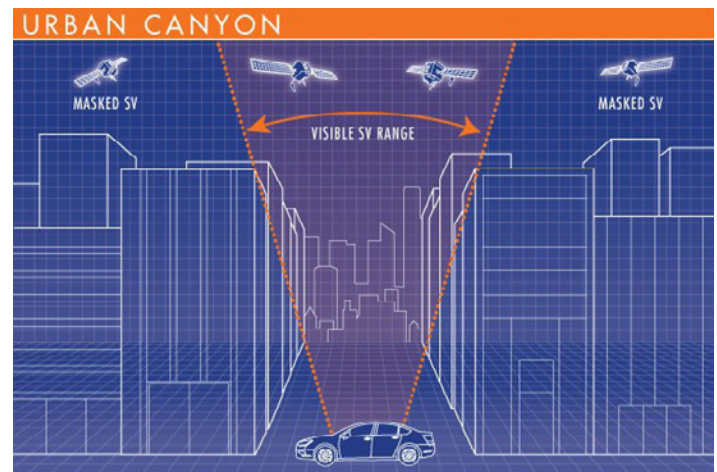
When running SketchUp for the first time you need to select a template. Select one of the two 'Simple Templates' using either feet or meters. The plugin "Model Info" is recommended to view the triangle count of the models. To install the plugin select the

Add plugin extensions to   SketchUp button from the toolbar.

Search for "Model Info" in the Extension Warehouse window, click on the Model Info link. Install the plugin by clicking the install button. You may be prompted to log into Google in order to download and install the plugin. You will be prompted to install an additional library as well in order to use the Model Info plugin. After both plugins are installed, close the Extension Warehouse window.
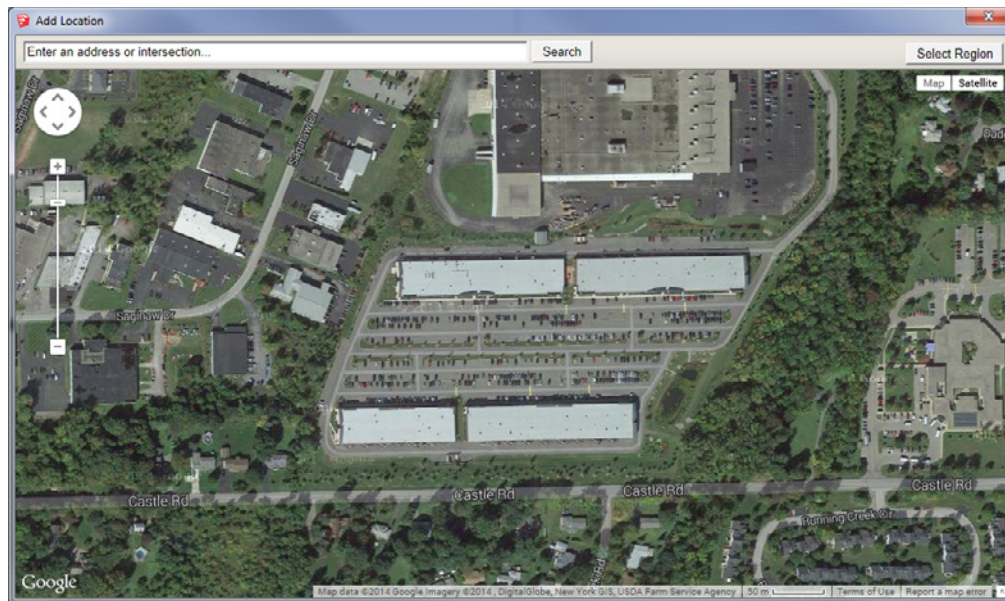
Building a Model

Delete the default model 'Sophie' by selecting her and pressing the delete key.

Add the map of the desired location for your environmental model. Choose File > Geo-location > Add location... to open the map. Or choose the   icon from the toolbar. Enter the address or location for your model in the search bar of the Add Location window.

Zoom in or out as desired to capture the desired area. Press the Select Region button to select the area to build your model.
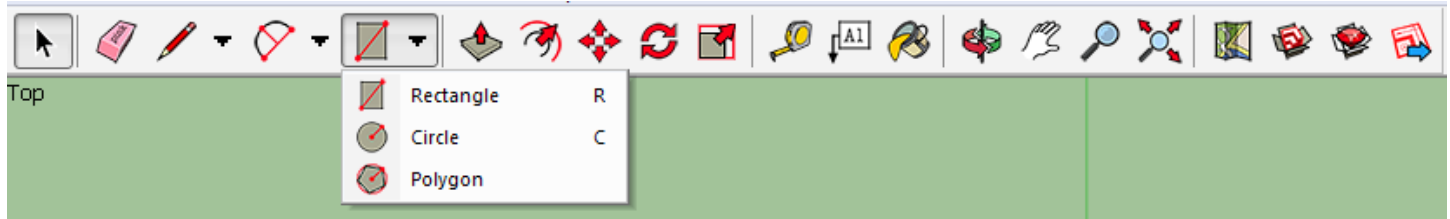
Move the selection box around until the area is selected and press the Grab button.
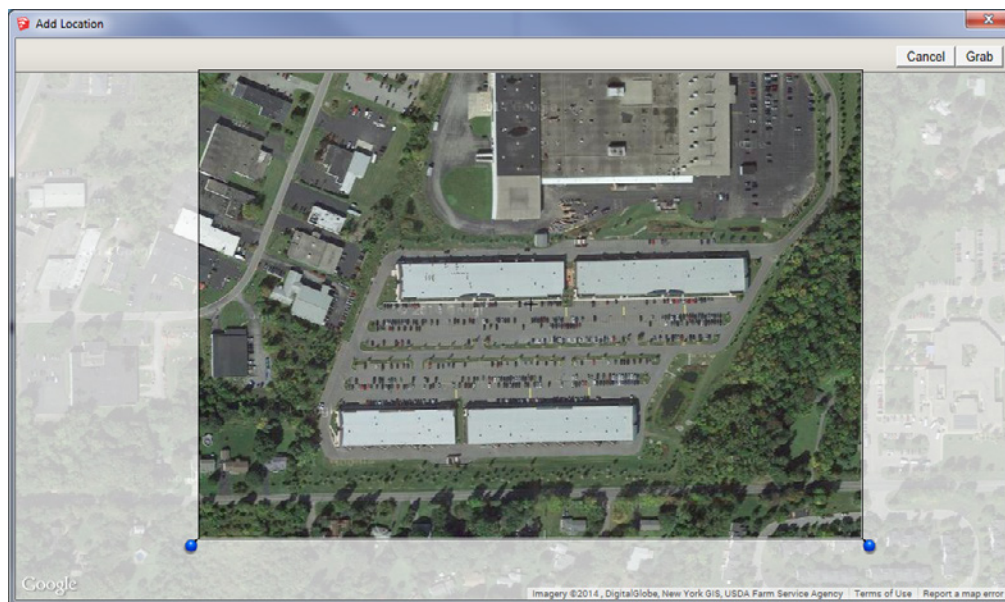

The location is placed in the SketchUp tool so you have a guide for building models. To view the placed map from above, select Camera > Standard View > Top.

To add objects to the map use the toolbar to select a shape to draw.

Draw the shape on the map and then give it height by using the button. Change the view angle by holding down the middle mouse button and moving the mouse or use the tool. Draw shapes and set their heights as desired to the map.
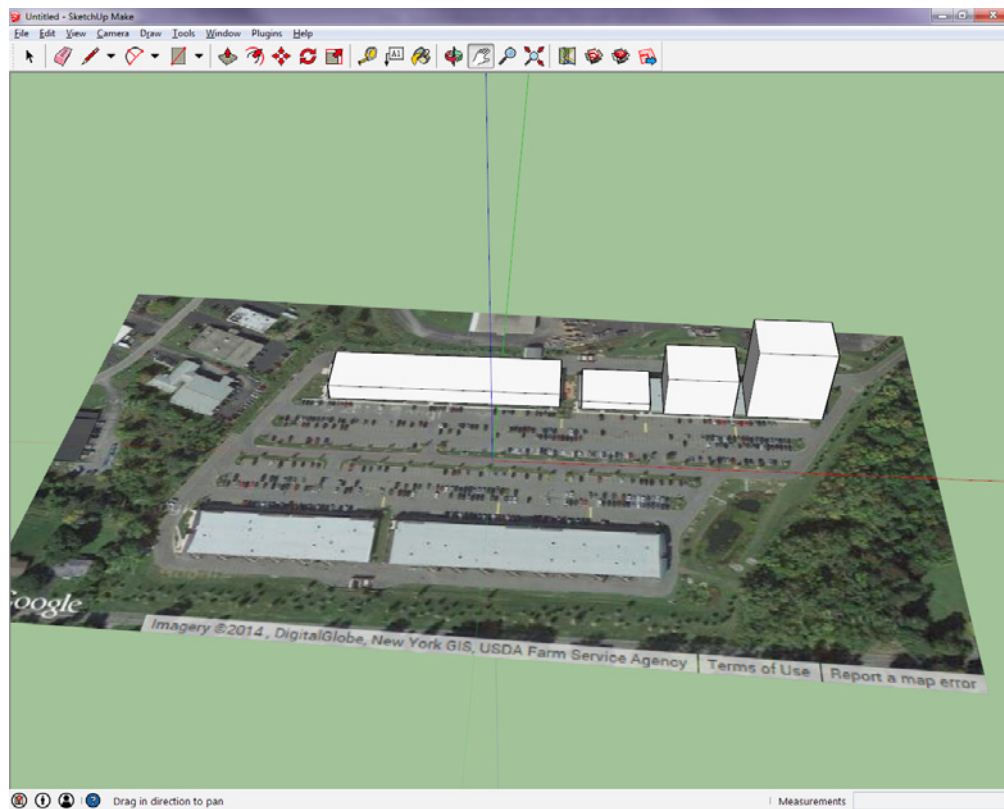
 To simulate a tunnel, draw the shape over the route that will be part of the trajectory in the simulation scenario. The sides and bottom of the tunnel should be removed by selecting them and pressing delete.
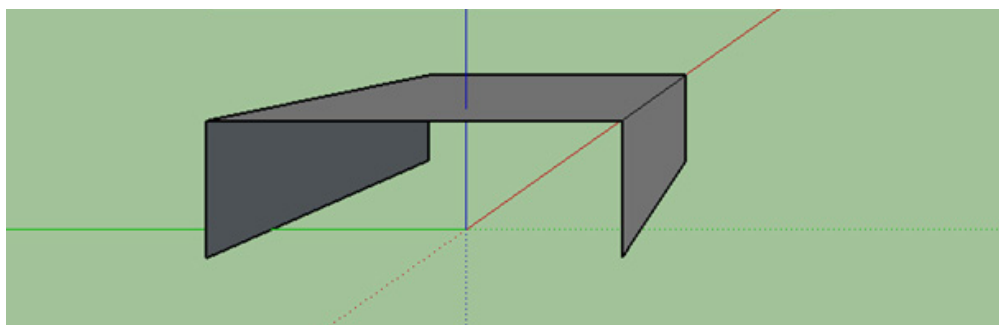
Save and Export the Model

Once the file is exported, the drawn objects will be saved as one object and cannot be easily edited. Therefore it is recommended to save the file as a SketchUp Model (.skp) and then exported as a .kmz file. To export the file choose File > Export > 3D Model... and select .kmz as the Export type in the dialog box.


Check the Triangle Count

A GSG simulator has a 300 triangle limit for the models. The Model Info plugin is used to determine the number of triangles in the file. In order to count the actual number of triangles in the exported kmz file, close the .skp file, close the SketchUp application, and reopen it. From the File menu select Import... and choose the exported kmz file. From the Plugins menu Choose Model Info > Statistics to Console. The triangle count for the model is displayed. As long as the model is not more than 300 triangles, it can be used in a GPS simulation scenario.
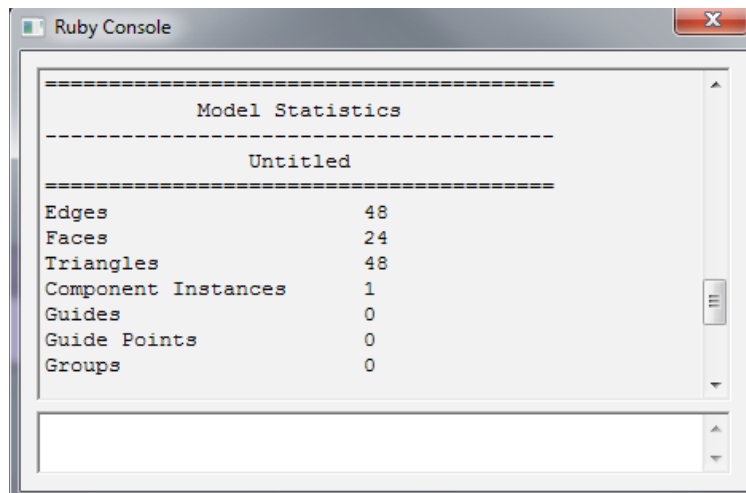

The triangle count for a tunnel is 6.
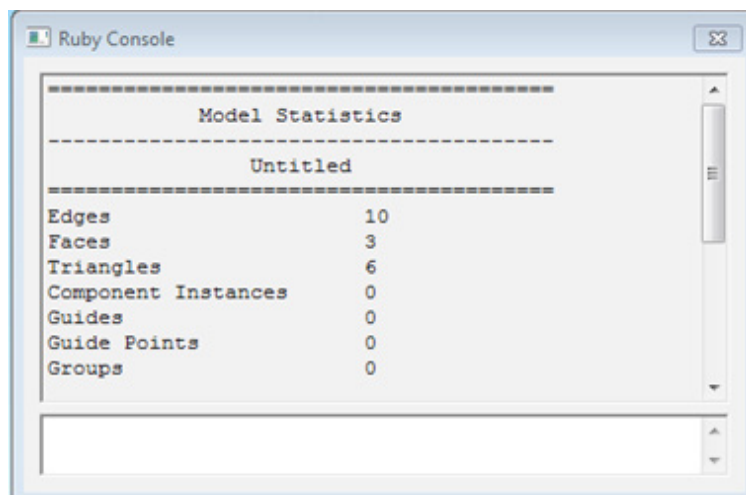
Use Model in a Scenario

Starting in GSG StudioView version 4.1.1.4 a model via kmz file can be added to the scenario. On the navigation tab for the scenario editor, find the environment. To upload the kmz model to the StudioView file repository, the select the radio button "File" and select the file. Make sure your trajectory file passes through the area of the model and configure the remainder of the scenario settings as desired.
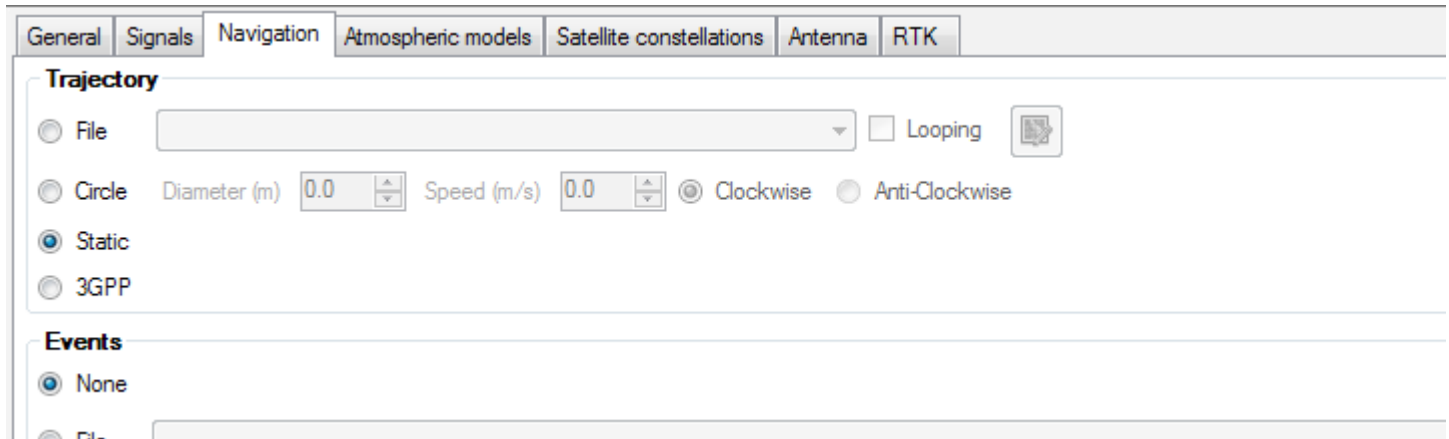
When the scenario file is loaded using the StudioView Uploader, the kmz file is also transferred to the unit. If manually moving files using the StudioView File Manager or the GSG Web Interface, make sure kmz files are saved in the environmentModels folder.

Additional Information

The base of all shapes and blocks drawn using SketchUp are created at zero altitude height above ellipsoid, HAE, (not mean sea level) and increase from there. Therefore all trajectories and scenarios using the environmental models must use zero altitude as a reference for ground level.

Also note that the environmental modeling feature does not automatically generate multipath conditions, which can be configured separately.

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