3D Studio Max Toolset for X-VP

Table of Contents

Table of Figures

1. Overview

The X-VP tool set for 3D Studio Max consists of a set of rollout panels that exist on the utility panel within Max's GUI. Each rollout panel can be used to export a particular type of Max object such as skin meshes, models, animation, lights, etc..., into formats readable by X-VP. The remaining sections in this document explain various aspects of using X-VP tool set including installation instructions, exportation requirements and examples.

1.1. File Formats

The X-VP tool set exports objects according to a set of file format specifications. In most cases, you can simply use a text editor to open exported files and understand their file format as well as easily edit the information they contain. See the list below to learn more about specific file extensions and their meaning.

- **XMF - X-VP Model Format.** This format specifies a hierarchical collection of geometric objects. It contains material information and object linkage information.
- **XSM - X-VP Skin Mesh Format.** This format specifies a skin mesh object and its associated bone hierarchy. It contains material information and bone linkage information.
- **XAF - X-VP Animation Format.** This format specifies an animation track for an object including position, rotation and scale key frames.
- **XOF - X-VP Octree Format.** This format specifies geometry for an octree data structure. It includes material information.
- **XBF - X-VP BSP Format.** This format specifies geometry and associated information for a BSP Tree data structure.
- **XLF - X-VP Light Format.** This format specifies properties for a light.
- **XCF - X-VP Camera Format.** This format specifies properties for a camera.
- **XPS - X-VP Particle System Format.** This format specifies properties of a particle system. This includes material information.

2. Installation

The X-VP tool set for 3D Studio Max functions as a set of plug-ins and utility programs that fit into the utility framework provided within 3D Studio Max. System requirements to run the tool set are listed below.

- **3D Studio Max 5.0** - Other versions of 3D Studio Max may support the X-VP tool set; however, no other versions have been tested.
- **Microsoft DirectX 9 or later.**

2.1. Installation Instructions

To install the X-VP tool set for 3D Studio Max, follow the instructions below.

1. Copy "X-VPUtility.dlu" and "X-VPParticleSystem.mse" to the "plugins" directory under your 3D Studio Max installation directory.
2. Start 3D Studio Max.
3. Go to the Utility panel in Max pictured below. (Hammer icon)

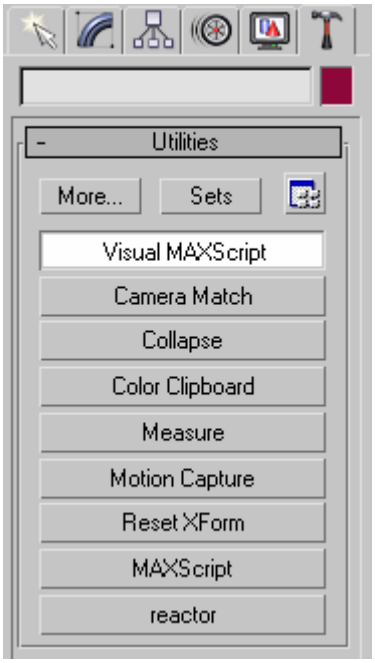


Figure 1 - Utility Panel

4. Click on the "Configure Button Sets" button.  The following dialog is opened.

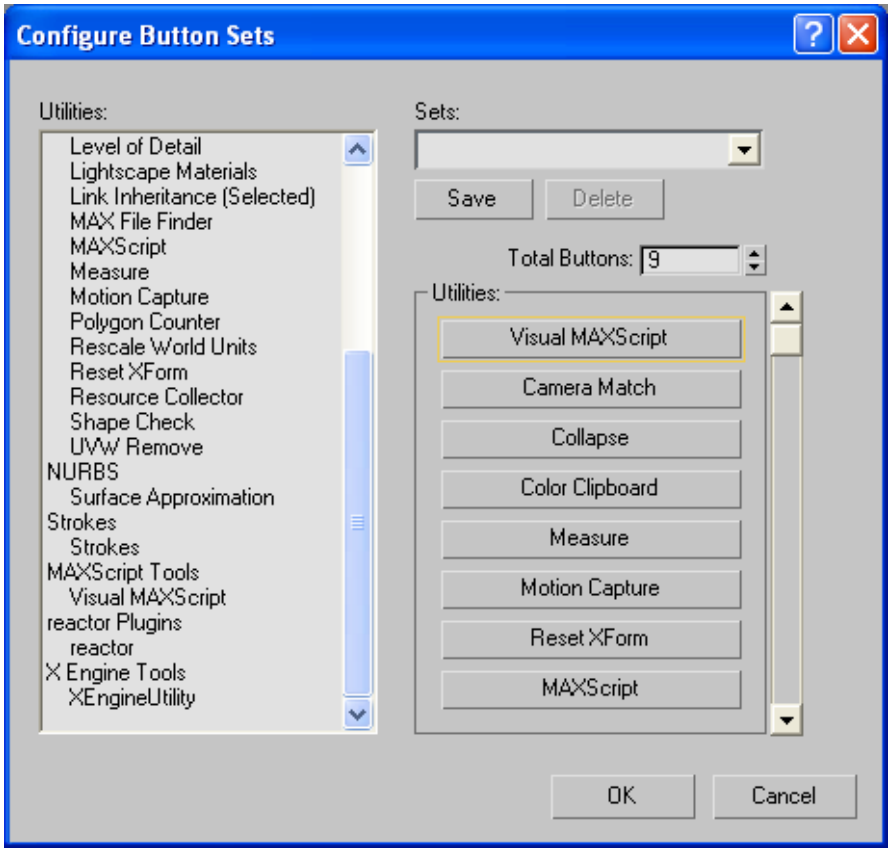


Figure 2 - Configure Button Sets

5. Add a new button on the right by incrementing the "Total Buttons" field by one. Drag the "X-VPUtility" text under "X-VP Tools" to the new button you just created. See below.

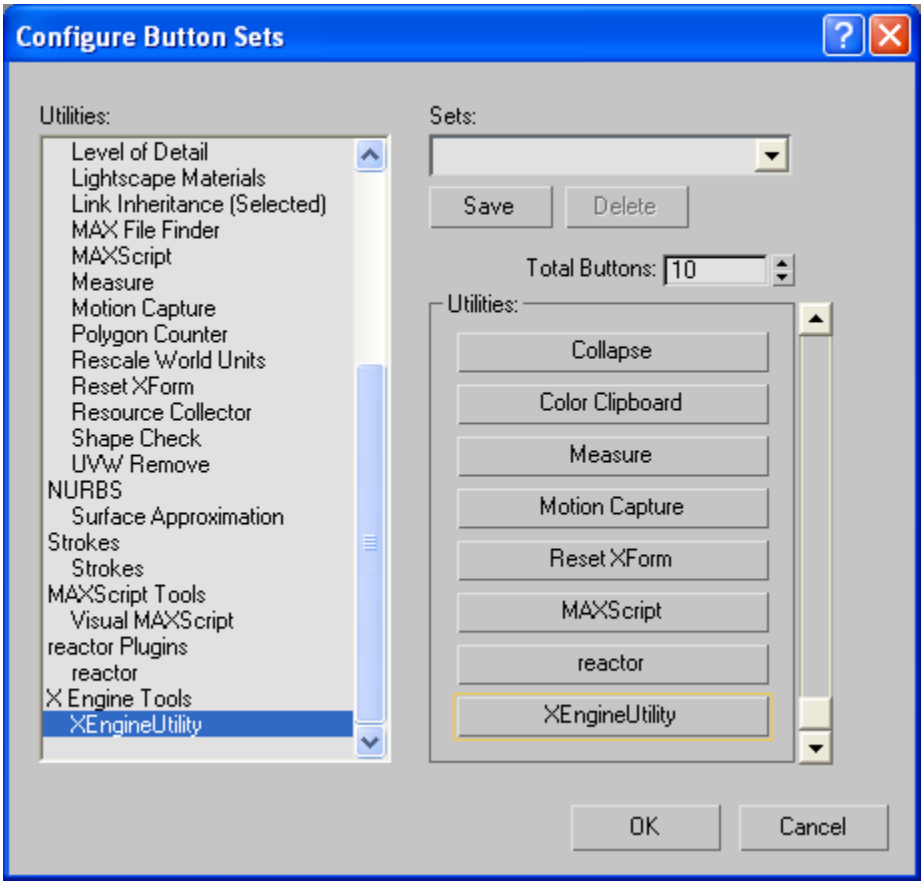


Figure 3 - Add New Button to Configure Sets Dialog

6. Click "OK" on the dialog.

Now, the X-VP tool set exists as a default option when you open the utility panel in 3D Studio Max. Click the new "X-VPUtility" button to open the tool set as pictured below.

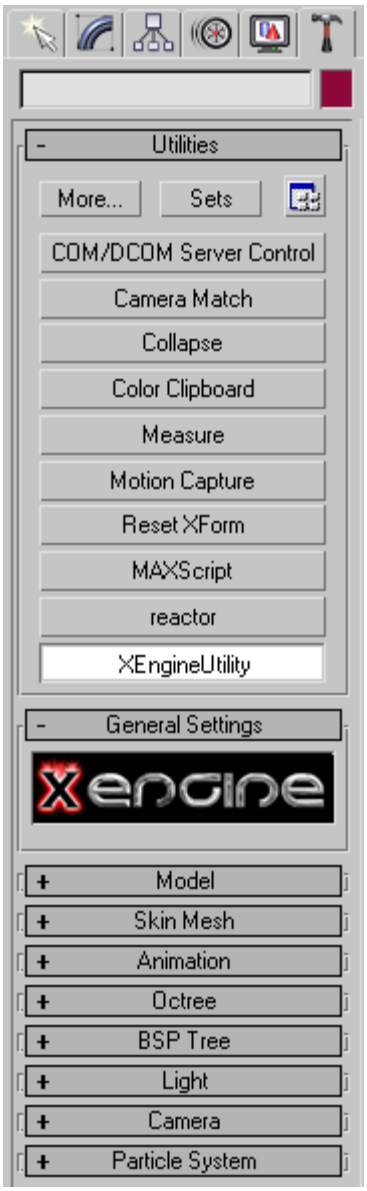


Figure 4 - X-VP Tool Set Dialog

3. Material Editor - Supported Features

The material editor allows you to specify the render properties of geometry including diffuse color, specular color, diffuse texture map, etc. The X-VP tool set only supports Max's "Standard" material type and exports the following material editor settings when applied to an object.

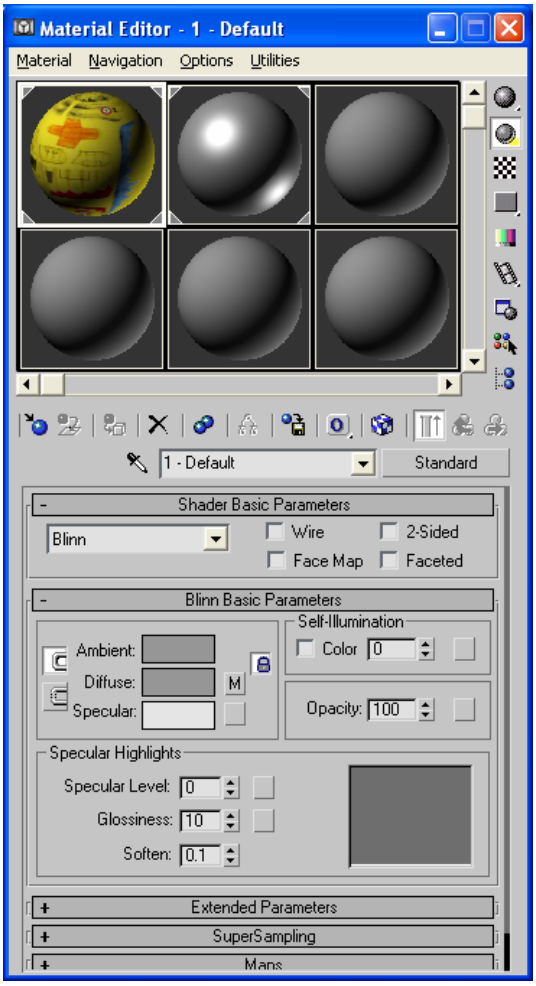


Figure 5 - 3D Studio Max Material Editor

- **Ambient Color**
- **Diffuse Color**
- **Specular Color**
- **Specular Level**
- **Opacity**
- **Diffuse Map** - Texture mapping is supported through the UVW Map modifier and its counterpart the Unwrap UVW modifier. In other words, to export texture coordinates for an object, you must assign a UVW Map modifier. Also, tiling

parameters are specified by the U Tile and V Tile parameters of the UVW Map modifier rollout. Polygon normals can also be modified via the UVW Map modifier.

- **Wire Frame**

4. General Settings Rollout

The General Setting Rollout provides configuration options for all of the exporters. The following options are supported.

- Path Options – this option lets you select whether to use absolute paths in exported files or to use a user defined relative path. This option affects external paths that are used to refer to other files.

5. Model Rollout

The Model Rollout allows you to export a single geometric object or a complete hierarchy of geometric objects into a .xmf file. In other words, you could export something as simple as a box or something as complex as an army tank with multiple moving pieces. In order to export objects with this rollout, they must adhere to the following rules.

- Each object must be convertible to a triangular mesh consisting of vertices and faces.
- Each object must have a material assigned to it from the material editor.
- If exporting a hierarchy of objects, they must be linked in parent-child relationships and only one object in the hierarchy should be the root.

Each object's pivot point will determine how the object will move in its model space once it has been loaded into X-VP. To illustrate the process of exporting a model made up of multiple objects, an example is provided below.

5.1. Biplane Example

In this example, we are going to export a biplane model which is made up of several objects such as the fuselage, propeller head, propeller blades, etc. This example will highlight the steps to take when preparing a model for exportation.

1. First, let's assume that we have the biplane model pictured below and that it is made up of a total of 4 objects. The objects are: fuselage (purple), nose cone (green), propeller blades (blue) and the wheels (red).

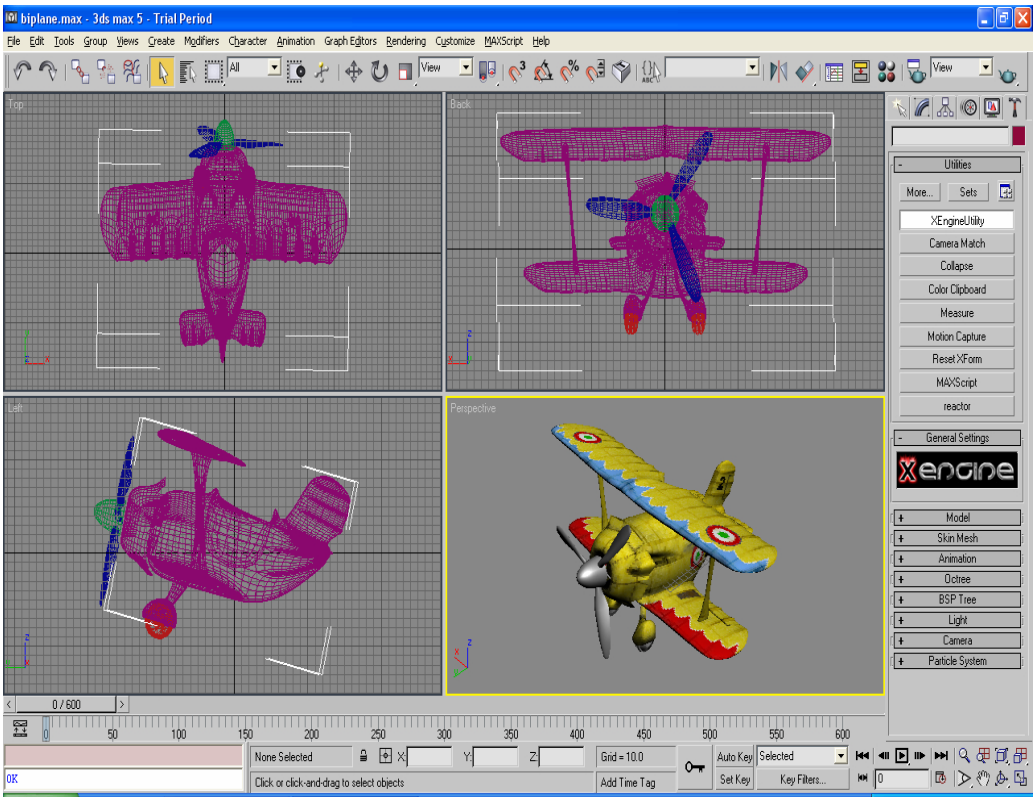


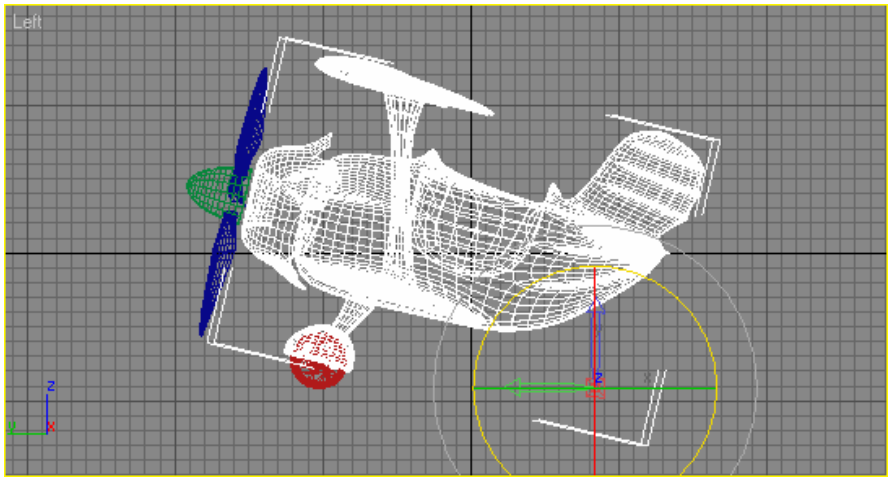
Figure 6 - Biplane Model Export

2. In order to export this model correctly, there are a few steps we must take to prepare the model for exportation. They are:

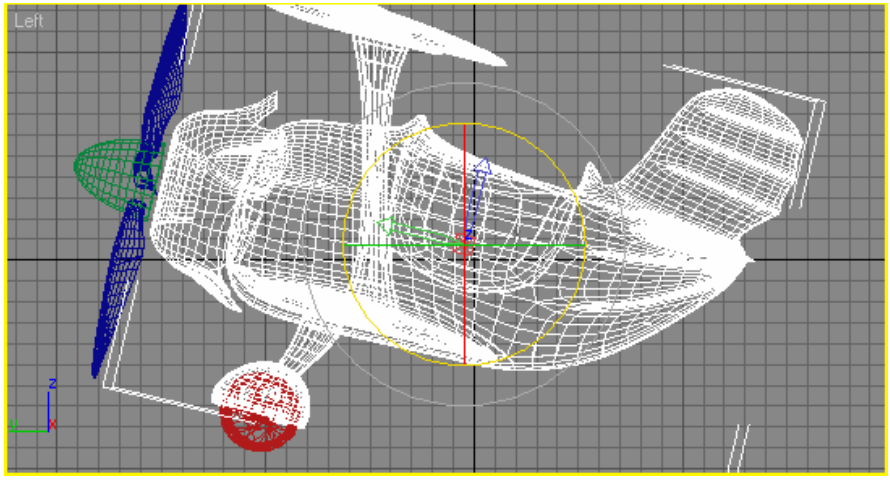
- **Assign each object a name.** This is an important step because this name is used to refer to the object from within X-VP. You can assign an object a name through the standard Max interface.
- **Position and orient each object's pivot point with respect to its anticipated motion.** The pivot point will determine the model space transform for the object and will define how it moves in its model space. The Y axis should point out of the "front" of the object, the Z axis should point "up" through the object, and the X axis should point "right" out of the object. Let's position the pivot points for each object in the biplane model.

First let's position and orient the fuselage's pivot point so that we can bank the aircraft later on in X-VP.

Fuselage's original pivot point location:



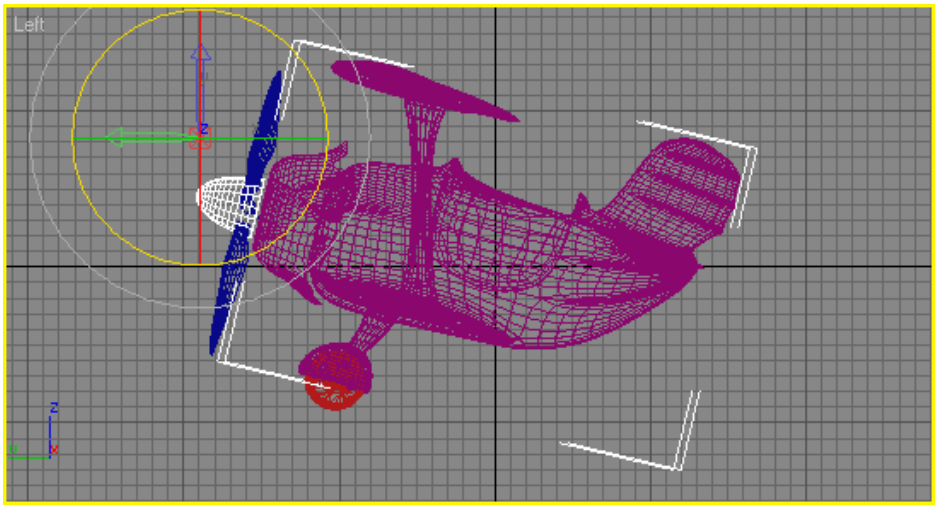
Fuselages new pivot point location:



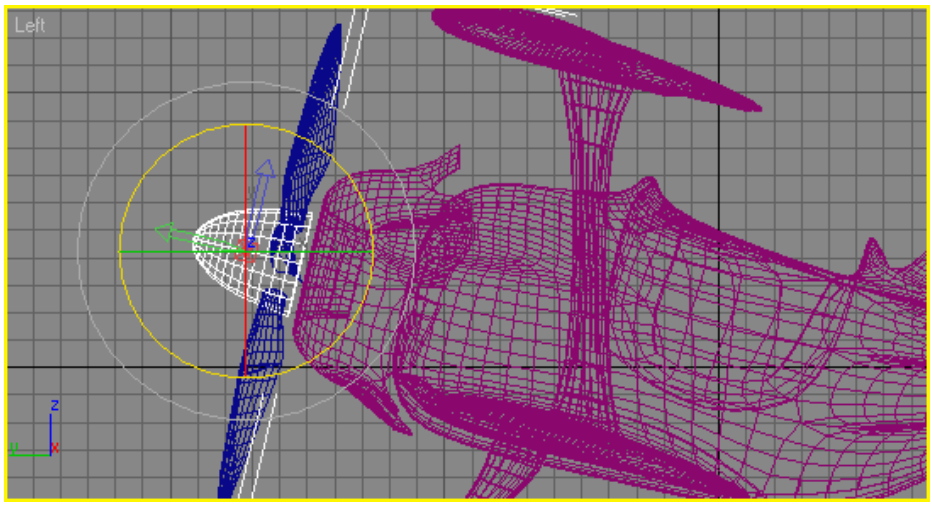
Now that we have the fuselage's pivot point where we want it, we will be able to roll the fuselage along its Y axis once it has been loaded into X-VP.

Next, let's position and orient the pivot point for the nose cone so that we can spin the propeller correctly.

Nose cone's original pivot point location:



Nose cone's new pivot point location:



Now, we can spin the nose cone around its Y axis and it will spin correctly. Also, since the propeller blades are linked as children to the nose cone they will spin around the nose cone correctly.

Do the same thing for other objects in the model.

- **Assign each object a material from the material editor.** This material determines how the object will be rendered.
- **Link each object into a parent-child hierarchy.** Since the biplane is made up of several independent objects such as the fuselage, propeller blades, etc..., they must all be connected in the same hierarchy tree with only one object being the root of the tree. When linking the biplanes objects together, keep in mind that

children will inherit the motion of their parents. So, in this model, we will link the propeller blades as children of the nose cone and the nose cone as a child of the fuselage. We also link the wheels to the fuselage. Now, as we move the fuselage the nose cone and wheels will follow. As the nose cone moves, so will the propeller blades. And so on...

- **Reset pivot and object scale.** As a finishing step for all objects in a model, you must reset the scale of each objects pivot point as well as the object itself. If you don't do this step, all kinds of strange things will happen…especially during animation.

3. Select the root object, which in this case, is the fuselage of the biplane.
4. Click the "Export Model" button on the Model Rollout.

Note that this procedure does not export any animation that may be associated with the biplane model. See the Animation Rollout for information regarding animation tracks.

6. Skin Mesh Rollout

The Skin Mesh Rollout allows you to export geometry and an associated bone rig that deforms it. The exporter will generate a .xsm file which can then be loaded directly by X-VP. Specifically, this rollout provides the capability to export a single mesh with an applied Skin Modifier and corresponding bone objects. Below are some important rules to remember when exporting a skin mesh.

- Only one, single-piece mesh can be exported at a time. No sub-objects are allowed.
- The mesh must have a Skin Modifier applied which contains the bone rigging information. The Skin Modifier will also be used to obtain skin weighting information for the skin mesh.
- The bones may be any object supported by the Skin Modifier. This includes Max Bones, Biped from Character Studio, simple boxes, etc...
- The mesh must have a material assigned to it from the material editor.

See the example below to learn more about exporting a skin mesh.

6.1. Wizard Character Example

In this example, we are going to export a skin mesh of a wizard character. The wizard skin mesh is a single piece mesh that has a Skin Modifier applied with a bone rig of 24 Max Bone objects. The bone rig also has IK Chains attached to assist in animation. See the screenshot below.

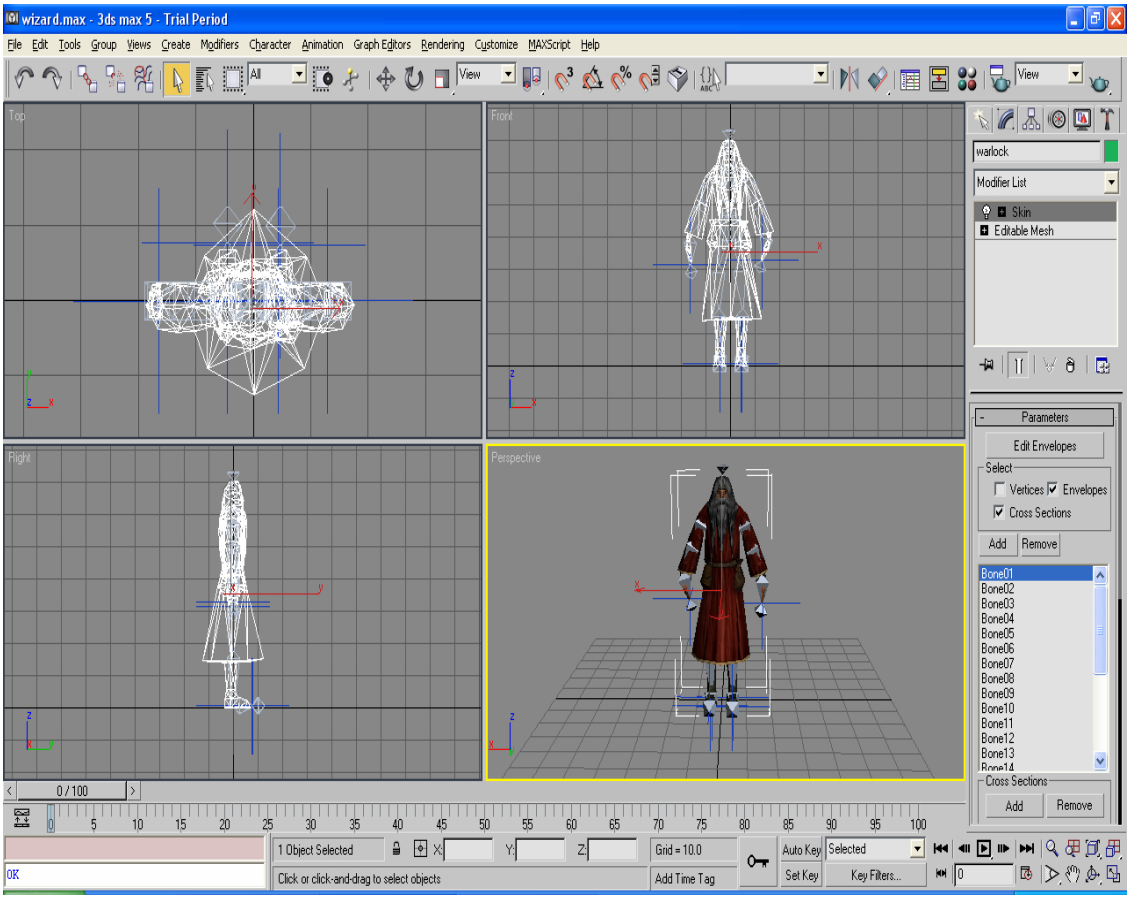


Figure 7 - Wizard Skin Mesh Export

In order to export this wizard character, follow the steps below.

1. Select the skin mesh object. This must be a single geometrical object with a Skin Modifier applied. In this case, we select the wizard mesh.
2. Click on the "Export Skin Mesh" button.

The exporter will automatically gather the necessary information including skin weights, bone objects, etc. Note that this procedure does not export any animation which may be associated with the skin mesh. See the Animation Rollout for information regarding animations.

7. Animation Rollout

The Animation Rollout allows you to export animation tracks for any type of object in 3D Studio Max. The exporter will generate a .xaf file which can then be loaded directly by X-VP. Animation can be exported for a single object or a complete hierarchy of objects. Here are a few key points to keep in mind when exporting animation tracks.

- Animations are based off of the initial pose of objects. This means that, if you wish to export more than one animation for a particular object, the animations must be exported from a .max file in which the objects are in the same initial pose. For example, if you have a skin mesh for which you want to export a walking animation, running animation, and jumping animation, all of these animations need to be recorded on the same initial pose of the skin mesh. One way of ensuring this requirement, and probably the most common, is to store all animation tracks for an object in the same .max file. Another method, which is less efficient, is to make multiple copies of the .max file so that the object is in the same initial pose in all of the files. Then record one animation per file. Since you cloned the .max files, the objects will all share the same initial pose. Keep in mind that this initial pose need not be in any of the animations. That is, although frame 0 of the time slider may be the initial modeling pose, you can begin recording animations from frame 1 in which the skin mesh may be in a completely different starting pose depending on the animation. The skin mesh example in this section uses the first method where all animations are stored in the same file.
- To export animation for an entire hierarchy of objects such as a character's bone rig, or a helicopter model made up of several sub-objects, you must select the root of the hierarchy in order to export the animation correctly.

In order to export animation, a few parameters on the Animation Rollout need to be specified. See below.

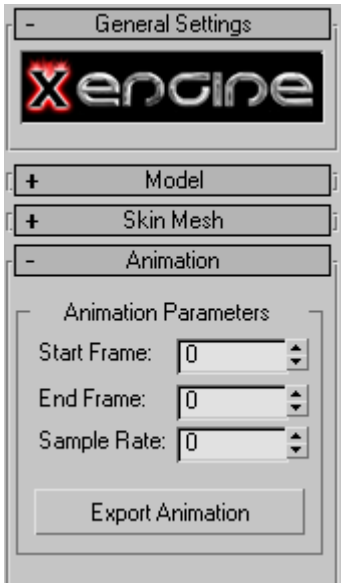


Figure 8 - Animation Rollout

- **Start Frame** - This number corresponds to the starting frame number on Max's time slider at which you wish to start exporting animation.
- **End Frame** - This number corresponds to the ending frame number on Max's time slider at which you wish to stop exporting animation.
- **Sample Rate** - The animation exporter works by sampling the motion of the selected object hierarchy over time. This number represents the rate, in milliseconds, at which the animation is sampled. For example, a value of 30 causes the exporter to sample the animation once every 30 milliseconds. There is an important trade off to remember when setting this parameter. Higher values will cause the exporter to sample the animation less often which will result in a lower quality approximation of the true animation but will generate smaller file sizes. On the other hand, lower values will cause the exporter to sample the animation more often resulting in better quality animations but will generate larger file sizes. There is no "hard and fast" rule to go by when deciding what the value of this parameter should be. It varies on a case by case basis. Typically, start with a low number such as 30. This will sample the animation about 30 times per second. If you are concerned with file sizes, try higher numbers to conserve space.

To learn more about exporting animation, see the example below.

7.1. Character Animation Example

In this example, we are going to export a few animations for a wizard character including a run cycle, idle cycle and a spell casting animation.

1. First, we'll select the object for which we want to export animation. In this case, since we are exporting animation that has been applied to a hierarchy of bones in a bone rig, we

must select the root bone. The name of the root bone in this Max Scene is called "Bone01". See below:

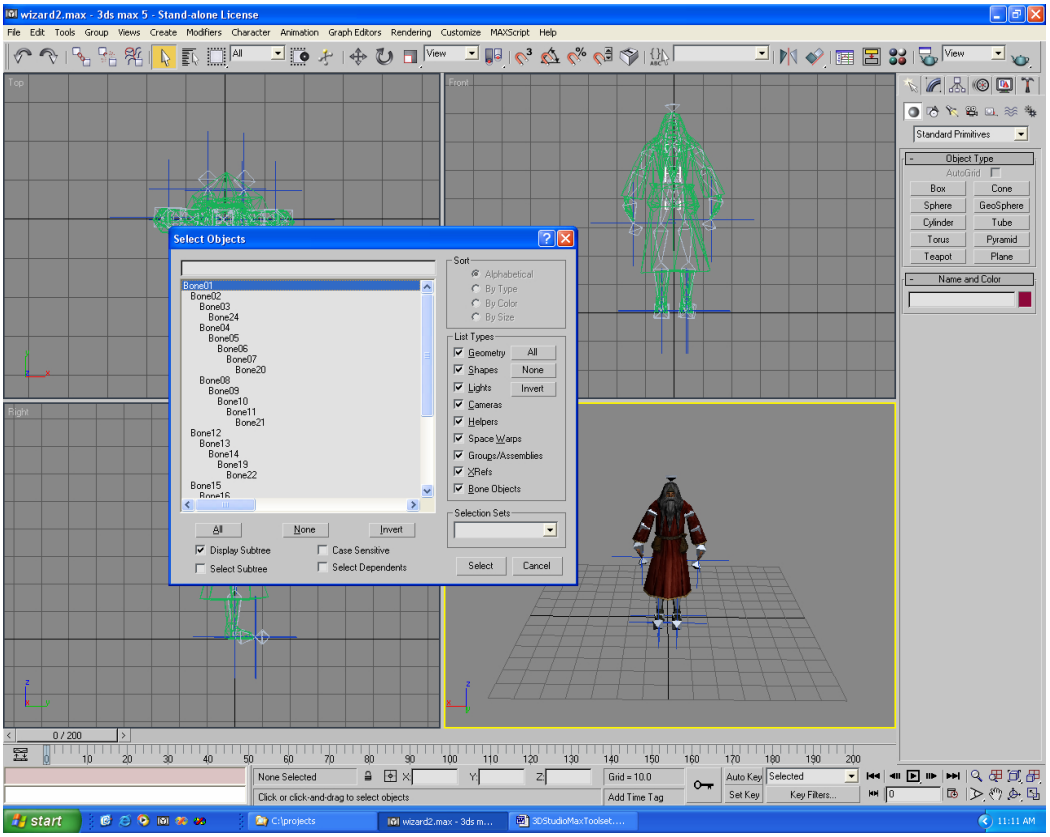


Figure 9 - Character Animation Export

2. Next, we need to decide which animation sequence we want to export. As mentioned before, there are three separate animation tracks in this Max file. The frame breakdown for the wizard character is as follows.

- **Frame 0** is a default standing pose. Remember, although frame 0 is not a part of any animation tracks, it serves as the initial world transform for each of the bones.
- **Frames 1-18** – running cycle animation.
- **Frames 19-79** – idle animation.
- **Frames 80-170** – spell casting animation.

Let's export the running cycle animation. On the Animation Rollout, fill in 1 for the Start Frame field, 18 for the End Frame field, and 30 for the Sample Rate. See below:

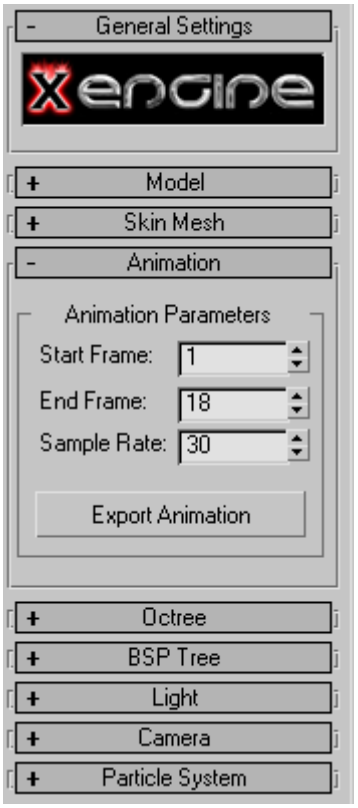


Figure 10 - Animation Rollout Field Values

3. Click the "Export Animation" button.
4. Now we can continue exporting the other animation tracks in this file by changing the Start Frame and End Frame fields as needed.

7.2. Helicopter Animation Example

In this example, we are going to export an animation for a helicopter model made up of many objects. The animation is a simple flight animation that runs from frame 0 to frame 30.

1. First, select the root object in the helicopter model. In this case, the root object is named “fuselage”. See below:

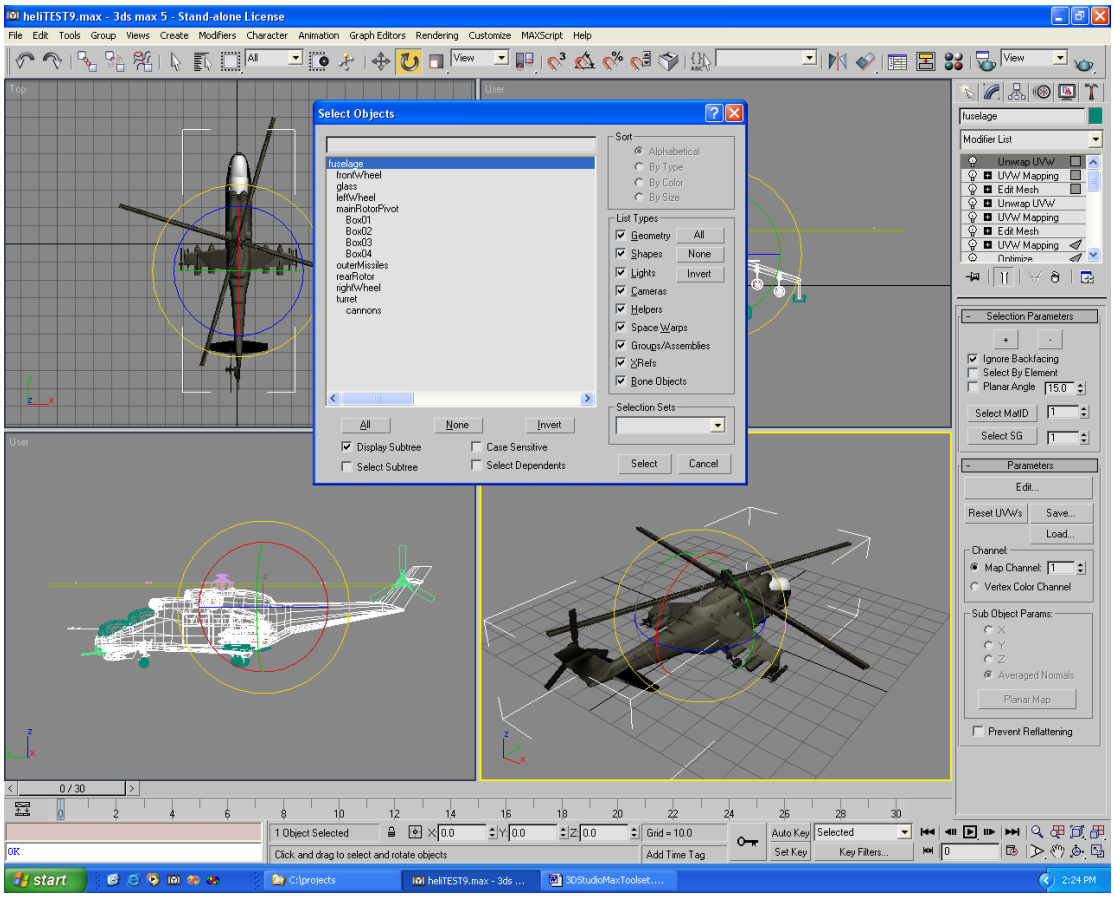


Figure 11 - Helicopter Animation Example

2. Next we fill out the fields in the Animation Rollout. The animation starts at frame 0 and ends at frame 30 in the Max file. We will use a Sample Rate of 30. The Animation Rollout should look like the figure below:

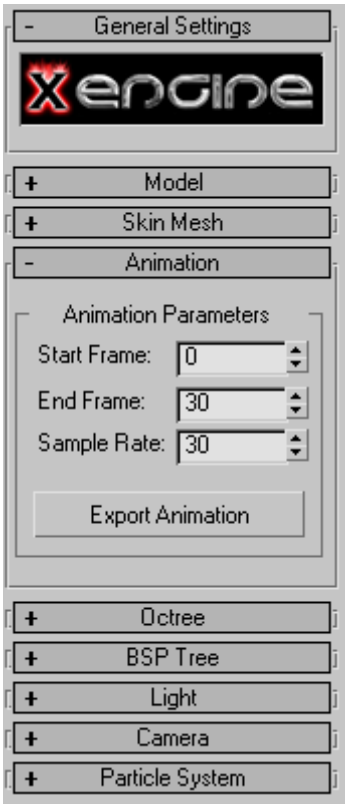


Figure 12 - Helicopter Animation Rollout Values

3. Click the “Export Animation” button.

8. Octree Rollout

The Octree Rollout allows you to export objects into X-VP octree format. The exporter will generate a .xof file which can then be loaded directly by X-VP. When exporting an octree, keep the following rules in mind.

- You can select any number of objects in the scene to be exported into the octree.
- The objects do not need to be linked in the form of hierarchy.
- Each object must have a material assigned from the material editor.

For an example octree export, see the example below.

8.1. Octree Example

In this example, we will export a simple level made up of multiple objects. The level has a brick floor with several concrete pillars placed in various locations. Each pillar as well as the floor is a separate object and has its own material applied from the material editor. See below:

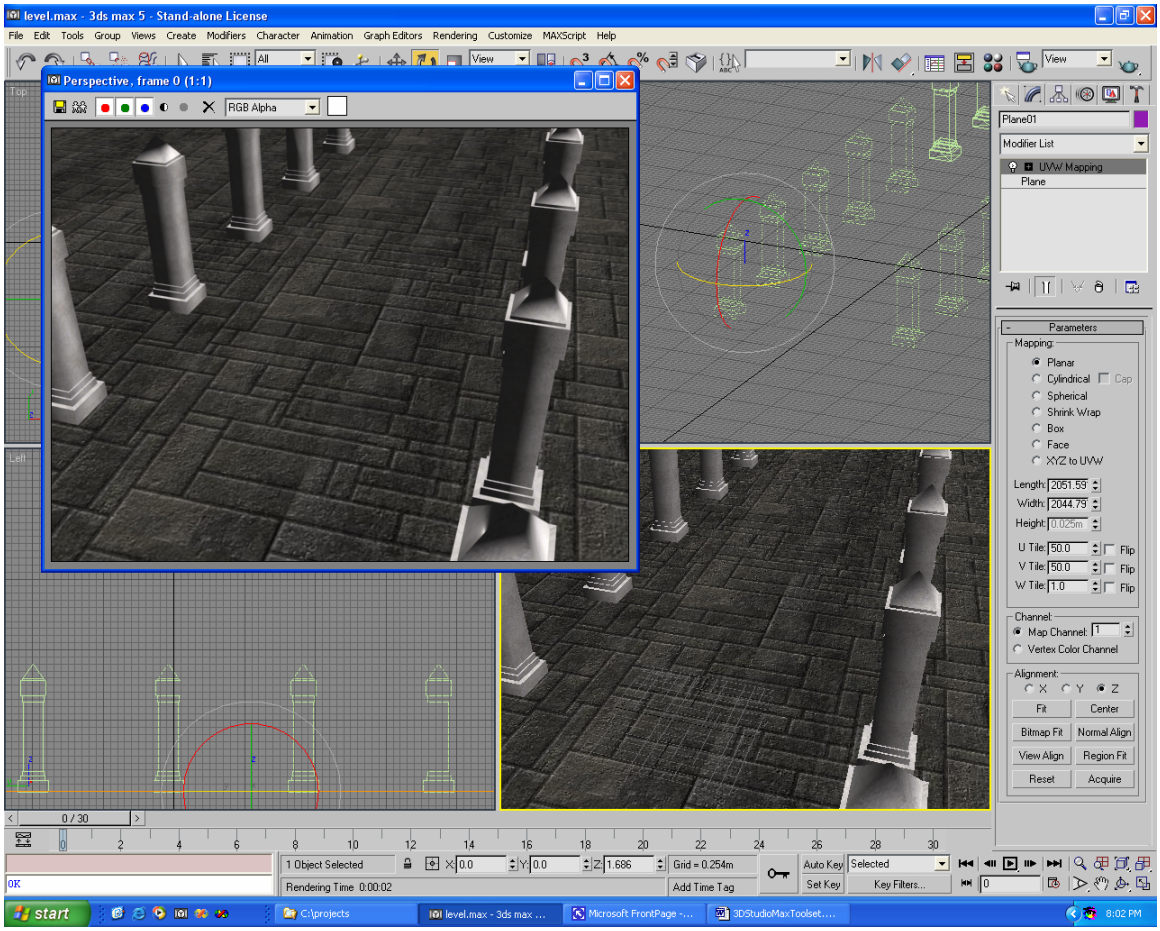


Figure 13 - Simple Level Example

1. First select all the objects you want to export into the octree. In this case, we want to export the brick floor and all the pillars so we select everything in the scene.
2. Click the “Export Octree” button on the Octree Rollout.

9. BSP Tree Rollout

TBD

10. Light Rollout

The Light Rollout allows you to export certain types of lights and their parameters from within 3D Studio Max. The exporter will generate a .xlf file which can then be loaded directly by X-VP. The following light types are supported by the tool set.

- Target Spot
- Target Direct
- Free Spot
- Free Direct
- Omni

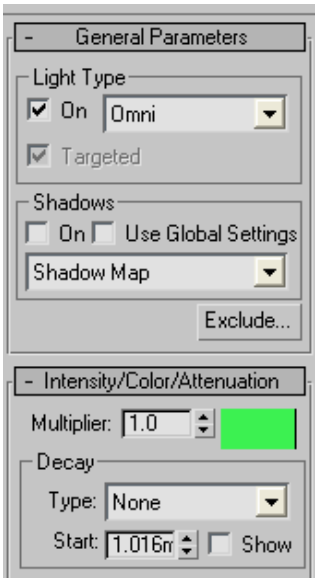
The following light settings are exported:

- World Position
- Direction (directional and spot lights only)
- Diffuse Color
- Ambient Color (taken from the global ambient environment setting in Max)
- Inner Cone Angle (spot lights only)
- Outer Cone Angel (spot lights only)

See below for an example of how to export a light.

10.1. Green Point Light Example

In this example we are going to create and export a green point light. First, create an Omni light and set the diffuse color to green in the "Intensity/Color/Attenuation" rollout as pictured below:



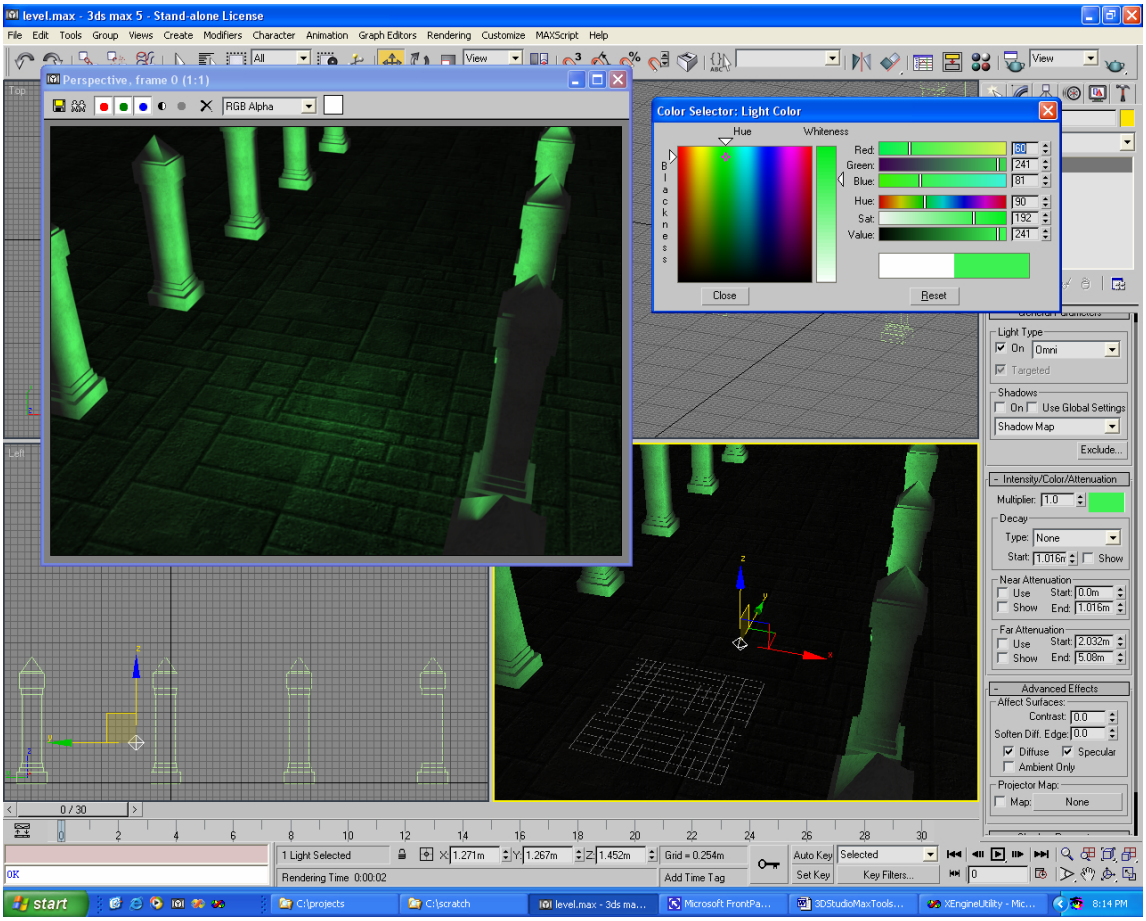


Figure 14 - Green Point Light Example

Select the Omni light and click “Export Light” on the Light Rollout.

11. Camera Rollout

The Camera Rollout allows you to export a Max camera object. The exporter will generate a .xcf file which can then be loaded directly by X-VP. The following camera types are supported.

- Free
- Target - Even though this camera has a target while in 3D Studio Max, the target information is not exported.

When exporting a camera, there is an important pre-processing step that must be completed before the camera is exported. By default in 3D Studio Max, when you create a camera, the pivot point looks like this:

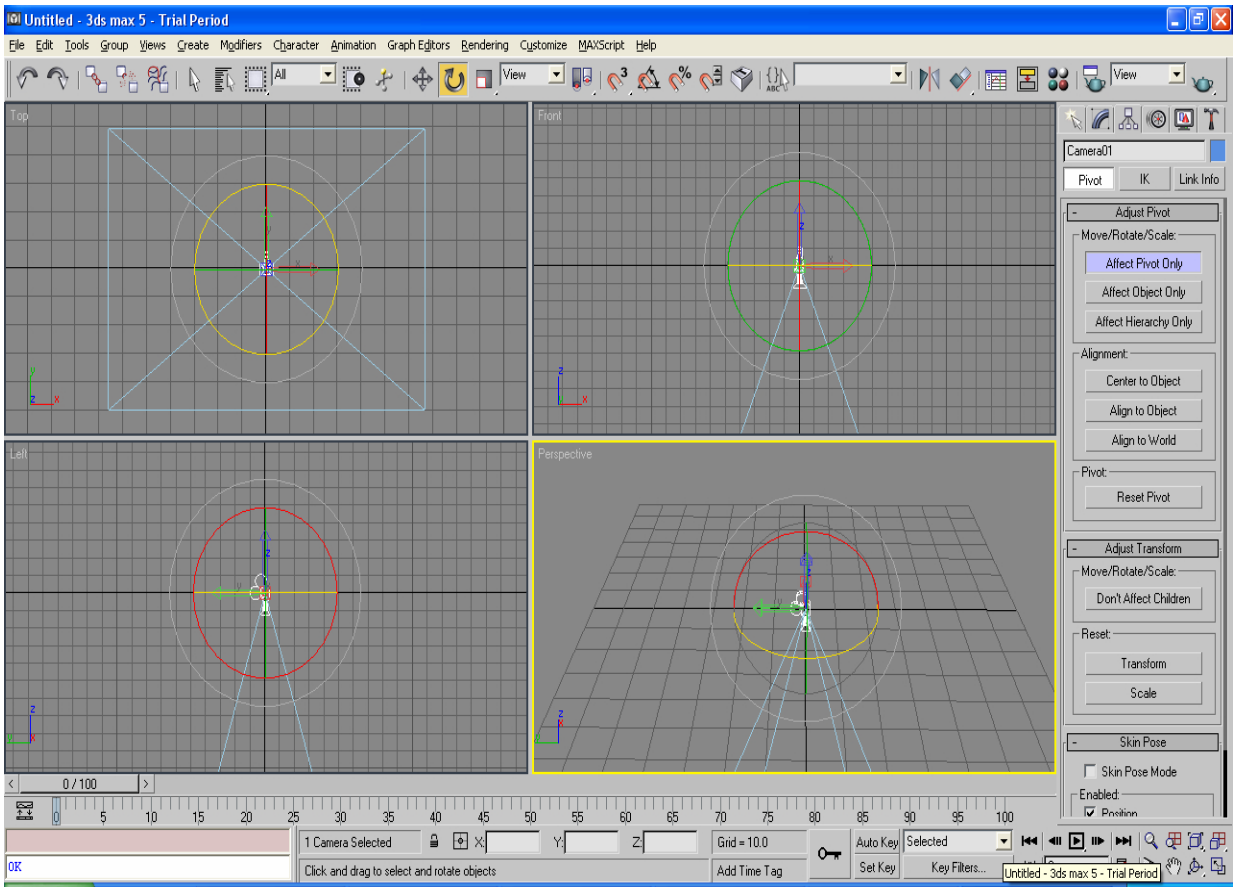


Figure 15 - Camera Export

X-VP will use the Y axis (green axis in the screenshot above) to determine which direction the camera is facing in the 3D scene. Therefore, the camera's pivot point must be adjusted by 90 degrees so that the Y axis points out the front of the camera object. See below for the adjusted pivot point.

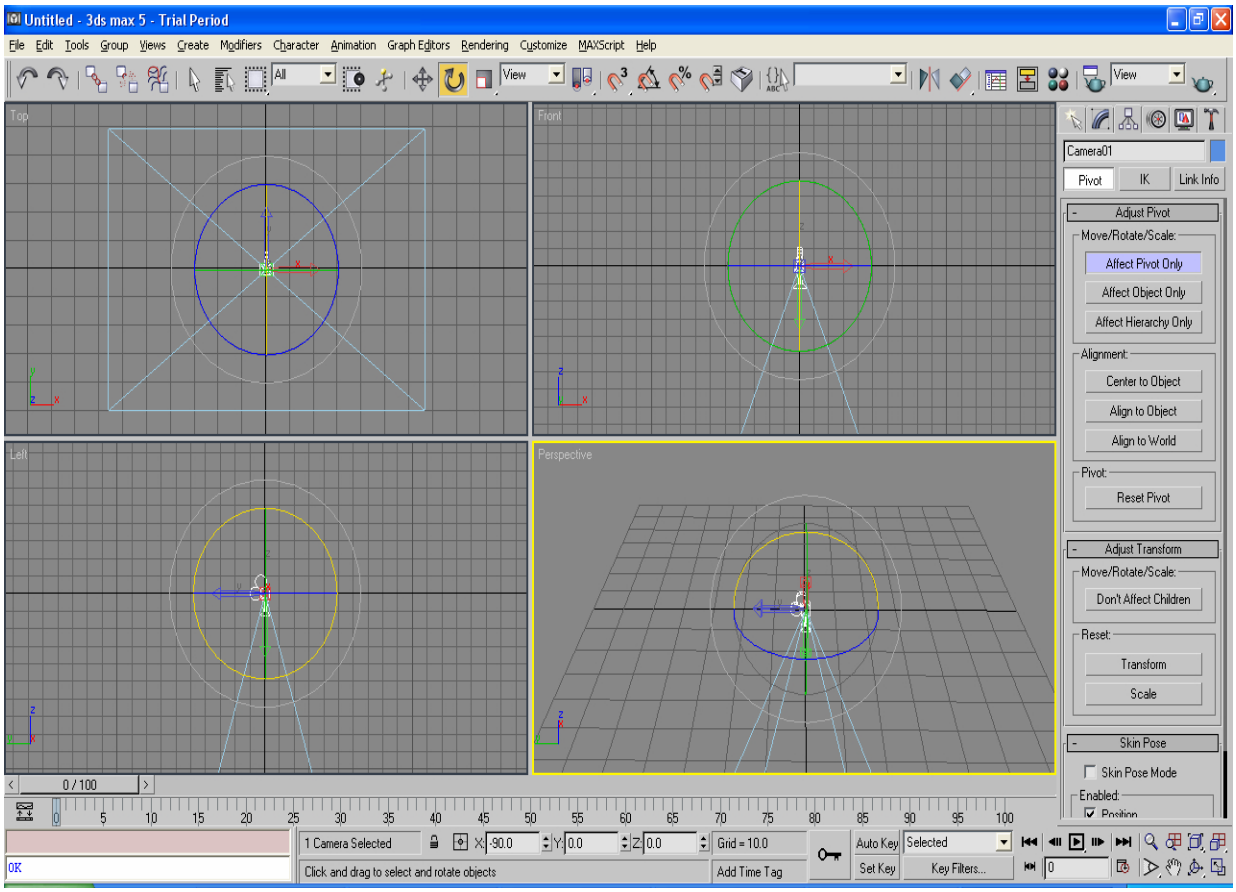


Figure 16 - Camera Pivot Point Modification

Now that the pivot point has been adjusted, we can position, orient and export the camera. To export the camera, follow the steps below.

1. Select the camera object to export.
2. Click on the "Export Camera" button on the Camera Rollout.

12. Particle System Rollout

The Particle System Rollout allows you to export Max PCloud particle system objects as systems of real time point sprites. The exporter will generate a .xps file which can then be loaded directly by X-VP. The PCloud is the only supported particle system object in 3D Studio Max because of its flexibility and functionality.

The following PCloud parameters are exported by the tool set.

- Particle Formation - This includes Box Emitter, Sphere Emitter and Cylinder Emitter.
- Display Icon - This includes Rad/Len, Width and Height.
- Use Rate and Use Total
- Speed and Speed Variation
- Random Direction and Direction Vector
- Life and Life Variation
- Size and Size Variation
- Grow For and Fade For

There are a few things to keep in mind when exporting particle systems.

- X-VP renders particles systems differently than Max; therefore you cannot view the final rendering of a particle system through the standard Max interface. You must use the particle system preview option on the Particle System Rollout.
- The particle system must have a material assigned to it from the material editor. If you apply a diffuse map, it will be rendered as a point sprite. That is, the texture will completely cover each particle.

More particle system options are available on the Particle System Rollout. See below.

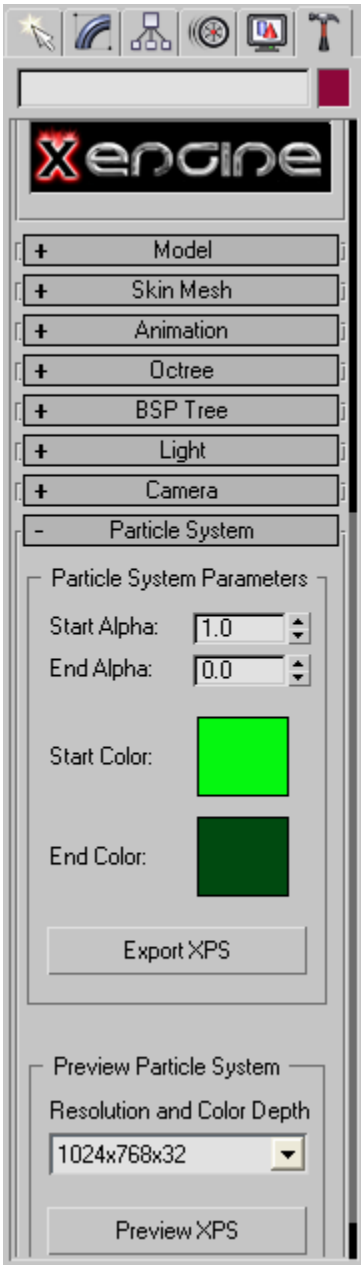


Figure 17 - Particle System Rollout Options

- **Start Alpha** - This is the starting alpha component that is assigned to each particle at the particle's birth.
- **End Alpha** - This is the ending alpha component that a particle will reach by the end of its life. Over a particles lifetime, the alpha component will be interpolated from the Start Alpha to the End Alpha.
- **Start Color** - This is the starting color component that is assigned to each particle at the particle's birth.
- **End Color** - This is the ending color component that a particle will reach by the end of its life. Over a particles lifetime, the color component will be interpolated from the Start Color to the End Color.

- **Preview Particle System** - Allows you to preview the particle system's basic behavior including the motion of particles and other particle properties.

See the example below to learn more about exporting particle systems.

12.1. Fire Particle System Example

Let's create a simple flame to illustrate the particle system creation and exportation process.

1. First, let's create a PCloud object in 3D Studio Max as shown below.

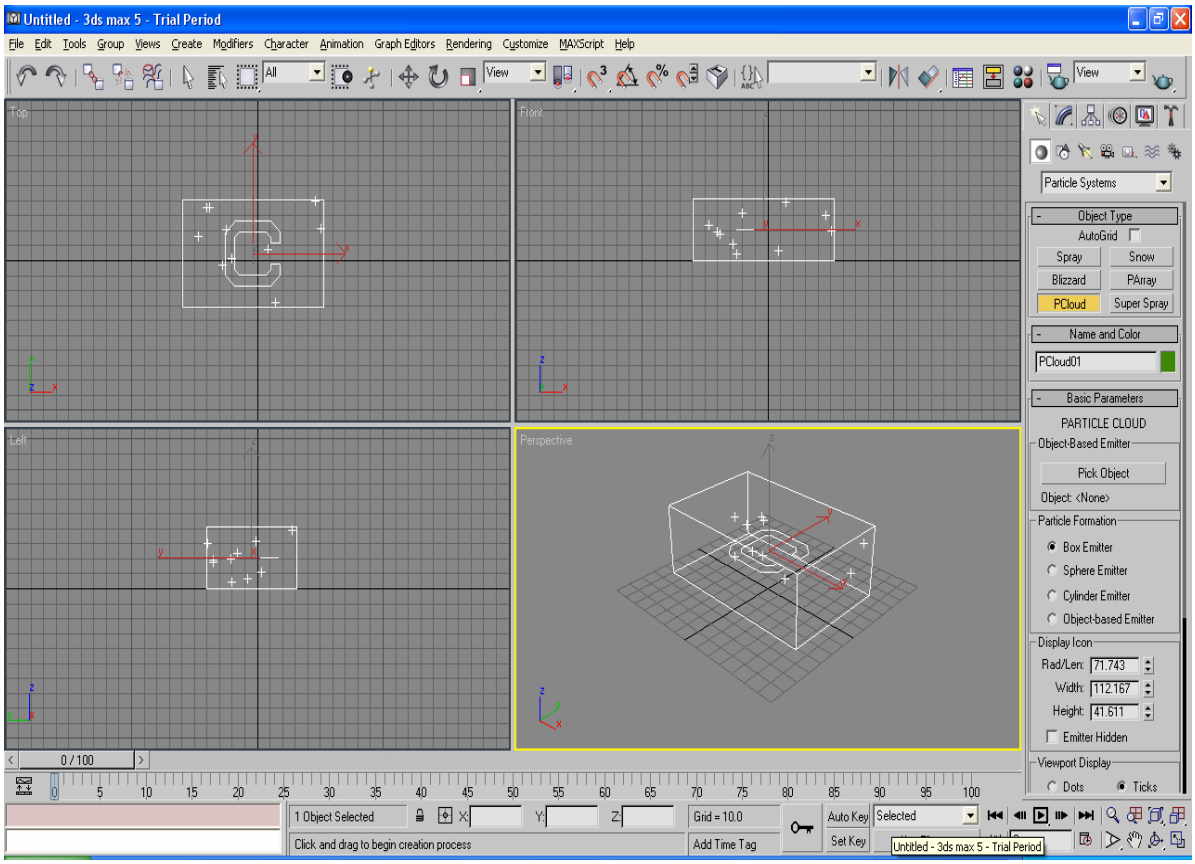


Figure 18 - Fire Particle System Export

2. Change the emitter type to a sphere to more closely model a flame. Also, set the Rad/Len to about 20.
3. Next, set the use rate to 50, speed to 6 and speed variation to 10%.
4. Set the direction vector to point straight up -> x = 0, y = 0 and z = 1. Set the direction variation to 3%.
5. Change the Emit Stop to high value such as 1000. This doesn't affect the exported particle system but will let you see the particles in Max's view port when you move the time slider.

6. Set the Life to 8.
7. Set the Fade For to 3.
8. Now, move the time slider around to see the final particle system properties take affect. The final particle system as it looks in Max is pictured below.

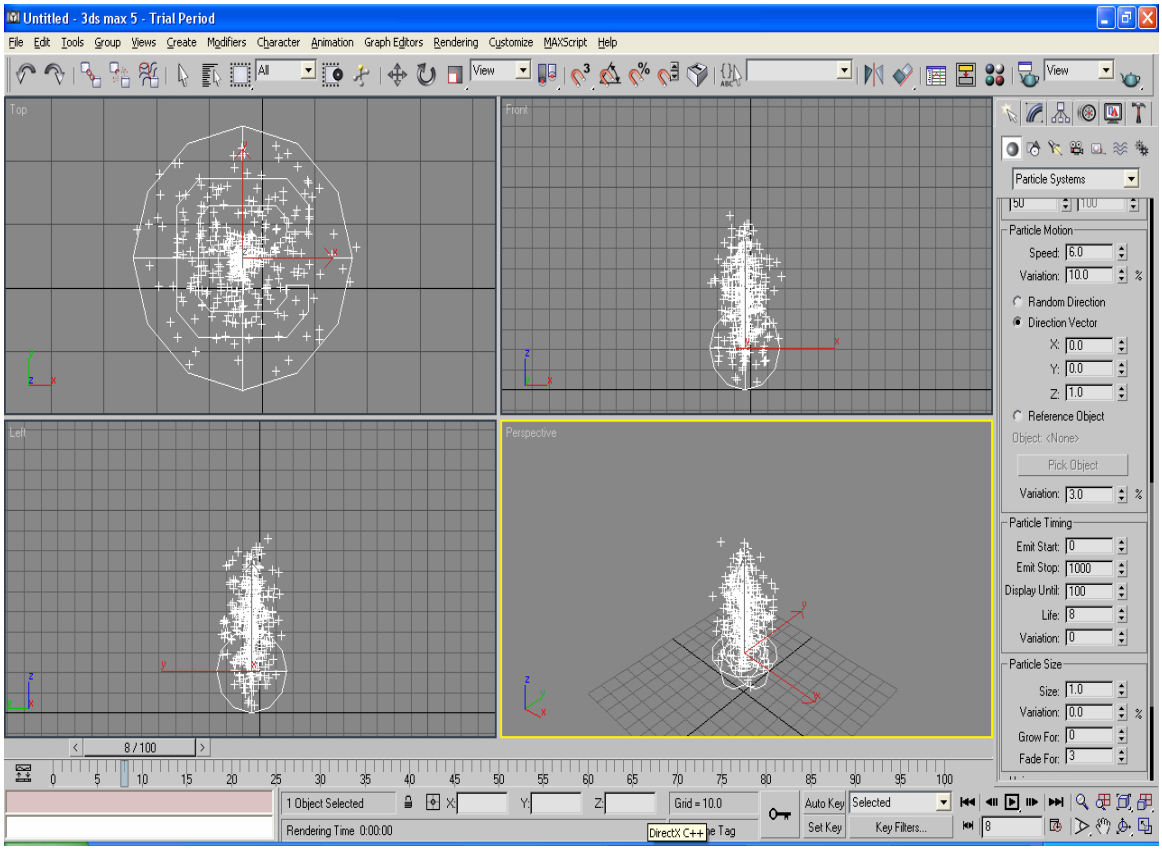


Figure 19 - Fire Particle System Properties

9. Now we must assign a material from the material editor to the particle system. The important thing to remember here is that the diffuse texture map will be applied completely to each particle. No UVW Map modifier is needed.
10. Select the finished particle system.
11. Click the "Export XPS" button on the Particle System Rollout.

You can take advantage of the Particle System Preview tool within the Particle System Rollout to fine tune parameters such as particle size, texture properties, etc...