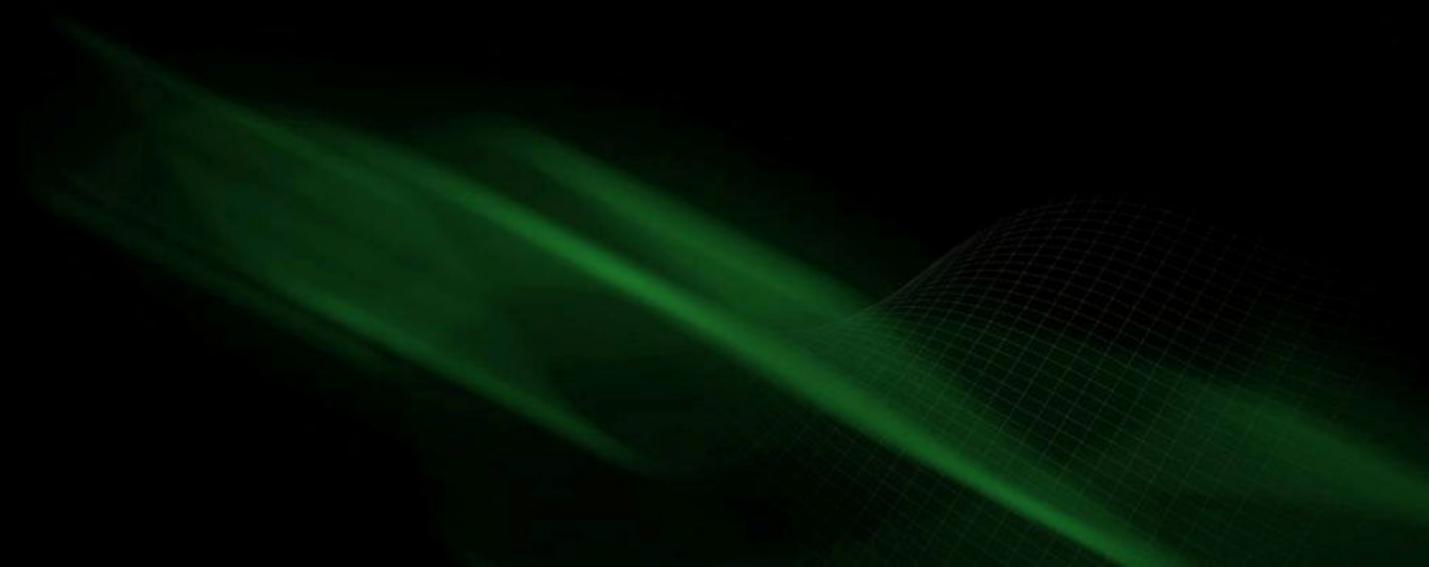




# GPU MeshMapper

GPU Developer Tools  
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## Introduction

The GPU MeshMapper simplifies the process of generating maps for a low-resolution mesh based on the details from a high-resolution mesh. This version of the tool has support for generating and visualizing normal maps, ambient occlusion maps, and displacement maps. The low-resolution mesh must have texture coordinates assigned to each vertex, and should ultimately be the mesh that will be used in your final application. The high-resolution mesh should contain all the detail that you want visible in the generated maps.

## What's New

### *What's New in GPU MeshMapper Version 1.2*

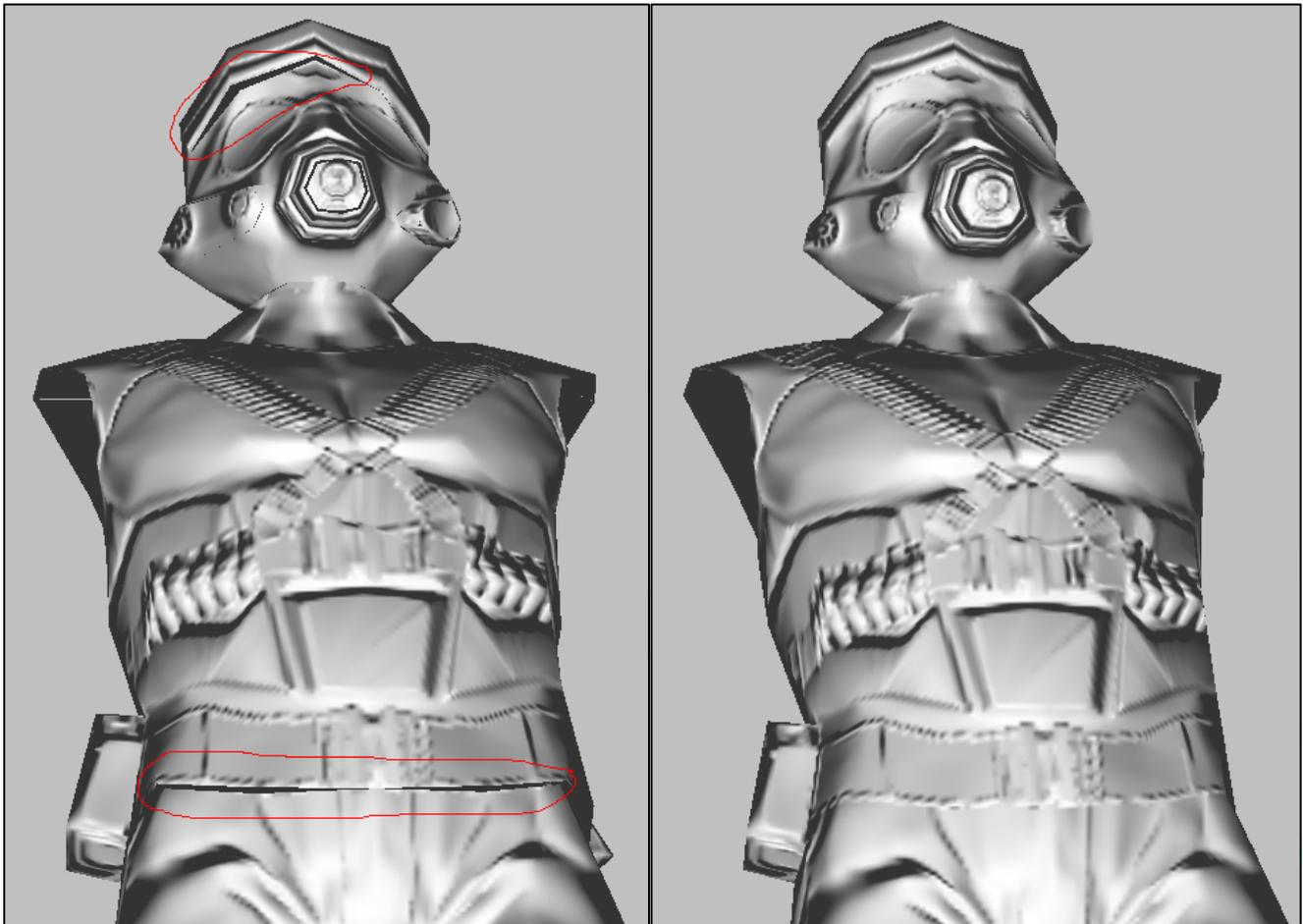
- Improved Ambient Occlusion Generation
- Updated to use the latest ATI Tessellation library (require Catalyst 8.11 or greater).
- Maintenance Release

### *Overview of New Features in GPU MeshMapper Version 1.1*

#### **Improved Texture UV Seams**

A new seam fixing algorithm reduces (or eliminates whenever possible) texture seams along texture UV boundaries. Texture seams can be color discontinuities for color texture map, lighting seams for normal map or geometry cracks for displacement map. This algorithm is performed automatically after map generation.

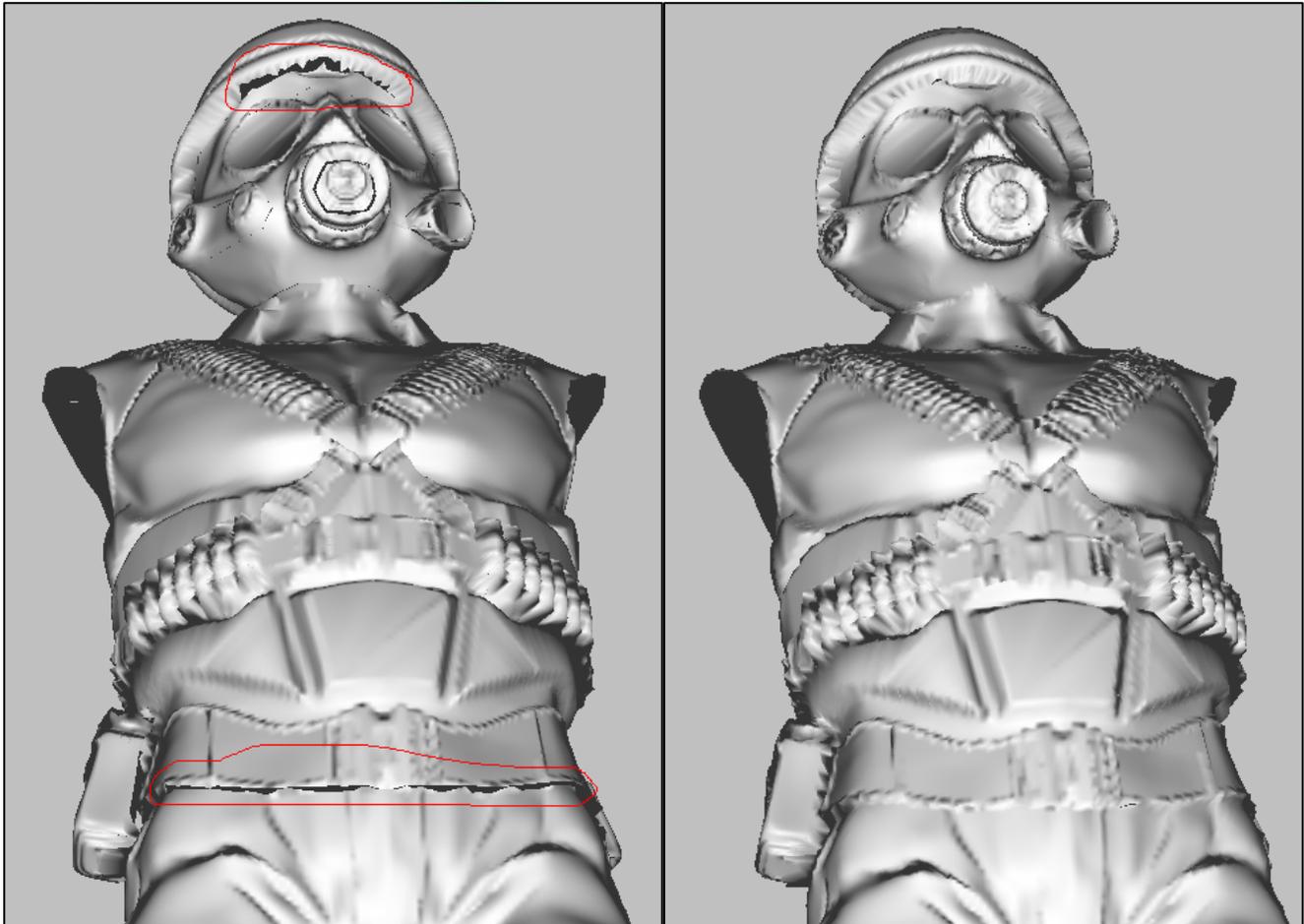
#### **Seamless Displacement Mapping**



Rendering a Soldier model with displacement mapping (with point-sampling) enabled. Left: Using a displacement map generated with GPU MeshMapper v1.0. Right: Using a displacement map

generated with GPU MeshMapper v1.1. Notice the geometry cracks along UV boundaries in the left figure (the area inside the red circles).

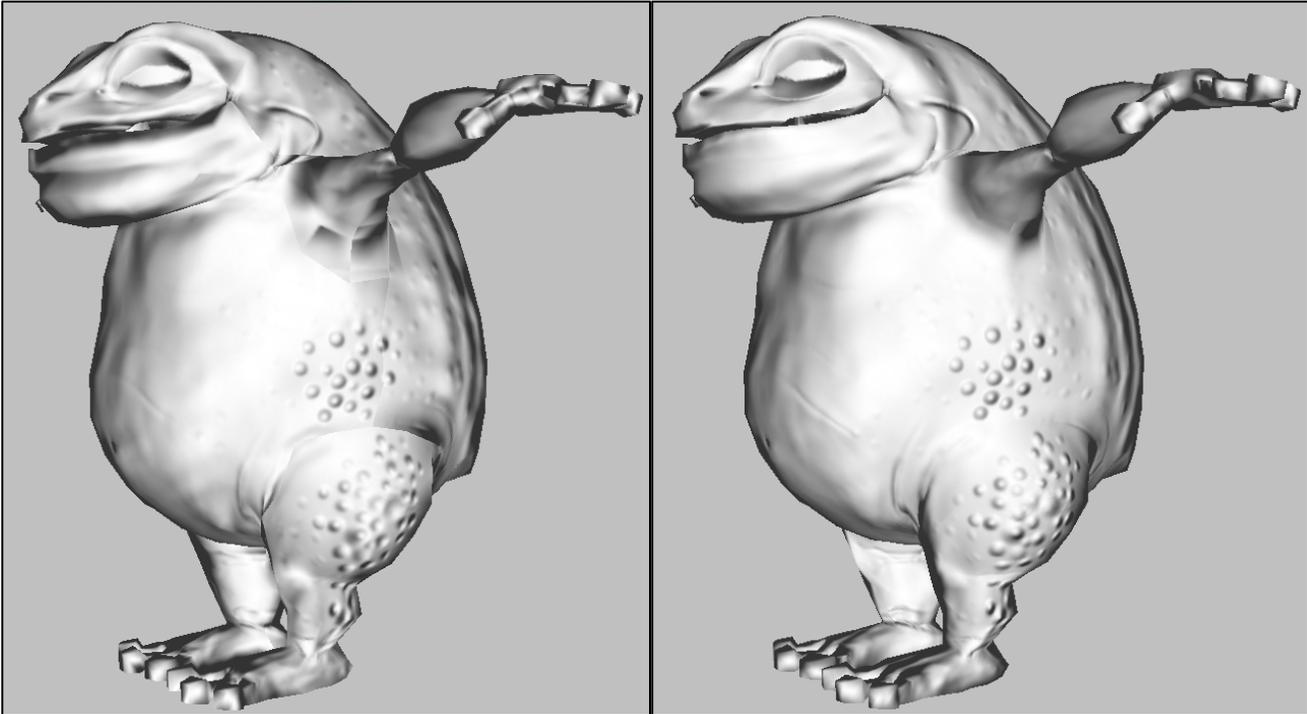
### Improved Seams for Tessellation



Rendering a Soldier model with displacement mapping and hardware tessellation enabled. Left: Using a displacement map generated with GPU MeshMapper v1.0. Right: Using a displacement map generated with GPU MeshMapper v1.1. Notice the geometry cracks along UV boundaries in the left figure (the area inside the red circles).

A similar improvement is achieved for normal mapping with bilinear sampling.

## Improved Support for Tangent Space Normal Map



Rendering a Froblin model with tangent space normal mapping enabled. Left: Using a tangent space normal map generated with GPU MeshMapper v1.0. Right: Using a tangent space normal map generated with GPU MeshMapper v1.1. Notice the visible lighting seams under the Froblin arm and on the upper part of the Froblin leg in the left figure.

For your application/engine to achieve continuous tangent space along texture UV boundaries as shown in the right figure, you should use an orthonormal tangent frame matrix. The formula for this matrix can be found in the Appendix A of Maya documentation for version 7.0 and above. Note that our own Demo Team is not able to use Maya v8.5 to generate a tangent space normal map that produces a high rendering quality similar to the right figure above.

## Improved Performance

- Support for multi-core processors.
- Improvements to internal algorithms (20% improvements).

Our in-house testing revealed a 2.2x total speed up for generating 2048 by 2048 maps on a dual-core CPU.

## Improved User Interfaces

- Preview options for the low and high resolution meshes will be saved in a project file. It is now possible to set all your favorite settings in the preview options (for example, CW cull mode, wireframe, render with lighting, etc) and save these settings in a project file.
- Camera settings will be saved in a project file. It is now possible to set up a view for the mesh and save this view in a project file.
- Added support for keyboard shortcuts.
  - **A** Toggle Ambient Occlusion rendering for the low resolution mesh.
  - **D** Toggle Displacement Mapping for the low resolution mesh.
  - **E** Change camera to Pan mode.
  - **R** Change camera to Rotate mode.
  - **S** Toggle Stats.
  - **T** Toggle Tessellation for the low resolution mesh.
  - **W** Toggle wireframe mode (solid/wireframe) for the low resolution mesh.
  - **Ctrl + H** Load a high resolution mesh.
  - **Ctrl + L** Load a low resolution mesh.
  - **Ctrl + O** Open a project.
  - **Ctrl + Q** Quit the app.
  - **Ctrl + S** Save the current project.
- Added a composite display for the preview window's title. The title has been updated from always displaying "Scene View" to a more descriptive text such as "Displaying Low Res Mesh with Displacement Mapping and Tessellation".
- Added a "pan" camera mode for the middle mouse button.
- Added support to capture a screenshot (right-click the preview window and select **Take Screenshot** option).
- Updated Stats display to show the number of triangles for the low, high resolution mesh and low resolution mesh after tessellation.
- Added an ability to perform dilation post-processing in the Map Composer. This is particularly useful for a mesh with multiple components. Now, there will not be cracks/seams along texture UV boundaries using the maps generated by Map Composer.

## Improved Stability

- Fixed bugs and memory leaks.
- Improved support for generating 1K by 1K and 2K by 2K maps.

## Other Features and Bug Fixes

- The application will now only ask to save a project if one or more settings have changed.
- Fixed support for 24 and 32 bits BMP file.
- Fixed support for using negative numbers in a script.
- Loading an obj file will no longer compute tangent vectors twice.
- Fixed support for Collada files with multiple/hierarchical objects/meshes.
- Added support for generating maps with multiple/hierarchical meshes.
- Fixed support for composing maps back to back using a map composer script.
- Fixed support for disabling displacement or ambient occlusion map generation using a script.
- Fixed a bug that will crash the application if you generate maps after viewing and closing the map viewer.
- Fixed a bug that will crash the application if you generate maps back to back especially for large maps.
- Fixed a bug in the preview option UI.
- Removed redundant UI display update calls.
- Fixed support for using absolute and/or relative path in the script.
- Fixed an error that will crash the application if the low resolution mesh contains texture coordinates that are outside of [0, 1] range. Now, it will ignore the portion of the map that lies outside of the [0, 1] range and print a warning to the output window to notify the user.
- Fixed a bug that will require an additional mouse click to transform the scene after selecting an option from the context menu.
- Fixed a bug that will not render the scene properly if we turn off the normal map option and use an ambient occlusion map in the alpha channel.
- Removed several unnecessary texture conversions.
- The box filtering option has been removed.
- Updated project, script and texture files.
- Added animate light (a rotating light) for the scene. This can be accessed by right clicking the preview window and select **Animate Light** from the context menu.
- The application now links to DX9 March 2008 library.

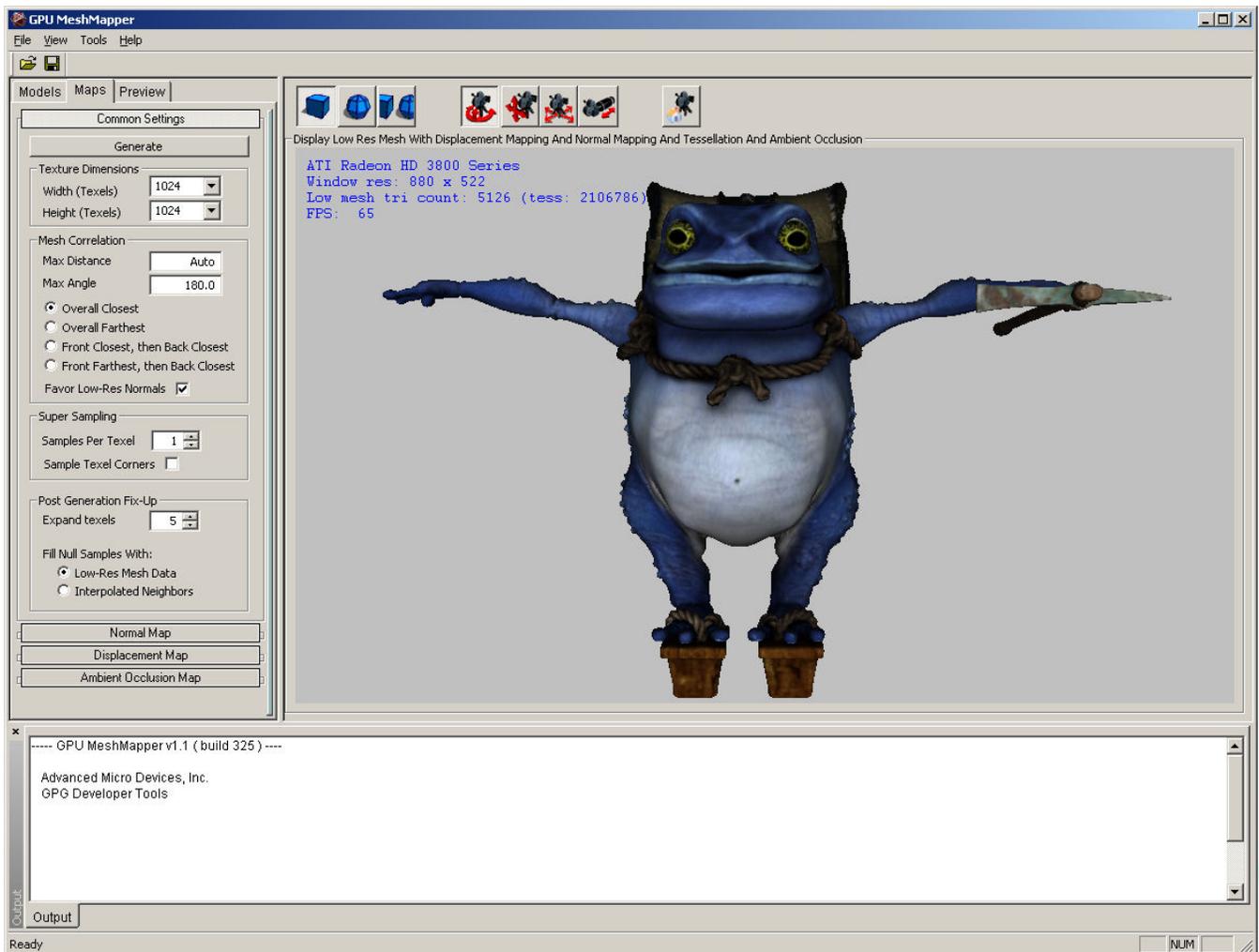
# Overview

The GPU MeshMapper application is composed of 3 main parts: *UI Panel*, *Preview Window* and *Output Window*.

The *UI Panel* is located on the left side of the screen and contains a tab controls to help load your low and high-resolution meshes, customize map generation settings, and modify the rendering visualization that is located in the *Preview Window*.

The *Preview Window* consumes the majority of the window and displays the currently loaded mesh based on the display settings that are available through the *UI Panel* or through the context menus.

The *Output Window* is located along the bottom of the window and displays the actions that are being performed along with error messages.



## Example Process

The outline below describes the typical map creation process.

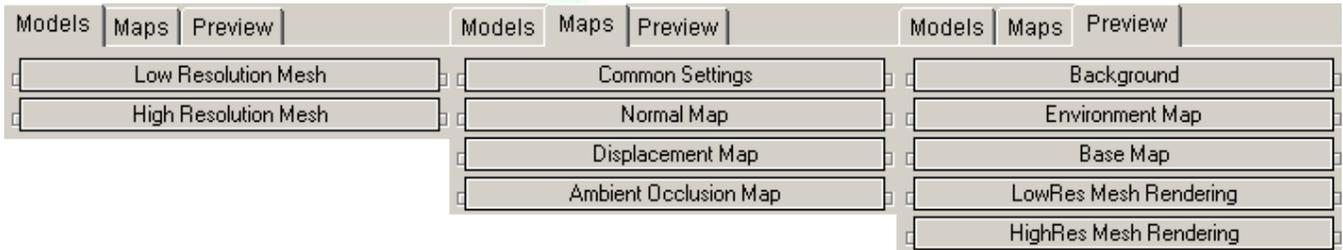
- 1) Load models.
  - a. Load low resolution mesh by either:
    - Open the “File” menu. Select “Load Low Res Mesh...”.
    - Right click on the left half of the *Preview Window* and select “Load Low Res Mesh”.
    - Select the “Models” tab from the *UI Pane* open the “Low Resolution Mesh” roll-up control and click the “Load Low Resolution Mesh” button.
  - b. Load high resolution mesh by either:
    - Open the “File” menu. Select “Load High Res Mesh...”.
    - Right click on the right half of the *Preview Window* and select “Load High Res Mesh”.
    - Select the “Models” tab from the *UI Pane* open the “High Resolution Mesh” roll-up control and click the “Load High Resolution Mesh” button.
- 2) Configure generation settings.
  - a. Select the “Maps” tab within the *UI Pane*.
  - b. “Common Settings” contains those settings which have an affect on all the maps that can be generated.
  - c. “Normal Map” contains settings that only affect the normal map. There is no way to disable normal map generation.
  - d. “Displacement Map” contains settings that only apply to the displacement map. Displacement map generation can be disabled, however it adds no additional processing time to generating the normal map.
  - e. “Ambient Occlusion Map” contains those settings that affect the ambient occlusion map. Generating this map can be disabled if desired, as it can add significant processing time to the generation process; however it can be optionally accelerated using the GPU.
- 3) Save your settings as a project file

- a. Open the “File” menu and select “Save Project As...” to open a save dialog box that will allow you to store your project settings. This will store the path to the meshes you have loaded and the current generation settings.
  - Now you can easily reopen this project and have the models automatically loaded and your customized settings restored!
  - It will also store the low and high resolution mesh preview options from the “Preview” tab and the camera settings.
- 4) Start the map generation process.
  - a. Select the “Maps” tab within the *UI Pane*.
  - b. Open “Common Settings”.
  - c. Click the “Generate” button.
- 5) Preview the resulting maps.
  - a. After the maps are done generating, the *Preview Window* will automatically switch to rendering with lighting and the normal map applied. Previewing settings can be switched by either:
    - Right clicking in the *Preview Window* on the mesh that you’d like to visualize differently and selecting one of the available options.
    - Open the “Preview” tab in the *UI Pane*; open the roll-up control related to the setting you’d like to change, and make your selection from the available options.
  - b. You can also view the textures directly using the Map Viewer, which can be accessed from the “Maps” tab within the *UI Pane*, then opening the roll-up control of the map you’d like to view and selecting the “View” button.
- 6) Save the maps to disk for use in your own application.
  - a. From within the “Maps” tab of the *UI Pane* there is a “Save” button located within each of the maps’ roll-up controls. Click on these buttons to save the corresponding map and to set the format the data should be stored in.
    - NOTE: Immediately after being generated, the maps are automatically stored in a 32-bit floating point texture format within the application’s directory. This uses a default filename for each map, so be sure to save them again with your own format and filename so they don’t get over written the next time you generate a map!

# User Interface

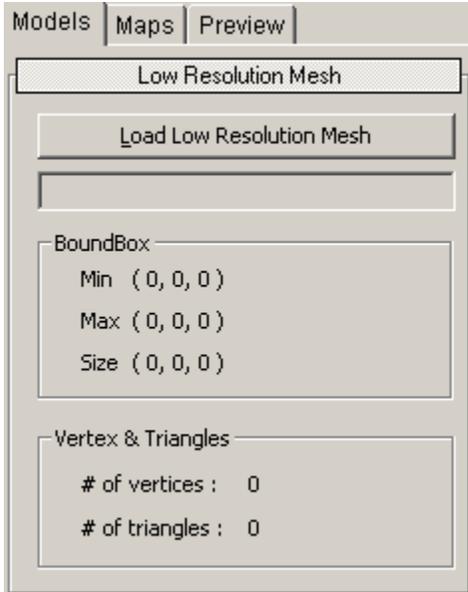
## UI Panel

The *UI Panel* window is the window on left side; it consists of three main tabs: “Models”, “Maps”, and “Preview”.



## Models Tab

The “Models” tab allows you to load high and low resolution meshes and reports the number of vertices and triangles in each mesh and statistics about the mesh’s bounding box.



Click here to collapse \ expand the options

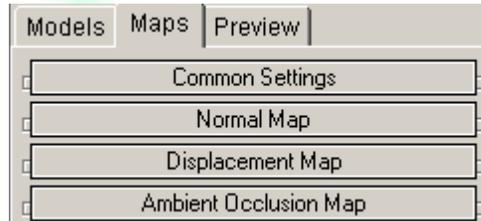
Click here to load mesh from disk

Displays the path name for the mesh

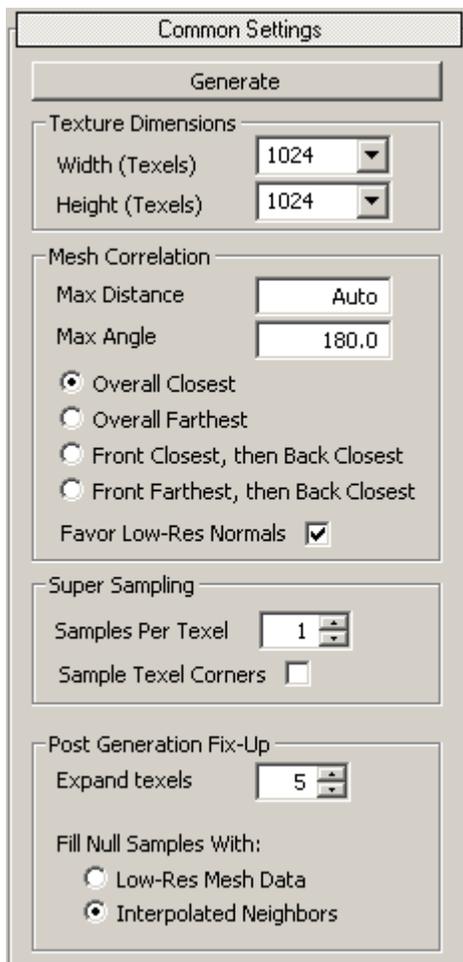
- BoundingBox is the extent of the mesh.
- Vertex & Triangles shows how many vertices and triangles make up this mesh.
- Currently, data can be loaded from NMF, OBJ, and DAE file formats.

## Maps Tab / Generation Settings

The “Maps” tab contains all the settings needed for map generation, loading, and saving. There are four sections contained within this tab; each will be described in detail below.



### Common Settings



Settings located here affect how all the maps will be generated.

- The **Generate** button activates the map generation process based on the specified settings. While maps are being generated, a progress bar will appear that allows you to cancel the generation process. If you'd like to minimize the main window during this time, right click on the task bar and select “Minimize”.

“Texture Dimensions” indicates the dimensions of the resulting maps.

- **Width** specifies the width (in texels) of all generated maps.
- **Height** specifies the height (in texels) of all generated maps.

“Mesh Correlation” contains the settings that control how the correlation between the low and high-resolution meshes is found.

- **Max Distance** specifies that a point on the high-res mesh must be closer than this distance to a point on the low-res mesh in order to be considered as a

correlating point. A surface that is further than this distance away will not be considered as a matching point. This value is in the same units as the high-res mesh. If cleared, and “Auto” is shown, then a distance of 50% of the shortest bounding-box dimension will be used (ex, if you the model is 60x100x80, then “Auto” will be calculated as 30).

- **Max Angle** the number of degrees within the low-res normal that a high-res normal must be in order to be considered as a correlating point. A Max Angle of 180 degrees (or 90 degrees in any direction) will prevent back-facing surfaces from being considered.

Given a set of correlating points on the high-res mesh, the following settings indicate how the choice is made between them:

- **Overall Closest** selects the point that is the shortest distance to the low res mesh considering surfaces in front and in back.
- **Overall Farthest** selects the farthest point away from the low-res mesh considering surfaces in front and in back.
- **Front Closest, then Back Closest** first searches in front of the low-res mesh and selects the closest surface. If no surfaces are found in front, then it searches for the closest surface behind the low-res mesh.

- **Front Farthest, then Back Closest** first searches in front of the low-res mesh and selects the farthest point away. If no points exist in front, selects the closest point behind. This is similar to the outer-most point.
- **Favor Low-Res Normals:** select the point whose normal is closest in direction to the low-res normal if the two points in question are equidistant from the low-res surface.

“Super Sampling” controls how many points per texel will be mapped to the high-resolution mesh.

- **Samples Per Texel** controls the number of points within each texel for which a correlating point on the high-res mesh will be found. For example, if set to 2, 2x2 samples will be taken and the result will be an average of them.

- When **Sample Texel Corners** option is ON, 4 extra samples (one at each corner of the texel) are added for the correlation search.

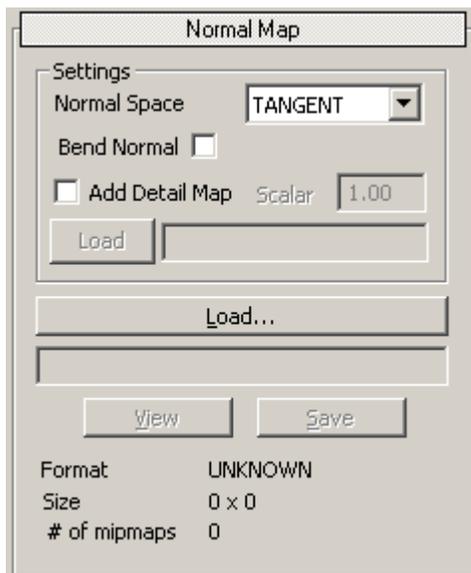
“Post Generation Fix-Up” contains processes that take place after the maps are generated to clean them up for final use.

- **Expand Texels** controls how many passes of dilation happen in a post process. This expansion will reduce artifacts along UV seams when rendering uses non-point sampling ( linear/trilinear/anisotropic ) and/or mip-mapping.

- Null Samples are texels for which no corresponding point on the high-res mesh could be found. If **Low-Res Mesh Data** is selected, these texels will be filled with the data from the low-res mesh. When **Interpolated**

**Neighbors** is selected, these texels will be intelligently filled with data from the neighbors that were not Null Samples. This option tends to yield much better (smoother) results when Null Samples occur.

## Normal Map



- **Normal Space** controls the space that the normal map is generated in:
  - **TANGENT** – Map will be in mesh's tangent space.
  - **WORLD** – Map will be in world space coordinates.

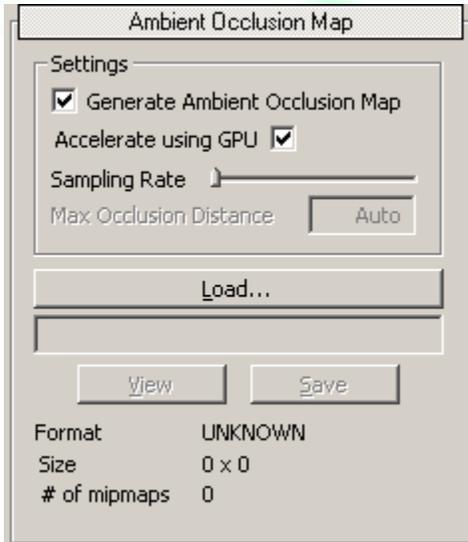
- **Bend Normal** will cause the normals to be slightly angled in the direction that most light will be received from. This calculation is similar to the ambient occlusion calculation and can be done for free if you are generating an ambient occlusion map.
- **Add Detail Map:** when selected, the loaded detail map will be applied to the generated normal map.
  - **Scalar:** a float value that will be multiplied by the detail map prior to applying it to the normal map.
  - **Load:** click this button to load the detail map. The path of the loaded map will appear in the field to the right.

## Displacement Map



- **Generate Displacement Map** enables the displacement calculation.
- **Desired Scale:** a float value that specifies the scale what will be used with the displacement map. This value will be used to scale the resulting values correctly. If the field is cleared and "Auto" is shown, the actual resulting scale will be calculated and reported for use in the rendering shader.
- **Desired Bias:** a float value that specifies the bias that will be used with the generated displacement map. This value will be used to shift the resulting values accordingly. If the field is cleared and "Auto" is shown, the actual resulting bias will be calculated and reported for use in the rendering shader.

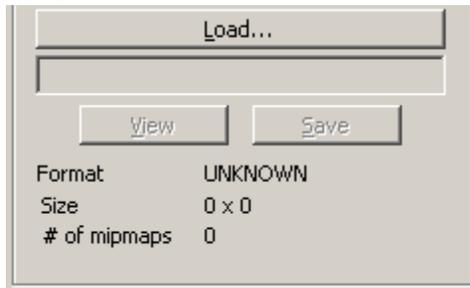
## Ambient Occlusion Map



- **Generate Ambient Occlusion Map** enables the ambient occlusion computation.
- When **Accelerate using GPU** is ON, normal mapper will use graphics card GPU processing power to accelerate ambient occlusion computation.
- **Sampling Rate** will control the number of occlusion samples that are taken when calculating ambient occlusion. Quality goes higher as the slider control goes right (and processing time takes longer).
- **Max Occlusion Distance** specifies the maximum distance between two objects such that one object will still be considered to occlude the other. This setting is disabled if the ambient occlusion calculation is accelerated using the GPU.

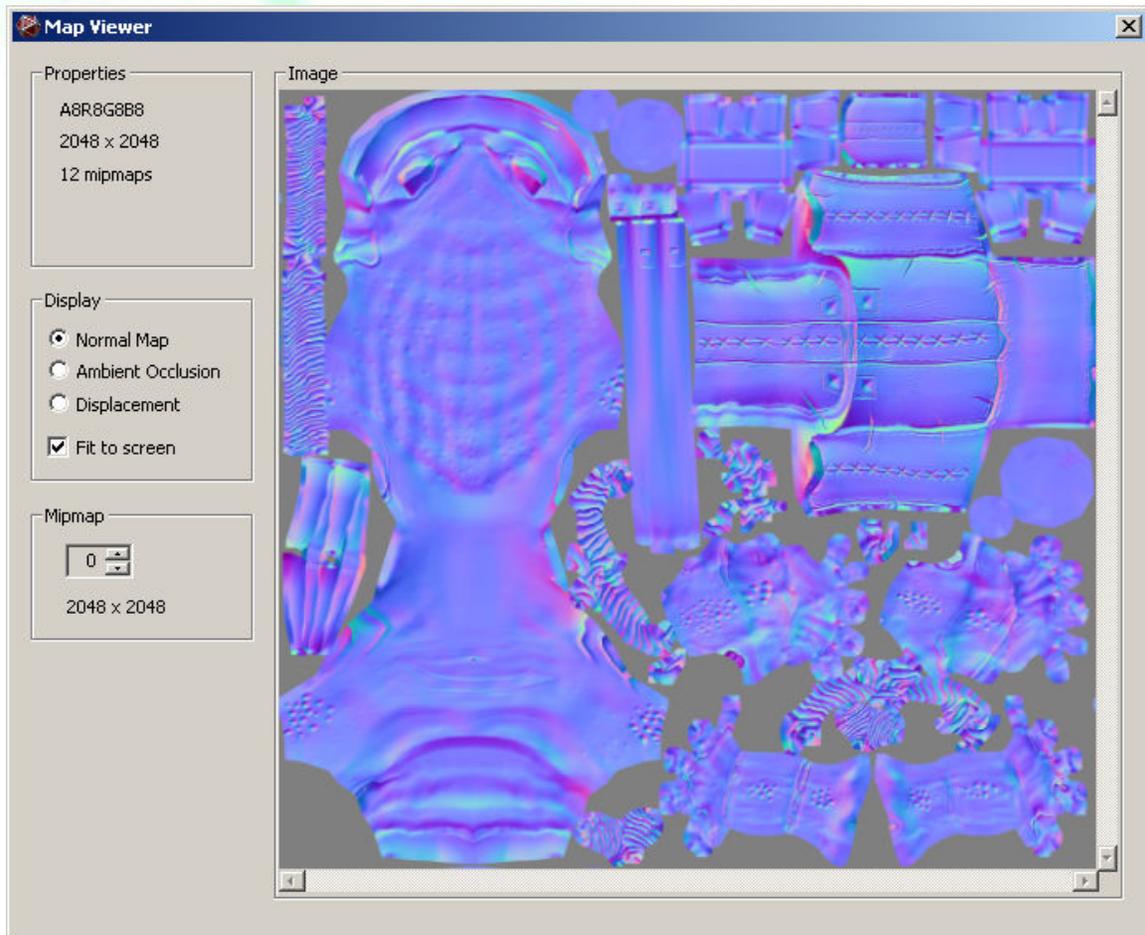
## Map Loading, Viewing, Saving

Each of the “Normal Map”, “Displacement Map”, and “Ambient Occlusion Map” sections of the “Maps” tab have controls that also allow you to load a pre-existing map for visualizing and saving (or for saving the map that was just generated).



- **Load...** Press this button to open an existing map from file for visualization or resaving.
  - **View:** Once a map is generated or loaded, clicking this button will open the MapViewer to allow you to view the actual texture.
  - **Save:** Once a map is generated or loaded, clicking this button will open a dialog box that allows you to save the associated map and specify the format that you'd like the values to be stored in; both unsigned int and float formats are supported with a variety of components and bits per component. Currently supported image types include TGA, JPG, DDS, BMP, and TIFF among others.
- “Format” shows the current format of the map. Ex. A8R8G8B8 means 8 bits each for alpha, red, green, and blue channels.
  - “Size” shows the dimension of map (in texels).
  - “# of mipmaps” shows how many mipmap chains were created for the map (including the top level).

## Map Viewer



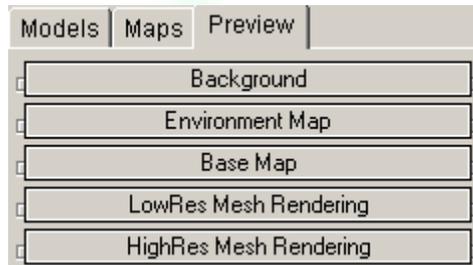
When you click on “View” from the Map section in the *UI Panel*, the Map Viewer window appears. This window can be resized for better viewing.

- **Properties** contains the format, dimensions, and # of mipmaps in the texture. When the viewer is set to display a displacement map, the scale and bias that should be used with the map is also displayed.
- **Display** controls which texture is displayed in the window. By default the normal map is displayed, but if they are available, the ambient occlusion and displacement map can also be shown.
  - **Normal Map** shows the normal map as color (xyz are encoded as rgb).
  - **Ambient Occlusion** shows the ambient term gray-scale (darker texels are more occluded and brighter texels are less occluded).

- **Displacement** shows the displacement map as a gray-scale image. (darker texels are displaced less than brighter texels).
- If **Fit to screen** is set, the texture will be scaled to fit inside the viewing window to the right. Otherwise, the texture will be displayed in actual size (without scaling); in this mode, you can either use the scroll bars or click and drag to move around the image.
- **Mipmap** allows you to change which mip-level is displayed and reports the dimensions of the currently displayed mip-level.

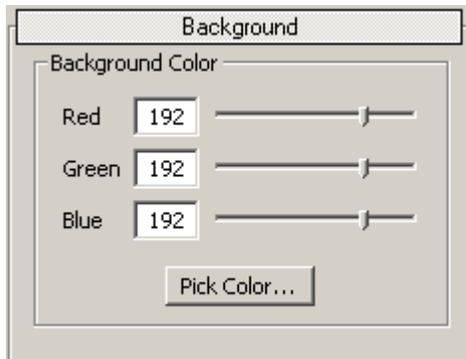
## Preview Tab

The “Preview” tab allows you to change the way that the scene is rendered in the *Render Preview* window. You can select and tweak the background color, load a skybox, load a texture to apply to the models and modify the low and high res mesh rendering options.



## Background Section

“Background” section contains controls to modify the background color.



- **Red:** You can tweak the red value by entering a color value (0 to 255) or adjusting the slider.
- **Green:** You can tweak the red value by entering a color value (0 to 255) or adjusting the slider.
- **Blue:** You can tweak the red value by entering a color value (0 to 255) or adjusting the slider.
- **Pick Color...** Press this button to bring up color dialog which will allow you to see the colors and make a selection more visually.

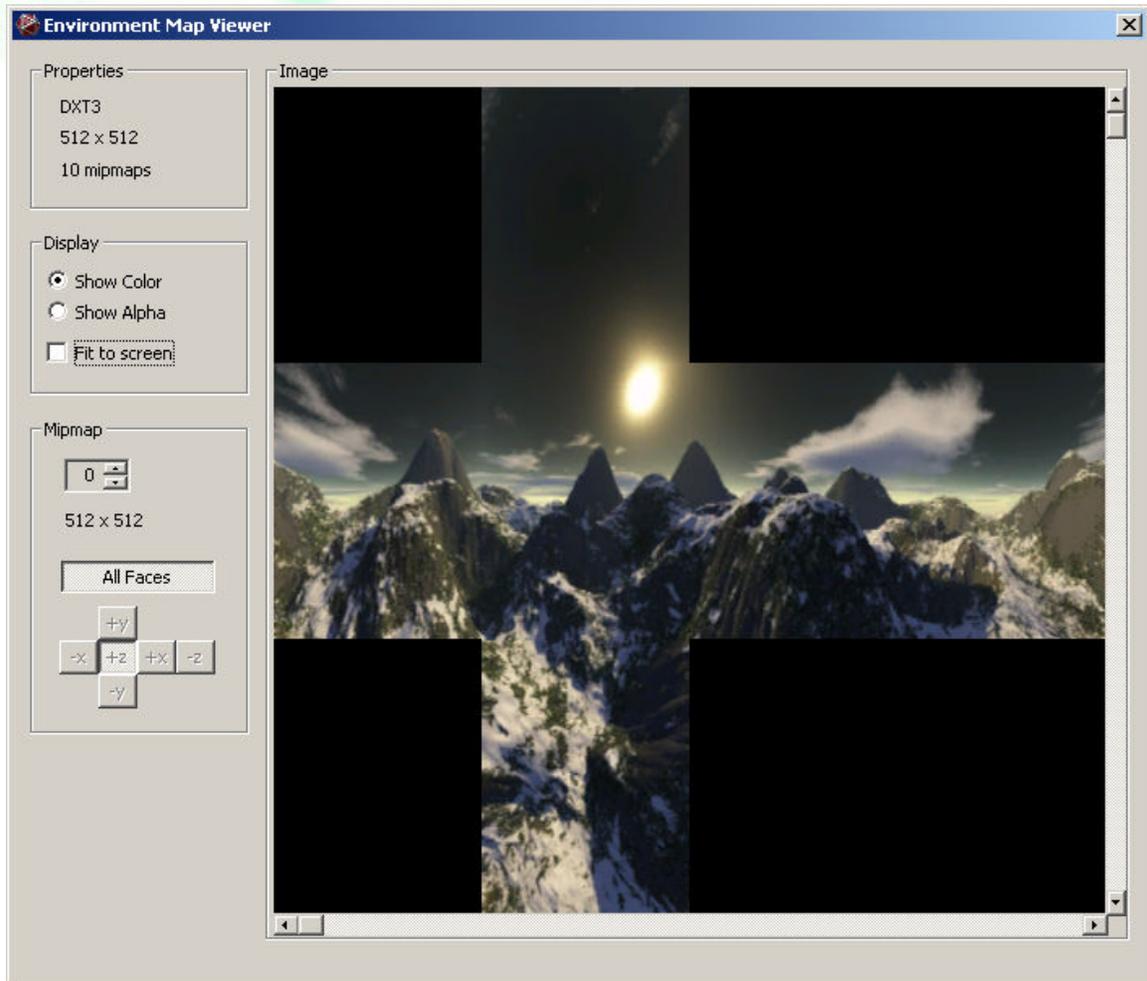
## Environment Map Section

The “Environment Map” section allows you to load a cubemap and toggle whether or not it is used in the preview window.



- Click on **Load** to load a cubemap texture from disk as an environment map. When a map is loaded, this same button will read “Unload” and can be clicked again to unload the map.
- If **Display As SkyBox** is checked, the preview window will render the loaded cubemap texture as a skybox.
- Click on **Save** to save cubemap texture to disk.
- Click on **View** to bring up SkyBox Map Viewer window.
- **Format** shows the cubemap’s format (Ex. A8R8G8B8 means 8 bits each for alpha, and rgb channels).
- **Size** shows the dimensions of the cubemap faces (in pixels).
- **# of mipmaps** shows how many mipmap chains are present in the cubemap.

## Environment Map Viewer

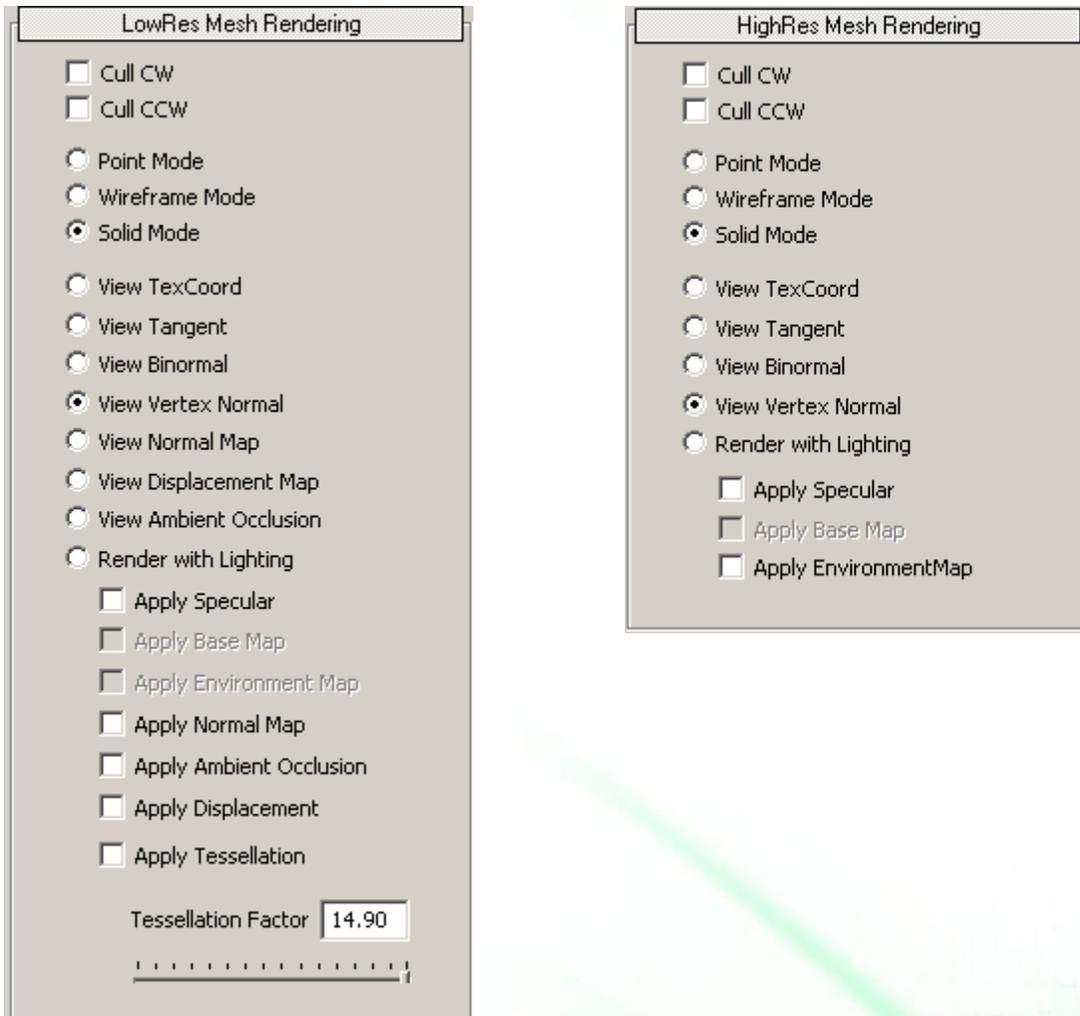


When you click on “View” from the “Environment Map” section in the *UI Panel*, the Environment Map Viewer window appears. This window can be resized for better viewing.

- **Properties** constrains the format, dimensions, and # of mipmaps in the texture.
- **Display** controls whether the color (RGB components) or alpha channel is displayed in the window.
- If **Fit to screen** is set, the texture will be scaled to fit inside the viewing window to the right. Otherwise, the texture will be displayed in actual size (without scaling).

- Within the **Mipmap** area, you can change which mip-level is displayed and see the dimensions of the currently displayed mip-level. You can also choose which faces of the cubemap you would like to view; either **All Faces** can be viewed, or a specific face ( either **+y, -x, +z, +x, -z, or -y** ).

## Low Res / High Res Mesh Rendering Sections



This section controls how the low and high resolution meshes are rendered in the preview window.

- **Cull CW** culls clockwise specified geometry with respect to the current view.
- **Cull CCW** culls counter-clockwise specified geometry with respect to the current view.

- **Point Mode** will render the mesh with a point for each vertex.
- **Wireframe Mode** will render the mesh in wireframe.
- **Solid Mode** will render solid triangles.
- **View TexCoord** will color the mesh with its texture coordinates ( uv -> rg ).
- **View Tangent** will color the mesh based on its tangent vector ( xyz -> rgb ).
- **View Binormal** will color the mesh based on its binormal vector ( xyz -> rgb ).
- **View Vertex Normal** will color the mesh based on the vertex normals ( xyz-> rgb ).
- **View Normal Map** if a normal map is available, it will be applied to the mesh as a texture, so that you can visualize the xyz values of the normal map as an rgb color.
- **View Displacement Map** if a displacement map is available, it will be applied to the mesh as a texture and the displacement value will be encoded as a gray-scale color.
- **View Ambient Occlusion** if an ambient occlusion map is available, it will be applied to the mesh as a texture and the ambient term will be encoded as a gray-scale color.
- **Render with Lighting** will render the mesh using the phong lighting model
  - **Apply Specular** specular lighting will be enabled.
  - **Apply Base Map** if available, the base map will be applied to the mesh.
  - **Apply Environment Map** reflection of environment will be applied.
  - **Apply Normal Map** if available, normals from the normal map will replace the interpolated normals used for lighting.
  - **Apply Ambient Occlusion** if available, the ambient term from the ambient occlusion map is applied.

- **Apply Displacement** if a displacement map is available and hardware allows it, vertex positions will be adjusted based on the displacement map.
- **Apply Tessellation** if the GPU in your machine supports tessellation and a displacement map is available; this enables tessellation of the low-res mesh. Also “Apply Displacement” to get the full effect of tessellation.
  - **Tessellation Factor** If tessellation is applied, the level of tessellation can be changed by either entering the level in the text box or adjusting the slider control.

## Preview Window

The preview window provides a quick and easy way to visualize the meshes that are being used to generate the maps and enables you to immediately view the results applied to the low-resolution mesh. This is useful for being able to quickly decide whether you want to make changes to the generation parameters and regenerate the maps, or if they should be saved for use farther down your tool chain.

NOTE: When both meshes are being previewed the view is setup based on the union of the meshes' bounding volume. If both meshes exist in the same world-space (and they should) then both models will appear centered. When a single model is being previewed (as shown below), the view will be adjusted for that particular model.





From left: Display low res mesh. Display high res mesh. Display both meshes.

If you click the currently selected button a second time (to depress it), neither of the meshes will be displayed. This is useful if you have loaded large meshes and rendering it causing the application to respond slowly. Selecting one of the buttons again will display the corresponding mesh(es).



From left: Rotate, Pan, Slide, Zoom UI mode.



Reset camera to default position.

## Keyboard Shortcuts

- **A** Toggle Ambient Occlusion rendering for the low resolution mesh.
- **D** Toggle Displacement Mapping for the low resolution mesh.
- **E** Change camera to Pan mode.
- **R** Change camera to Rotate mode.
- **S** Toggle Stats.
- **T** Toggle Tessellation for the low resolution mesh.
- **W** Toggle wireframe mode (solid/wireframe) for the low resolution mesh.
  
- **Ctrl + H** Load a high resolution mesh.
- **Ctrl + L** Load a low resolution mesh.
- **Ctrl + O** Open a project.
- **Ctrl + Q** Quit the app.
- **Ctrl + S** Save the current project.

## Context Menus

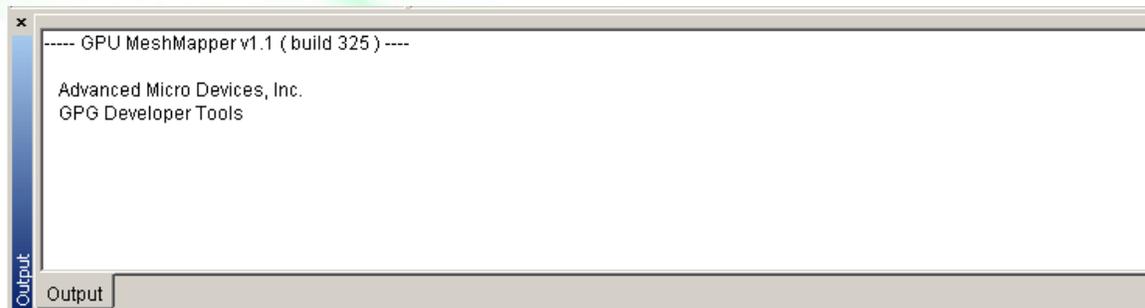


By left-clicking in the *Preview Window*, context menus will appear to help you easily modify the preview window.

The first four options will remain constant and can affect both the low and high res mesh previewing.

The remaining options will differ depending on whether you click in the low-res mesh rendering window or in the high-res mesh rendering window. These options provide you quick access to the options in the Display Tab of the *UI Panel*.

## ***Output Window***



The Output Window will display any errors or notifications that may be important, along with the start and end time of map generation.

This window can be closed via the View menu.

## Menu Options

The available menu options are: **File View Tools Help**

### File



Allows you to load and save project files. By selecting “Save Project As”, you can

also save the settings as a script which can be used for command-line map generation. This menu also lists the 5 most recently opened project files, allows you to load low and high resolution meshes, and allows you to exit the application.

### View



**Status Bar** allows you to show / hide the status bar at the bottom of the application.

**Output Window** allows you to show / hide the Output Window.

### Tools



The menu contains additional tools that can assist you with the maps you’ve generated.

## Map Composer

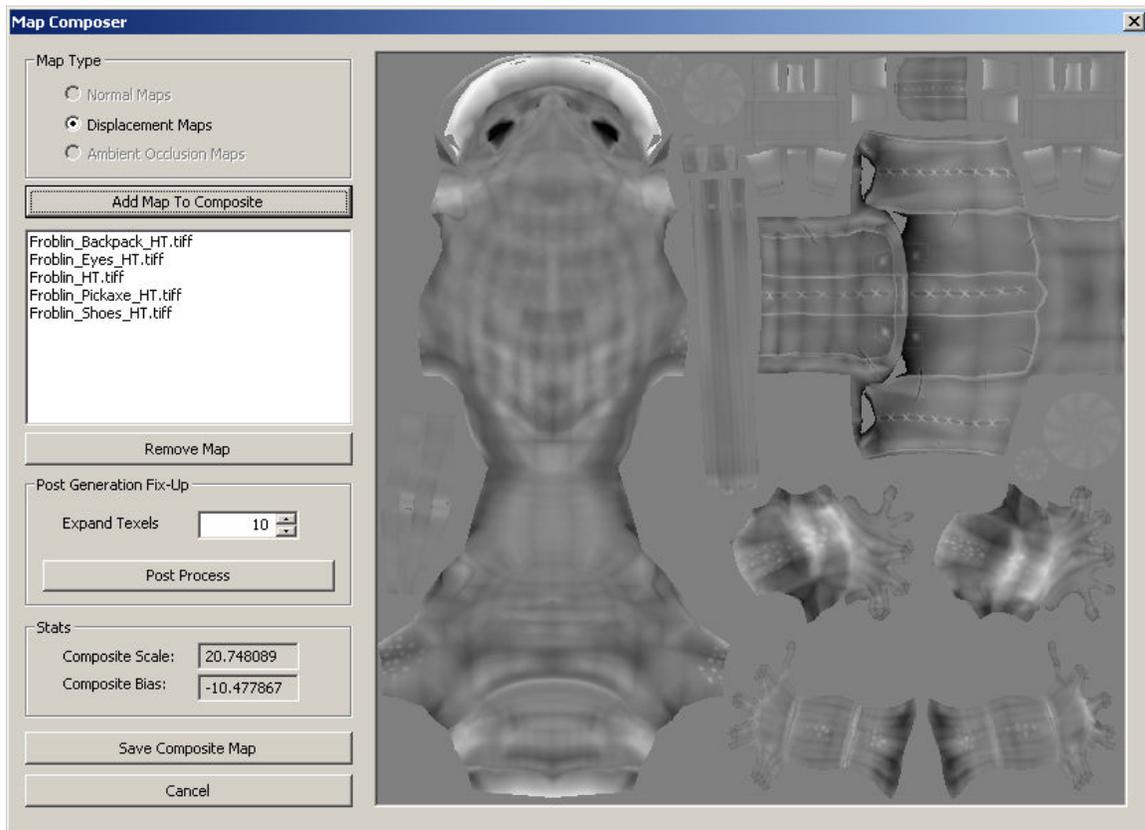
The Map Composer allows you to combine multiple maps of a particular type (Normal, Displacement, or Ambient Occlusion) and can normalize the composite map into a single scale and bias.

This tool is particularly useful when trying to generate maps for a complex object (for example, a character in a game) which may need to be separated out into individual pieces for the maps to be generated properly. This allows maps to be generated separately for arms, legs, bodies, and accessories, and then be properly combined into a

single map rather than having to manually paste them together. Manually combining displacement maps would require additional care to keep the scale and bias values the same for each generated map, or to be manually corrected when combining the maps. Fortunately, the Map Composer was designed to perform these tasks for you.

Similar to the map generation, the Map Composer allows you to perform **Expand Texels** (how many passes of dilation) on the generated maps.

When saving generated maps, an additional “\*\_mask.dds” texture is saved that is used by the Map Composer to identify where the important information is stored in the texture. These masks do not include the areas that may have been dilated as a post process (to prevent overwriting one texture’s important data with the dilated information from a second texture). Normal maps are assumed to have a scale of 2 and a bias of -1 and ambient occlusion maps are assumed to have a scale of 1 and a bias of 0. Displacement maps, which can have any scale and bias, are saved with an additional “\*.txt” file that contains the maps scale and bias values. The Map Composer automatically loads this file when you are compositing displacement maps and uses the data to dynamically adjust the scale and bias of the final composite map. These final scale and bias values are displayed in the “Stats” section of the window.



Maps do not have to be saved in the same internal format in order for them to be combined and they do not have to be of the same file type. The only constraint on the textures is that they need to have the same width and height.

When saving a composite map, the same options are available as when the maps are saved after generation. So the maps can be generated and saved in one (or more internal formats) and then can be resaved to a different internal format (or file type) after map composition. Saving will also output an additional mask texture for the composed map and a text file containing the scale and bias if the composed map is a displacement map.

## Help



The Help menu provides access to the “About GPU MeshMapper” dialog.

## Running in Script ( Command Line ) Mode

GPU MeshMapper has a scriptable interface that allows you to generate maps from the command line. The scripts can be used to control both map generation (MeshMapper Scripts), and map composing (MapComposer Scripts). Although their descriptions are separated out below, a single script can contain both types of commands. MeshMapper Scripts can be saved from within the application using the “File” -> “Save Project As...” menu option and selecting “MeshMapper Script File (\*.nms)” as a file type. MpComposer Scripts must be authored manually.

To run GPU MeshMapper in command line mode, type in the following command at a command prompt (or simply double click on the script file).

```
GPUMeshMapper.exe /script <script filename>
```

### ***MeshMapper Scripts***

There are two sample scripts included with GPU MeshMapper: `car_script.nms` and `ninja_script.nms`. They are located in the `GPU MeshMapper\samples\scripts` directory and should produce similar results as their counterpart projects.

Below is a different sample script that shows that you can generate maps for two different sets of models within the same script.

Relative paths within the scripts should be relative to the directory that the script file is located in.

## Example Script

```
//-----  
// Script file for GPU MeshMapper  
//-----  
  
// Set Output Names and formats  
//-----  
Set Height = 512  
Set Width = 512  
  
Set NormalMapFileName = "..\textures\CarNM.tiff"  
Set NormalMapFormat = A16B16G16R16  
  
Set DisplacementMapFileName = "..\textures\CarDM.tiff"  
Set DisplacementMapFormat = A8  
  
Set AmbientOcclusionMapFileName = "..\textures\CarAO.tiff"  
Set AmbientOcclusionMapFormat = A8  
  
// Set Mesh Data  
//-----  
Set LowResMesh = "..\mesh\CarLow.nmf"  
Set HighResMesh = "..\mesh\CarHigh.nmf"  
  
// Set Generation Options  
//-----  
Set NormalSelectionRule = 1  
Set MaxRayCastDistance = 20.000000  
Set MaxAngle = 180.000000  
Set Epsilon = 0.000100  
Set FavorLowResNormal = True  
  
Set SuperSamplingQuality = 1  
Set AddTexelCorner = False  
  
Set ExpandTexels = 10  
Set InterpolateAcrossEmptyRegions = True  
  
Set NormalInWorldSpace = False  
Set BentNormal = False  
Set ApplyDetailMap = False  
  
Set GenerateDisplacementMap = True  
Set DisplacementMapScale = 16.000000  
Set DisplacementMapBias = -8.000000  
  
Set GenerateAmbientOcclusionMap = True  
Set OcclusionSamplingRate = 300  
Set UseGPU = True  
  
// Trigger Computation  
//-----  
Compute
```

```

//-----
// Model #2
//
// - Inherits all previous settings
//   Just change whatever you want to change
//-----

// set new models
Set LowResMesh           = "..\mesh\ninjaHead_low.obj"
Set HighResMesh          = "..\mesh\ninjaHead_high.obj"

// set new map file names
Set NormalMapFileName   = "..\texture\ninjaHead_NM.tiff"
Set DisplacementMapFileName = "..\texture\ninjaHead_HT.tiff"
Set AmbientOcclusionMapFileName = "..\texture\ninjaHead_AO.tiff"

// Since a displacement map scale and bias were already set
// these maps will have the same scale and bias

// Trigger computation
Compute

```

## Syntax

MeshMapper scripts can contain both comments and commands:

- **Comments**      Comment can start with // and end with end of line.  
Or /\* to start and \*/ to end. ( Just like C++ )
- **Command**

There are two kinds of commands in MeshMapper scripts.

- "Set <Param name> = <Value>" to set parameter for map generation.  
( format, size, ambient occlusion etc )
- "Compute" to start computation of maps.

## Command Parameters

- *CurrentDirectory*      Sets current working directory.
- *LowResMesh*              Path name for low res mesh model file.
- *HighResMesh*             Path name for high res mesh model file.
- *Width*                    Specify the width of normal map to be saved.

- *Height* Specify the height of normal map to be saved.
- *NormalSelectionRule* 0 = Any Dist, 1 = Closest, 2 = Farthest, 3 = Mixed, 4 = Front Farthest, 5 = Front Closest.
- *FavorLowResNormal* Set to *True* to favor high res normals that are closer in direction to the low res normal.
- *MaxRayDistance* Set max ray distance for intersection. If this is set to zero, default value will be used.
- *MaxAngle* Set max ray angle that will be used when considering if a high-res normal is generally in the same direction as the low-res normal.
- *SuperSamplingQuality* Specify how many samples per texels when correlating the two meshes. (integer value 1-10).
- *AddTexelCorner* If set to *True*, 4 corners of a texel will be added for super sampling.
- *NormalMapFileName* The name to save the normal map as.
- *NormalMapFormat* Format to save normal map in.
- *NormalInWorldSpace* Set to *True*, if you want normal in normal map to be in world space. If *False*, then normals will be in tangent space.
- *BentNormal* Set this *True* to calculate and store bent normals.
- *ApplyDetailMap* Set this *True* to apply a detail map to the normal map.
- *DetailMapHeight* Height in texels of the detail map.
- *DetailMapWidth* Width in texels of the detail map.
- *DetailMapScalar* Float scalar value to apply to the detail map.
- *DetailMapFileName* Path and filename of the detail map to use.

- *GenerateDisplacementMap* Set this to *True* if you want to also generate a displacement map.
- *DisplacementMapFileName* The name to save the displacement map as.
- *DisplacementMapFormat* Format to save normal map in.
- *DisplacementMapScale* Desired scale value of the generated displacement map.
- *DisplacementMapBias* Desired bias value of the generated displacement map.
- *GenerateAmbientOcclusionMap* Set this to *True*, if you want to generate an ambient occlusion map.
- *AmbientOcclusionMapFileName* The name to save the ambient occlusion map as.
- *AmbientOcclusionMapFormat* Format to save ambient occlusion map in.
- *UseGPU* Set this *True*, if you want use GPU power to assist computation of the ambient occlusion map.
- *OcclusionSamplingRate* If use GPU is enabled, this integer number (0 to 100) specifies the quality of sampling. 0 for lowest quality and 100 is the highest.
- *MaxOcclusionDistance* Maximum distance two objects can be apart and still impact occlusion on one another (ignored if *UseGPU* is set to *True*).
- *ExpandTexels* Set integer value to specify how many pixels to dilate normal map.

## Map Composer Scripts

### Example

```
//-----  
// Script file for GPU MeshMapper Map Composer  
//-----  
  
//-----  
// First compose the normal maps  
//-----  
Compose "normal map"  
  
Add "..\textures\car_door_NM.tiff"  
  
Add "..\textures\car_spoiler_NM.dds"  
  
Add "..\textures\car_body_NM.dds"  
  
// set post processing (dilation)  
Set ExpandTexels = 10  
  
Save "..\textures\car_composite_NM.tiff" A16B16G16R16  
  
//-----  
// Now compose displacement maps  
//-----  
Compose "displacement map"  
  
Add "..\textures\car_door_DM.tiff"  
  
Add "..\textures\car_spoiler_DM.dds"  
  
Add "..\textures\car_body_DM.dds"  
  
// set post processing (dilation)  
Set ExpandTexels = 10  
  
Save "..\textures\car_composite_DM.tiff" A16B16G16R16
```

### Syntax

MapComposer scripts can contain both comments and commands:

- Command

There are four kinds of commands in MapComposer scripts:

- Compose <map type>

This command must come before adding any textures to the map composer because it tells the composer what types of files it will be loading and adding together. The valid values for <map type> is either “normal map”, “displacement map”, or “ambient occlusion map”.

- Add “<file name>”  
This command tells the map composer to load the specified file and add it to the composite map. The <file name> should be an absolute path to the file, or a path relative to the directory containing the script.
- Set ExpandTexels = <value>  
This command tells the map composer to perform dilation on the generated maps. If not specified a default value of 10 will be used.
- Save “<file name>” <format>  
Save tells the MapComposer that no more maps will be added to this composite map and that the resulting map can be stored as the file named “<file name>” (again this can be absolute or relative). The final parameter, <format> indicates what internal format the composed map should be saved in.

## Support and Feedback

Support for GPU MeshMapper can be obtained by email [gputools.support@amd.com](mailto:gputools.support@amd.com). We welcome all feedback too, so please let us know if you find the tool useful or if you have ideas for features that would be useful in future releases.