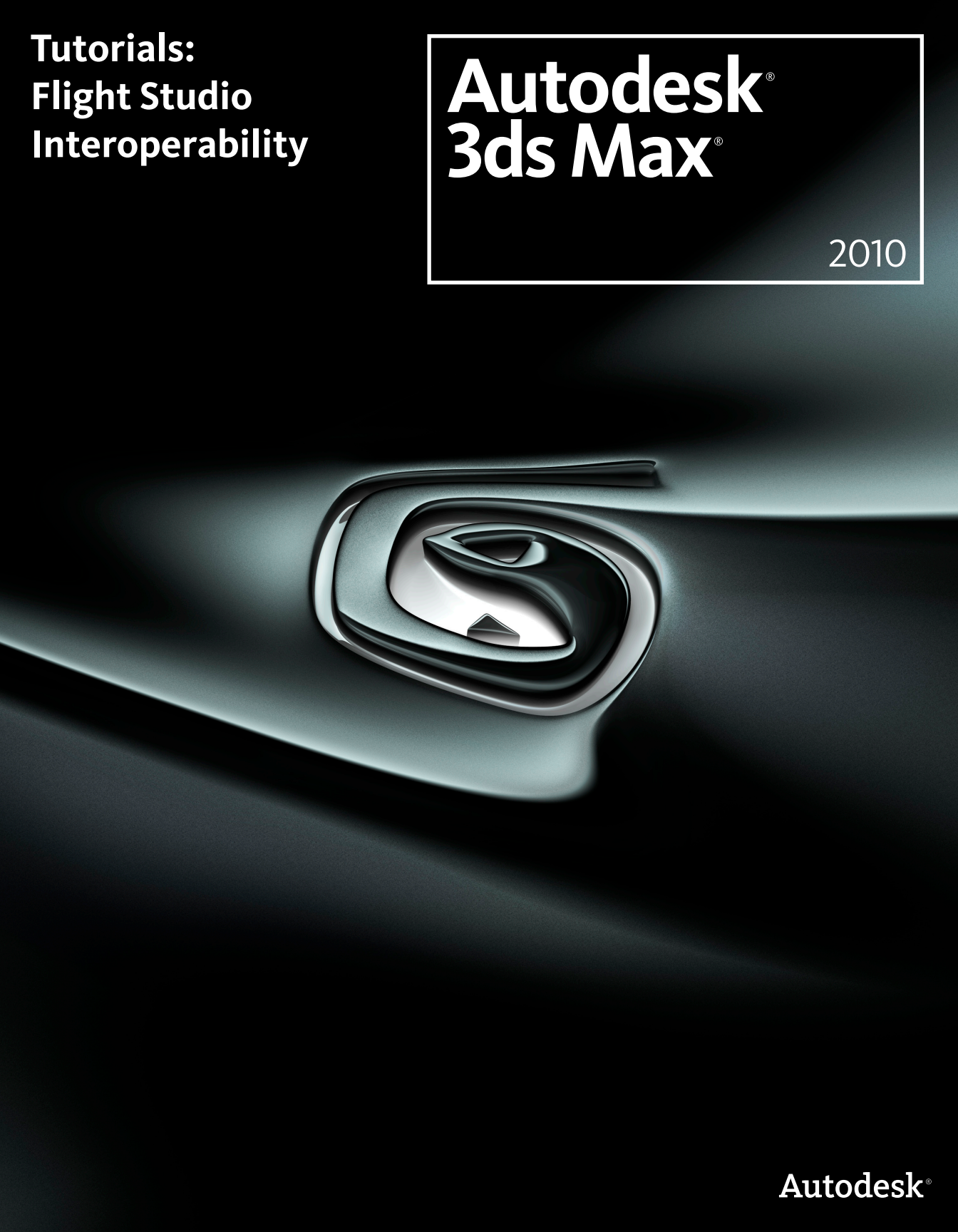
Tutorials: Flight Studio Interoperability

Autodesk® 3ds Max®

2010



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Disclaimer

Flight Studio Interoperability

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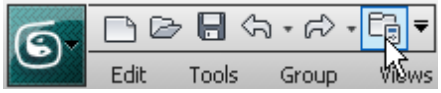
In this tutorial, you will learn the basics of using Flight Studio® to import, edit, and export an OpenFlight® model. OpenFlight is a popular file format used by flight simulators and other military simulation and training applications. Flight Studio enables content-creation tools such as 3ds Max accurately to export 3D graphics models, with materials, to visual-simulation engines. The Flight Studio tool set is integrated into 3ds Max.

Preparation for This Tutorial



On the Quick Access toolbar, click Project Folder and set your current project to *3ds Max 2010 Tutorials*.

Importing, Editing, and Exporting OpenFlight Files

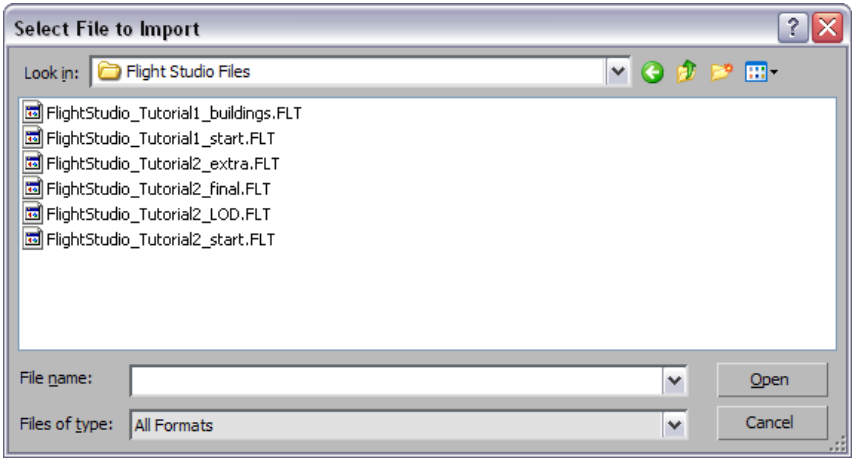
In this tutorial, you will learn the basics of importing an OpenFlight models, editing the model and its attributes, and then exporting the model to the OpenFlight format.

Import an OpenFlight Model and Edit It in 3ds Max

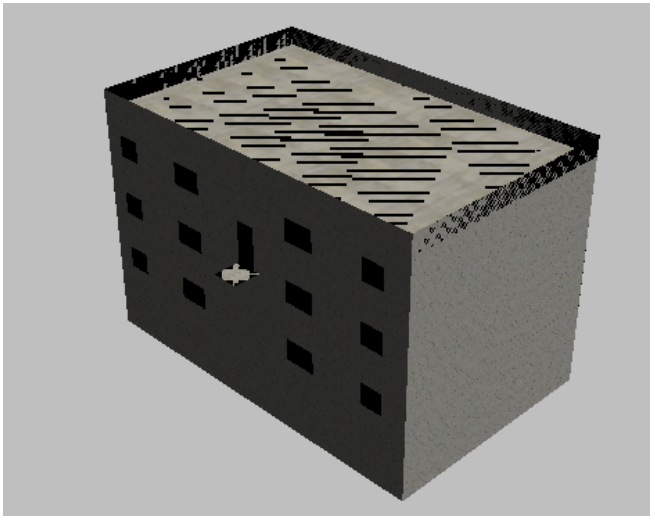
The first thing you'll do is import an OpenFlight model and prepare it for editing.

Import an OpenFlight model:

1  From the Application menu, choose Import, and navigate to the *\import\flight studio files* folder.

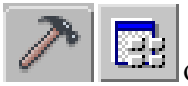


2 Choose *flightstudio_tutorial1_start.flt,* and then click Open. In the dialog that opens, leave the Flight Studio Import Options as they are, and click OK.



You now have an OpenFlight file in 3ds Max.

Open the Flight Studio utility:

1  Open the Utilities panel and click Configure Button Sets.

3ds Max opens the Configure Button Sets dialog.

2 Increase the value of Total Buttons by 1. This adds a blank button to the bottom of the sample Utilities buttons below Total buttons. (If you can't see the blank button at first, scroll down.)

3 In the Utilities list on the left side of the dialog, locate the Flight Studio entry. Drag this entry and drop it over the blank button.

The button should now show the label "Flight Studio ©".

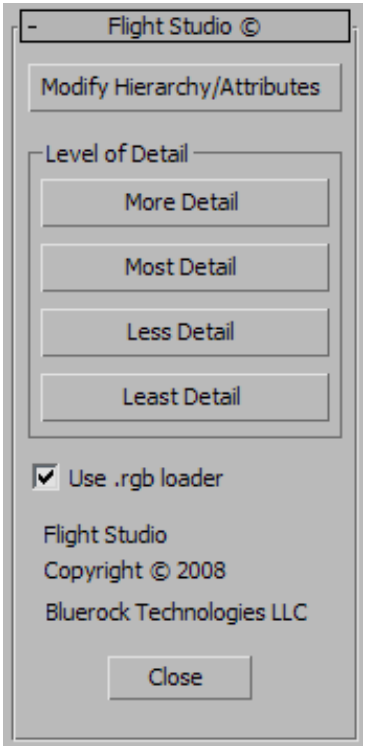
4 Click OK to close the dialog.

Now the Flight Studio button will appear in the Utilities panel whenever you run 3ds Max.

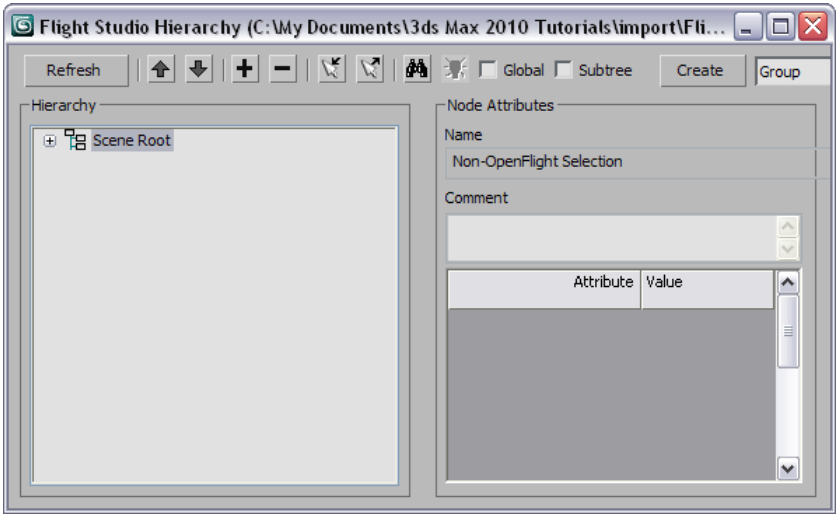
Run the Flight Studio utility and look at the Hierarchy Browser:

1  On the Utilities panel, click the Flight Studio button.

3ds Max opens the Flight Studio rollout.

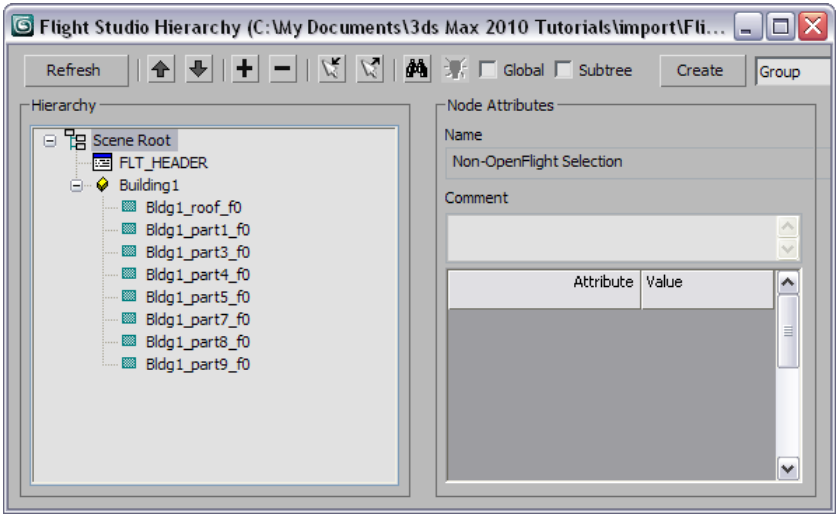


2 Click Modify Hierarchy/Attributes to open the Hierarchy Browser.



The Hierarchy window lists OpenFlight objects in the Hierarchy group on the left.

3  Click the plus-sign icon next to *Scene Root*. This expands the hierarchy to show a *FLT_HEADER* entry and the *Building1* object. Click the plus-sign next to *Building1* to see the building's component objects, which are faces.



The hierarchy after expanding all nodes

NOTE The term "node" refers to a structure in an OpenFlight file. It is interchangeable with the term "object."

Collapse and expand the entire hierarchy:

1  Select *Scene Root* by clicking the icon to the left of its name.

2  On the Hierarchy window toolbar, click the minus-sign button.
The entire hierarchy collapses once again.

3  Click the plus-sign button on the toolbar.
The entire hierarchy expands.

4  Select *Building1* by clicking the icon to the left of its name.

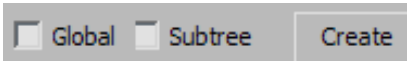
5  On the toolbar, click the minus-sign button once again.
The sub-objects of the *Building1* object are collapsed again.

In the Hierarchy window, you can use the plus and minus buttons to expand or collapse the hierarchy of any node that has children.

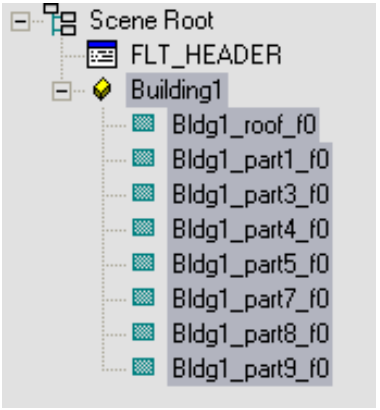
To prepare an object for editing, you might need to locate the object in the Hierarchy browser by searching the vertical list located on the left of the window. The SubTree and Select Set features can help you do this, as the next procedure shows.

Select nodes for editing:

1.  Select *Building1* by clicking the icon to the left of its name.
2.  Click the plus-sign icon to show the sub-objects of *Building1*.
3. Click to turn on the SubTree checkbox, located on the Hierarchy window toolbar.

4. Now select *Building1* again.

   When SubTree is turned on, selecting an object in the Hierarchy list also selects its sub-objects. For example, selecting the Scene Root selects all OpenFlight objects in the scene.

5. Turn off SubTree.

1  Select the object *Bldg1_roof_f0* by clicking the icon to the left of its name.

2  Send the selection to the 3ds Max viewport by clicking Select Set.

The object previously selected only in the Hierarchy Browser is now selected in the 3ds Max viewports. The highlight in the Hierarchy list goes away.

With an object selected in the 3ds Max viewports, you will isolate that object and then add a dome to the top of the building.

Use 3ds Max to add new geometry:

1 Make sure the *Bldg_roof_f0* object is selected in the 3ds Max viewports.

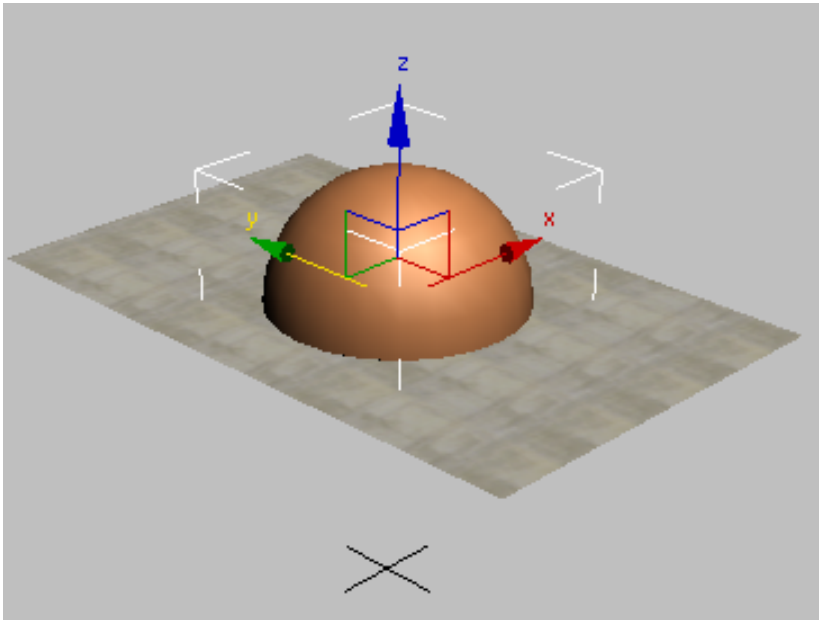
2 Right-click the Perspective viewport. From the Quad menu, choose Hide Unselected.

The roof object is now isolated in the viewports.

3  Go to the Create panel. With Standard Primitives chosen in the drop-down list, click Sphere.

4 Click Autogrid to turn on this option, then drag over the roof to create the sphere. Set the Radius to **150**, Segments to **24**, and Hemisphere to **0.5**.

5  In the Top viewport, move the sphere so it is positioned in the center of the roof.



Add a texture to the dome:

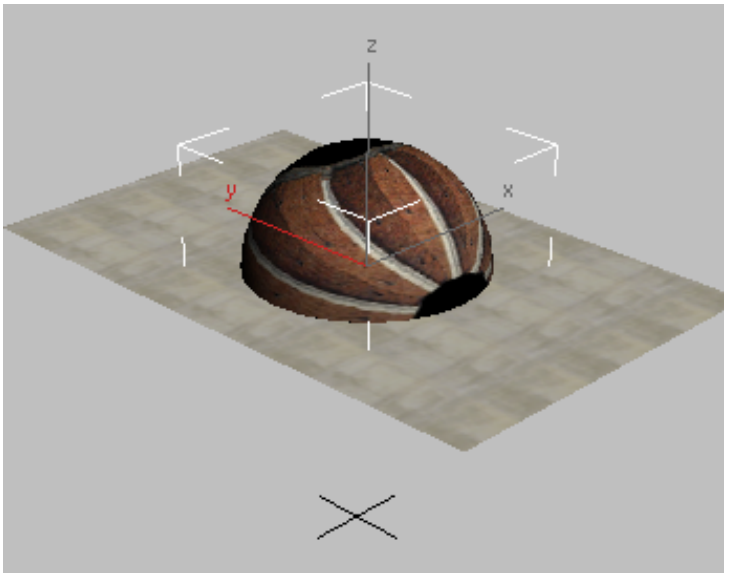
1  Open the Material Editor. Click an unused sample slot to highlight it, then on the Blinn Basic Parameters rollout, click the empty map button to the right of the Diffuse color swatch.

3ds Max opens the Material Map Browser.

2 In the Browser's list of map types, double-click Bitmap. Then in the file dialog that opens, choose *dome.rgb,* and then click Open.

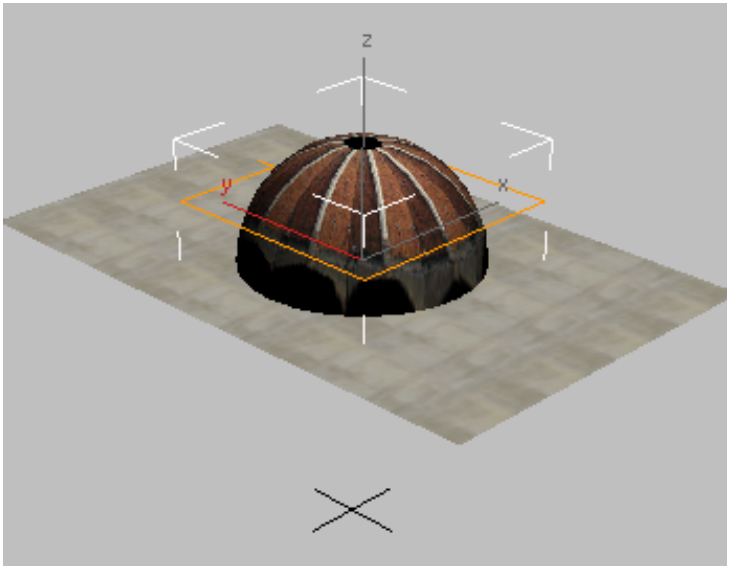
3  Click Assign Material To Selection, and then Show Standard Map In Viewport.

The dome texture appears in the Perspective viewport, but it isn't aligned correctly.



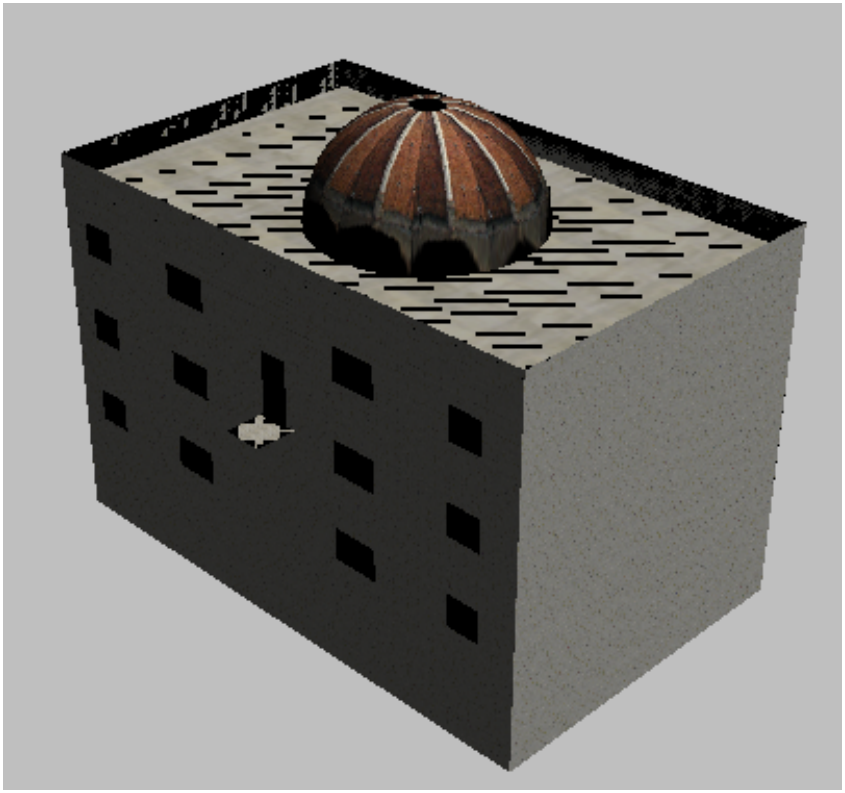
4  With the dome still selected, go to the Modify panel. Apply a UVW Map modifier to the sphere.

The default UVW Map settings align the dome texture correctly.



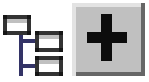
5 Close the Material Editor.

6 Right-click the Perspective viewport and from the quad menu, choose Unhide All.

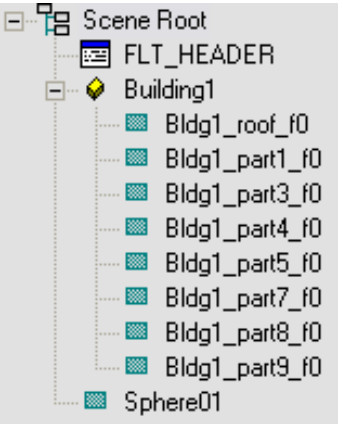


If you look at the Hierarchy Browser, you see that the Hierarchy list is inactive. This is because you have used 3ds Max to alter the scene.

Update the Hierarchy Browser:

1  In the Hierarchy Browser, click Refresh. Select *Scene Root* by clicking its icon, then click the plus button.

Now the hierarchy shows the sphere you created.



2 In the Hierarchy list, click the name *Sphere01*, then change the name of the object to **Bldg1_dome**. Press Enter to complete the name change.

TIP If clicking the name once does not make the name editable, click it a second time.

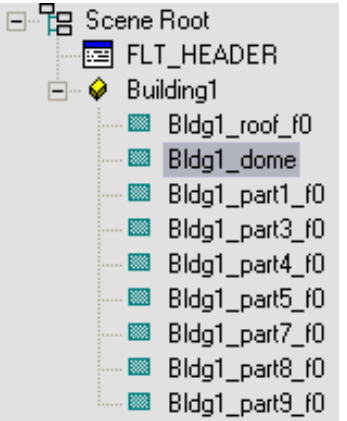
Bldg1_dome now has a meaningful name, but it should be part of *Building1*, and it makes sense to have it appear next to *Bldg1_roof_f0*.

Use the Hierarchy Browser to change the hierarchy:

1 In the Hierarchy list, drag the *Bldg1_dome* icon and drop it on top of the name *Building1*.

The *Bldg1_dome* object is now a child of *Building1*, and its name appears at the bottom of the list of sub-objects.

2 Select *Bldg1_dome* once again, then click the up-arrow button on the Hierarchy Browser toolbar to move *Bldg1_dome* up in the list. Continue clicking the up-arrow until *Bldg1_dome* is just below the name of *Bldg1_roof_f0*.



Next

Add Objects Using Import and the Hierarchy Browser on page 1880

Add Objects Using Import and the Hierarchy Browser

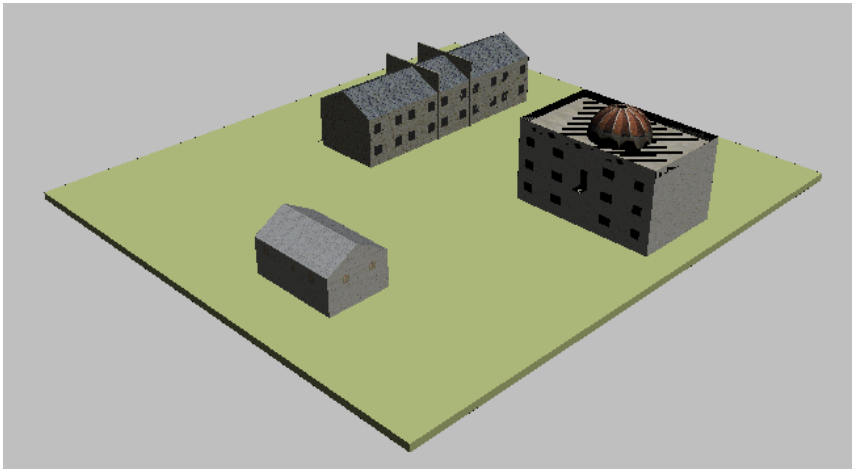
In this lesson, you import additional objects into the scene.

Add additional objects via import:

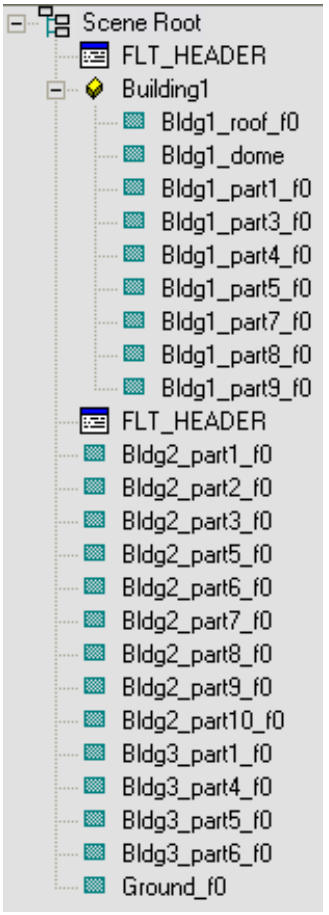
1  From the Application menu, choose Import and import the file *flightstudio_tutorial1_buildings.flt*.

In the Flight Studio Import dialog that opens, leave the defaults unchanged, and click OK.

Importing another OpenFlight file does not replace your scene. Instead, it adds thenew OpenFlight objects to the scene.



2 In the Hierarchy Browser, click Refresh to update the Hierarchy list, then expand the *Scene Root* hierarchy.



NOTE After you import the new objects, an additional *FLT_HEADER* entry appears in the hierarchy. You don't have to remove this node, because Flight Studio exports only the topmost header node it finds in the hierarchy. But for the sake of consistency and readability, we will remove it.

Delete the extra header.

1  In the Hierarchy list, click the icon of the second *FLT_HEADER* entry.

2  On the Hierarchy Browser toolbar, click Select Set.

3 Right-click a viewport, and then press Delete.

4 In the Hierarchy Browser, click Refresh to update the Hierarchy list, then expand the *Scene Root* hierarchy.

The second header entry is now gone.

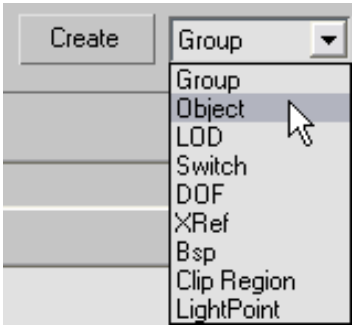
TIP  If you have trouble deleting the extra header, select it by using Select By Name.

Another way to add OpenFlight nodes is to create them "by hand" in the Hierarchy Browser. The Face nodes that make up the other buildings in the scene should be grouped under a parent object the way *Building1* is organized.

Create new OpenFlight nodes:

1  In the Hierarchy Browser, select the *Scene Root* node. This will be the parent of the new Object nodes.

2 From the drop-down list located to the right of the Create button on the Hierarchy Browser toolbar, choose Object, then click Create.



The new Object node appears in the Hierarchy list as a child of the *Scene Root* node. It has the default name *o01*.

3 Click Create once more to create another new Object node, *o02*.

4 Rename *o01* and *o02* to **Building2** and **Building3**.

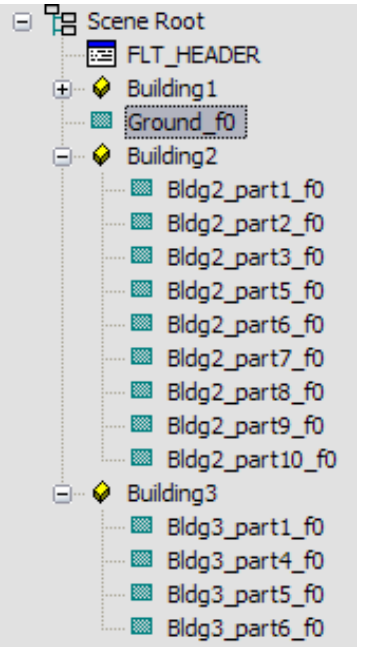
Next you will arrange the hierarchy so that all face objects become children of the new object nodes.

Reorganize the objects:

1 Drag the icon of each Face whose name begins with *"Bldg2_"*, and drop it on top of the entry for *Building2*.

NOTE You have to drag and drop the faces one at a time. You can't drag and drop a selection of more than one node.

2 Use the same method to make the *"Bldg3_"* Faces children of *Building2*.



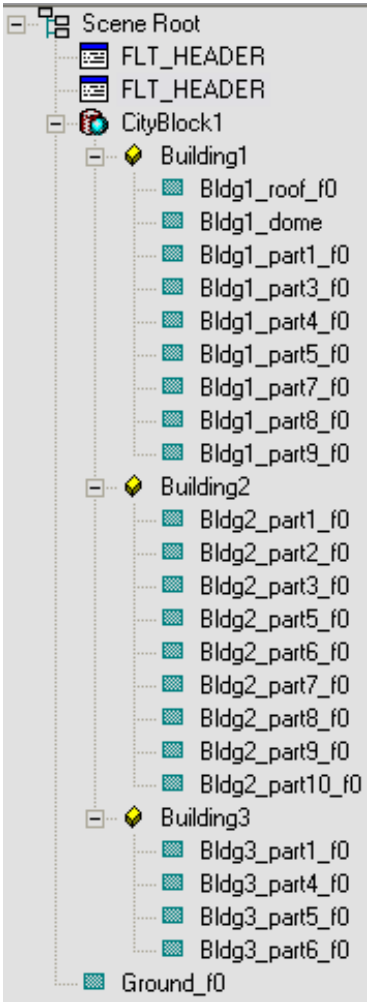
Now you will organize the objects into a single Group node.

Create a group node:

1.  In the Hierarchy Browser, select the *Scene Root* node. This will be the parent of the new Group node.
2. From the Create drop-down list, choose Group, then click Create.

   The newly created Group node, *g01,* appears as a child of the *Scene Root* node.
3. Rename the Group node to **CityBlock1**.

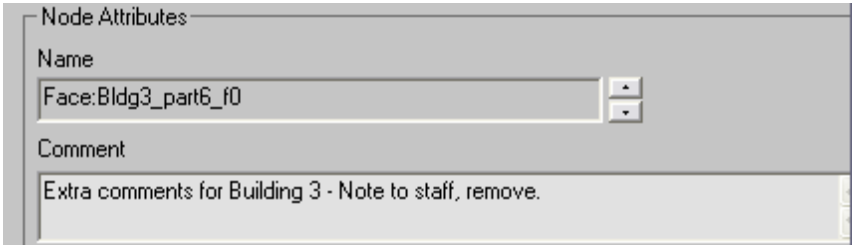
➤  Finally, drag the Object icons for the three building Objects and drop them on the *CityBlock1* object.



Add a comment:

1. In the Hierarchy Browser, select any Face node (such as *Bldg3_part6_f0)*.
2. In the right-hand Node Attributes group, you will see the Comments field.
3. Edit comments by entering text into the box. To confirm the changes, press Enter when you are done.

   On export, the comment will be saved along with the Face node.



4 Close the Hierarchy Browser.

Next

Export to OpenFlight on page 1887

Export to OpenFlight

Once you've created and organized the objects that you want for your OpenFlight scene, you can export the scene to the OpenFlight format.

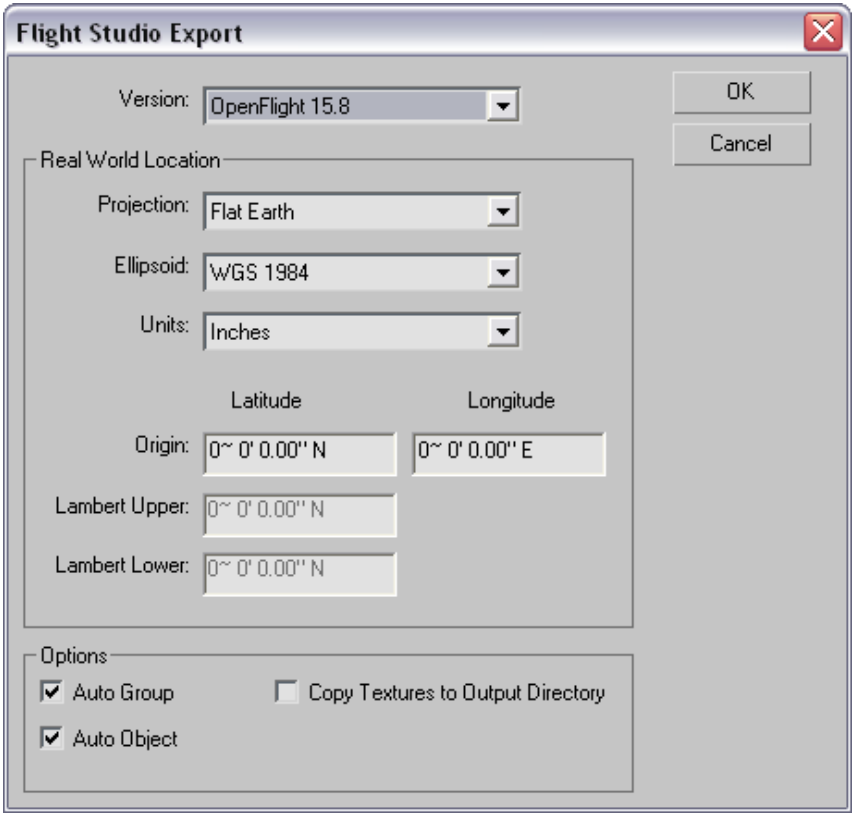
Export the scene:

1  From the Application menu, choose Export.

2 In the Export dialog, choose “Flight Studio OpenFlight (*.FLT)” from the Save As Type drop-down list.

3 Enter **myfirstopenflightmodel** as the file name, and then click Save.

3ds Max opens the Flight Studio Export dialog.



4 Use the Version drop-down list to choose the version of OpenFlight used by your flight simulator or other application. (For this tutorial, you can leave it set to OpenFlight 15.8.)

5 The export dialog has options to automatically add Group and Object nodes to the scene. Since you already added these nodes, there is no need to add them. Turn off Auto Group and Auto Object.

6 Click OK to export the scene.

Now your scene has been saved as an OpenFlight file.

NOTE You can also export only selected objects, instead of the entire scene. Use the Application menu > Export > Export Selected choice.

Summary

In this tutorial, you've been given a general overview of the controls within Flight Studio that help you import OpenFlight files, navigate OpenFlight hierarchies, add new nodes, and export the results back out to the OpenFlight format.

Creating Level-of-Detail (LOD) and Switch Nodes

This tutorial shows how to use 3ds Max to create some OpenFlight structures: Level-of-Detail (LOD) nodes and Switch nodes. These control the way geometry appears within a visual simulation system.

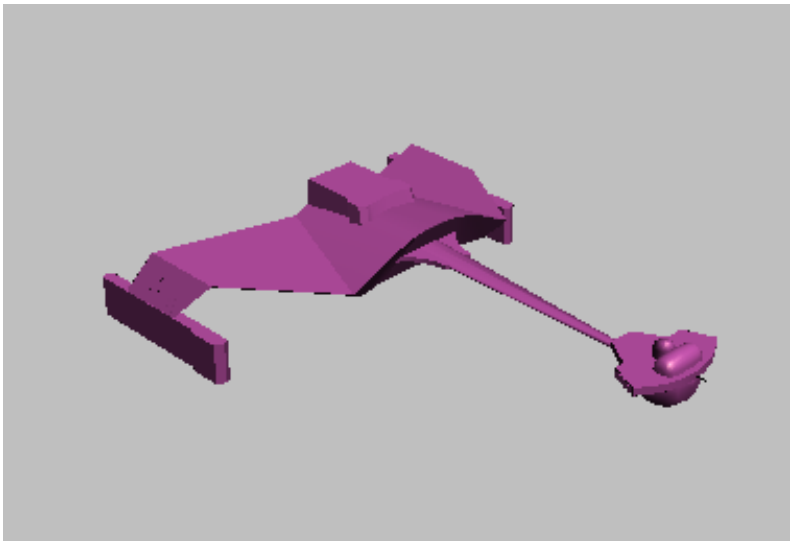
Set Up an LOD Node

A Level-of-Detail (LOD) node is a set of models that represent the same object at varying degrees of complexity. The objects under the LOD node are displayed by the simulator's runtime engine based on the distance from the object to the viewpoint. Objects that are far from the viewpoint can contain less detail, and objects that are close to the viewpoint need to contain more detail. Varying object complexity based on distance helps to optimize simulator performance.

Open the original, high-detail model:

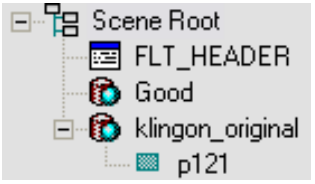
1.  From the Application menu, choose Import and open the file *flightstudio_tutorial2_start.flt*.

   In the Flight Studio Import dialog that opens, leave the defaults unchanged, and click OK.



2  Go to the Utilities panel, click Flight Studio, and then on the Flight Studio rollout click Modify Hierarchy/Attributes to open the Hierarchy Browser.

3  Click the *Scene Root* icon, and then click the plus-sign button to expand the scene hierarchy.



Now you are ready to set up the hierarchy for the LOD node.

Create the LOD structure:

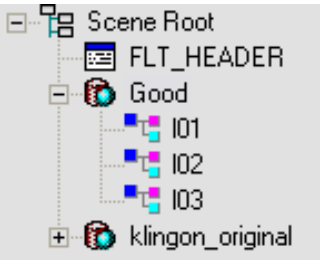
1  In the Hierarchy Browser, select the *Good* node by clicking its icon.

This node will become the root of the object tree in which you will create one part of the LOD structure.

2 Choose LOD from the Create drop-down list, then click Create.

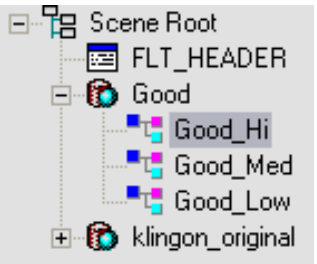
This adds one LOD node as a child of the *Good* Group object.

3 Click Create two more times to add two additional LOD nodes so that *Good* contains three LOD nodes in all.



4 Rename the LOD nodes **Good_Hi, Good_Med,** and **Good_Low.**

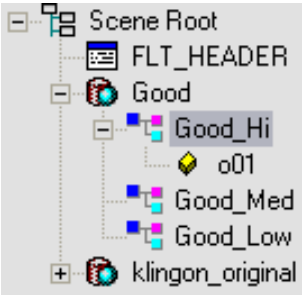
1  If the LOD nodes aren't in order, select a node by clicking its icon, then use the up-arrow or down-arrow buttons on the toolbar to move the node. Make sure that *Good_Hi* appears first, *Good_Med* second, and *Good_Low* third.



2  Once the LODs are ordered correctly, select the *Good_Hi* LOD node again.

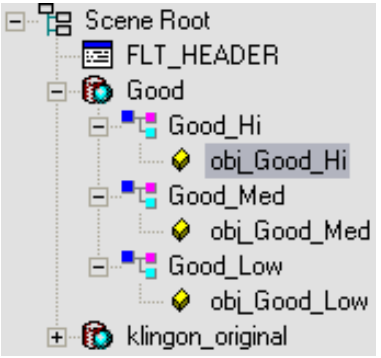
3 Choose Object from the Create drop-down list, then click Create.

This adds one Object node as a child of the *Good_Hi* LOD object.



4 Repeat the previous step for the *Good_Med* and *Good_Low* objects. Remember to select the correct LOD node before you click Create to add an object.

➤ Name the new objects **obj_Good_Hi, obj_Good_Med,** and **obj_Good_Low,** to match their parent nodes.



Set the distance thresholds:

1 Select the *Good_Hi* LOD object.

2 In the Attributes group, set the Max Distance value to **250** and the Min Distance value to **0**.

Attribute	Value
Max Distance	250
Min Distance	0
Transistion	0

TIP Click a field twice to make it editable. After you've entered the new value, press Tab to finish.

1  Select the *Good_Med* LOD object and set its Max Distance to **500** and Min Distance to **250**.

2  Finally, for the *Good_Low* LOD object, set the Max Distance to **1000** and Min Distance to **500**.

Now that you have created an LOD hierarchy structure, you need to provide Flight Studio with geometry. The first step in this process is to create two less detailed objects based on the original model.

Make a less detailed model:

1  In the Hierarchy list, select *p121.* which is a child of the *klingon_original* object.

2  Send the selection to the 3ds Max viewports by clicking Select Set.

3 From the main 3ds Max menu, choose Edit > Clone. In the Clone Options dialog, choose Copy. Change the name of the copy to **p121_Med,** and then click OK.

The scene now contains a copy of the original spaceship.

4 Right-click a viewport, and choose Hide Unselected.

5  Go to the Modify panel, and apply the ProOptimizer modifier to the copied object.

TIP To get to the ProOptimizer modifier in the drop-down list, you can press P repeatedly till ProOptimizer is highlighted, and then press Enter.

6 On the Optimization Level rollout, click Calculate to initialize ProOptimizer, and then set the value of Vertex % to **40**.

ProOptimizer reduces the vertex count of the model, making a simpler version of the spaceship.

Make an even less detailed model:

1 Right-click a viewport and choose Unhide All.

2  In the Hierarchy Browser, click Refresh. Select *Scene Root* by clicking its icon, then click the plus button.

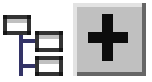
3 Repeat the previous procedure, with the following differences:

- Name the new copy **p121_Low.**
- In the ProOptimizer modifier, set Vertex % to **20**.

4 Right-click a viewport and choose Unhide All once again.

Your scene now contains three models in the same location, but with varying levels of detail. The next step is to sort them into the three LOD objects.

Assign the lower-resolution models as LOD objects, then view the results:

1  In the Hierarchy Browser, click Refresh to update the hierarchy list, then select *Scene Root* and expand the hierarchy.

2 Using the drag-and-drop technique, move *p121* to be a child of the *obj_Good_Hi* node.

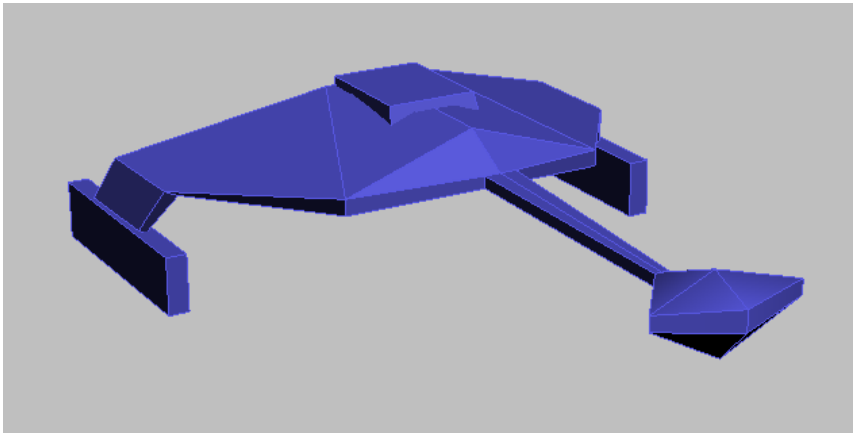
3 Move *p121_Med* to be a child of the *obj_Good_Med* node.

4 Move *p121_Low* to be a child of the *obj_Good_Low* node.

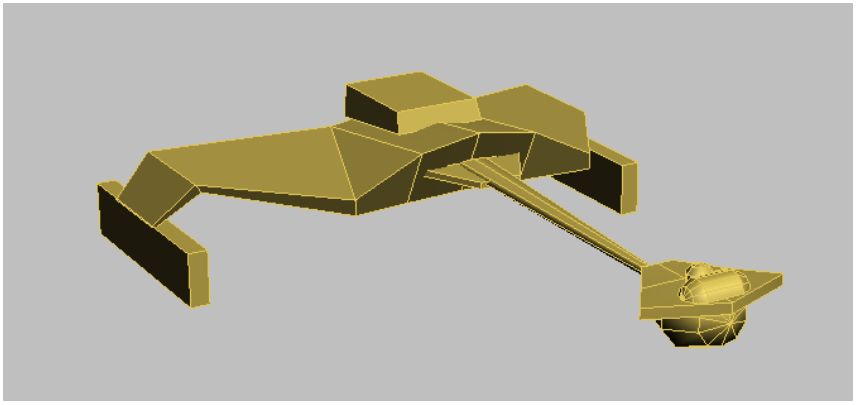
Now the LOD structure is complete. On the Flight Studio rollout in the Utilities panel, you can now view the various LODs by using the buttons in the Level of Detail group. Most Detail shows the full-resolution model; Least Detail shows the lowest-resolution model, and the More Detail and Less Detail buttons

step through intermediate levels. This is a preview of how the model will appear in a runtime simulation, with the level of detail based on the viewer's distance from the spaceship.

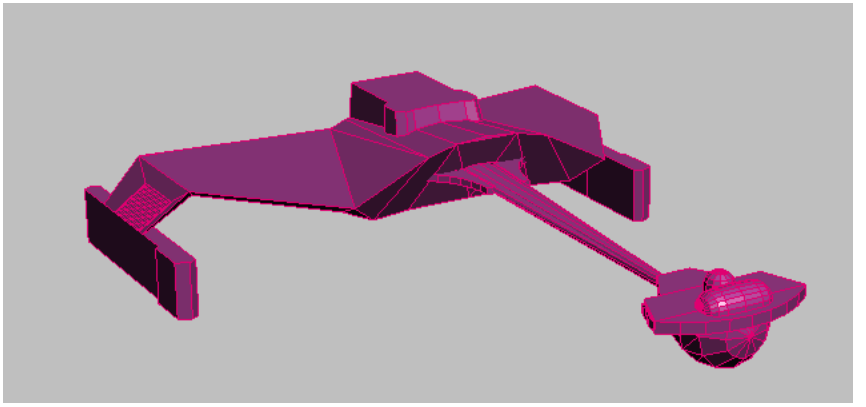
For comparison, you can look at the scene file *flightstudio_tutorial2_lod.max*. This is a similar scene, but it has more elaborate geometry, and the different LODs are color-coded for demonstration purposes.



Low detail



Medium detail



High detail

Next

Set Up a Switch Node on page 1896

Set Up a Switch Node

Switch nodes are used by the simulator's runtime system to display certain objects. The choice of which object to display is based on conditions other than distance. For example, if an object has been damaged, it can display as a broken model instead of a model that appears to be working. The switch node can contain many representations of an object. The display of any switch child is determined by a series of mask settings in the Switch node attributes.

In this lesson you will create the structures necessary to establish a Switch node so it can be integrated with the LOD nodes you created in the previous lesson.

Set up the lesson:

- Continue working with the file you created in the previous lesson, or open *flightstudio_tutorial2_lod.max*. This scene is in the folder *\interoperability\flight_studio*.

Create a switch node and arrange the hierarchy:

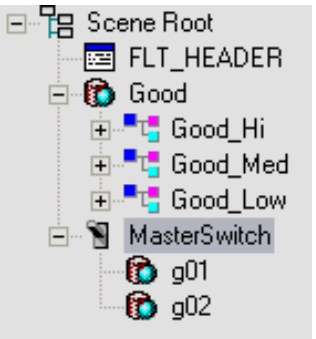
1  In the Hierarchy Browser, select the *Scene Root* node.

2 Choose Switch from the Create drop-down list, and then click Create.

3  Select the new Switch node and rename it **MasterSwitch**.

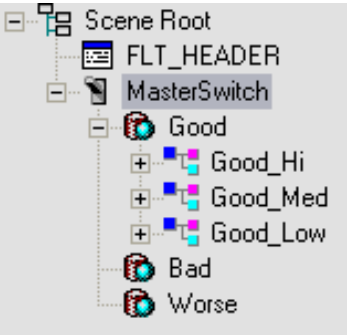
4  If the node becomes deselected after you rename it, select it again.

5 Choose Group from the Create drop-down list, and then click Create twice to create two new Group nodes. These new nodes should now appear as children of the *MasterSwitch*.



6 Rename the new Group nodes **Bad** and **Worse**.

7  Drag and drop the *Good* Group node to make it a child of *MasterSwitch*, then use the up-arrow or down-arrow buttons to arrange the groups so they are in the order *Good, Bad, Worse.*

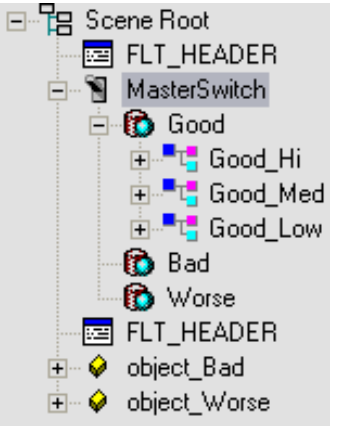


Load additional OpenFlight objects

1  From the Application menu choose Import, and then open the OpenFlight file *flightstudio_tutorial2_extra.flt*. Leave the import settings at their defaults, and click OK.

2  In the Hierarchy Browser, click Refresh. Select *Scene Root* by clicking its icon, then click the plus button.

New objects appear under the *Scene Root*.

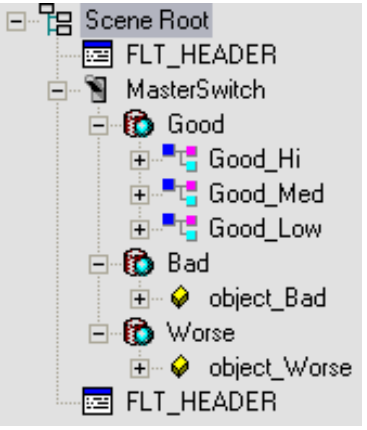


The new objects are named according to which section of the Switch node they belong. There is an object named *object_Bad* and another named *object_Worse*.

NOTE After you import the new objects, an additional *FLT_HEADER* entry appears in the hierarchy. You don't have to remove this node, because Flight Studio exports only the topmost header node it finds in the hierarchy. For steps to remove the Header node, see Delete the extra header on page 1882.

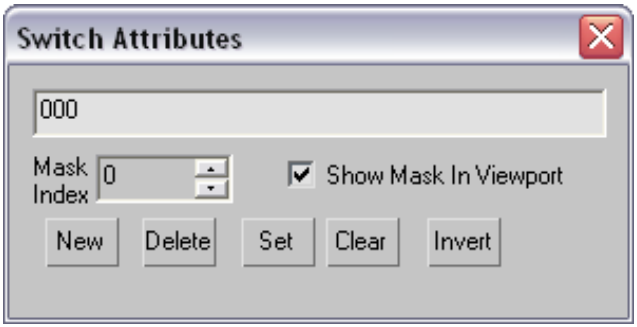
Make the new objects part of the switch:

1. Drag and drop *object_Bad* to make it a child of *Bad*.
2. Drag and drop *object_Worse* to make it a child of *Worse*.



Set the masks for the switch:

1.  Select the *MasterSwitch* node.
   The Switch button becomes available on the Hierarchy Browser toolbar.
2.  Click the Switch button. 3ds Max opens the Switch Attributes dialog.



3 Turn off Show Mask In Viewport.

This prevents the viewports from changing while you are creating masks.

4 Click the New button twice to add two more masks to the Switch.

Masks are counted starting at 0, so you should have a final count of 2. Use the Delete button if you create extra masks.

5 Use the Mask Index spinner arrows to change which mask is active. First go to mask 0.

6 In the text field at the top of the dialog, enter **001**.

This mask value indicates that the first child of the Switch node should be displayed.

7 Go to mask 1, and set the mask value to **010**.

This mask value indicates that the second child of the Switch node should be displayed. (Mask values are binary.)

8 Go to mask 2, and set the mask value to **100**.

This mask value indicates that the third child of the Switch node should be displayed.

View the effects of the switch:

1 Turn on Show Mask In Viewport.

2 Change the active Mask Index. As you change the active mask, the viewports display the associated geometry.

Export to OpenFlight format:

-  Choose Export from the Application menu, and name the file **spaceship_complete.flt**.
  You can also examine the file *flightstudio_tutorial2_final.flt* to see a completed version of the hierarchy.

Summary

This tutorial showed you how to set up OpenFlight Level-of-Detail (LOD) and Switch nodes, and how to view their effect using Flight Studio in 3ds Max.