



# Remo 3D v3.1

**White Paper**



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# 1. Abbreviations

This section describes the abbreviations used in this white paper.

3DS	3D Studio
API	Application Programming Interface
BMP	BitMaP
DDS	Direct Draw Surface
DOF	Degree-Of-Freedom
ECEF	Earth-centered, Earth-fixed
GIF	Graphics Interchange Format
INT	INTensity
INTA	INTensity-Alpha
IVE	OpenSceneGraph deprecated binary file format
JPEG	Joint Photographic Experts Group
LOD	Level-Of-Detail
OSG	OpenSceneGraph deprecated ASCII file format
OSGB	OpenSceneGraph binary file format
OSGT	OpenSceneGraph text file format
OSGX	OpenSceneGraph XML file format
P3D	3D model file format used by VBS2
PBM	Portable Bit Map
PGM	Portable Gray Map
PNG	Portable Network Graphics
PNM	Portable aNy Map
PPM	Portable Pixel Map
RGB	Red-Green-Blue (SGI image file format)
RGBA	Red-Green-Blue-Alpha (SGI image file format)
SGI	Silicon Graphics Incorporated
SHP	ESRI SHaPe file format
STL	StereoLithography
TGA	TarGA
TIFF	Tagged Image File Format
VBS2	Virtual BattleSpace 2
WYSIWYG	What You See Is What You Get
XML	eXtensible Markup Language

## 2. Introduction

Remo 3D is an effective tool for creating and modifying 3D models intended for realtime visualization. Remo 3D's primary file format is OpenFlight and it allows the user to import and export many different file formats.

This white paper provides an overview of Remo 3D, targeted towards managers, project leaders, procurement officers, system administrators and end-users. If more information is required, Remo 3D can be downloaded as a demo version from Remograph's website, [www.remograph.com](http://www.remograph.com). The download contains a detailed user's guide as well as a tutorial.

By offering the user full control of the model scene graph and allowing for modification of features like degree-of-freedom nodes, level-of-detail nodes, switch nodes, etc., Remo 3D is targeting the realtime visual simulation industry. Allowing for focusing on the individual polygons and vertices, as well as supporting the commonly used OpenFlight file format also makes Remo 3D suitable for creating and modifying 3D models intended for realtime visualization.

The product is developed by Remograph and it has been on the market since 2005. It has users world-wide, both private and governmental, in defense and commercial industries.

Remo 3D is currently available for Microsoft Windows 10/11 64-bit and Linux 64-bit. Node-locked, USB dongle and floating licenses are available for purchase with affordable price-tags and optional support plan. Floating licenses are only available in the Pro license level.

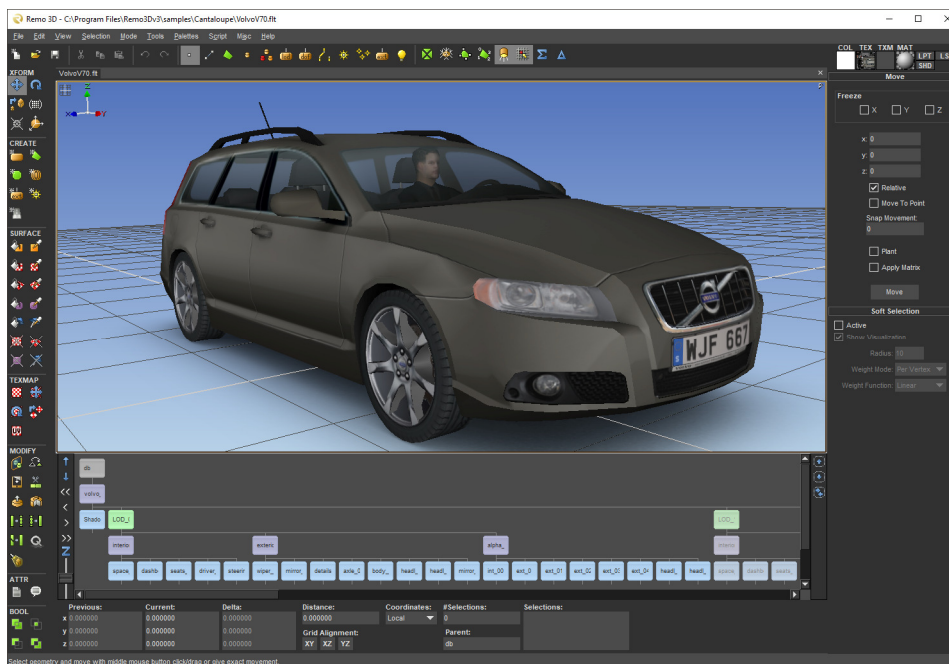


Figure 1: Remo 3D showing a sample model, its scene graph and the Move tool activated (3D model by cantaloupe13d)

## **3. Advantages**

This section describes the main advantages of Remo 3D compared to its competitors.

### **3.1. Realtime Characteristics**

There are several 3D modeling applications on the market, but not all of them are intended for the creation of realtime models. Many competent 3D modeling tools are great for producing beautiful 3D models to be rendered in a film or animation. This is where they differ from Remo 3D, which offers the user full control of the 3D model scene graph and allows for modification of features like DOF (degree-of-freedom) nodes, LOD (level-of-detail) nodes, switch and sequence nodes, etc. These features are essential to create a full-featured 3D model that will be used in a simulation, game or other realtime application. Moreover, Remo 3D is based on OpenFlight, the most common file format used in the visual simulation industry and for realtime models generally.

So, a strong incentive to choose Remo 3D is the realtime support. There are other products on the market with this support as well, although not that many. Either they are expensive, have awkward user interfaces or their OpenFlight support is only represented by import/export functionality at best. However, since there are many users with experiences from Remo 3D's main competitors, the application has been designed with ease of moving from these products in mind.

### **3.2. Multi-Platform Support**

An important issue to consider is which operating system you prefer. Remo 3D supports both Windows and Linux. Although Windows is generally speaking the dominating operating system, Linux is undoubtedly quite common in the visual simulation industry. Furthermore, Remo 3D is available for both Windows and Linux. Being based on several open standards, Remo 3D is also prepared for porting to other operating systems, if required by customers.

### **3.3. Import/Export Formats**

The large number of import and export file formats supported by Remo 3D will really simplify the process of receiving models from different sources and converting them to OpenFlight or other file formats. You won't have to purchase expensive conversion products that still have a lot of limitations and even more important - you will be able to edit the converted models in the process.

### **3.4. OpenSceneGraph**

Remo 3D is developed using OpenSceneGraph [OSG], a high performance 3D graphics toolkit that has quickly become the de-facto standard in industries such as visual simulation, games, virtual reality and modeling. The rapid progress of this open source API (Application Programming Interface) enables Remo 3D to follow the development and quickly add for example new import and export file formats as soon as they are supported by the OpenSceneGraph. Since the API is so widely used and based on standard OpenGL, the Remo 3D WYSIWYG (What You See Is What You Get) model view is most likely to provide the exact same representation of the model as in your target runtime system.

### **3.5. Automation**

All tasks available manually in Remo 3D Pro are possible to automate through a script (see more about the Pro license level in 3.7). The script language is based on Lua 5.2.3 ([www.lua.org](http://www.lua.org)) with an addition of over 280 Remo 3D-specific functions. Besides the obvious capability of creating a script programmatically, it can also be generated by recording the interactive operations performed in Remo 3D.

In order to make a script more user-friendly and appear more or less as a regular Remo 3D tool, you can wrap it in a macro. A macro will appear in the Remo 3D menu and the top 9 macros will have convenient shortcuts, making them easily accessible. A macro can also take parameters which will appear in the tool area to the right together with an Apply button, just as with a regular tool. Macro parameters can be loaded and saved, so that successful macro execution can be recreated.

Script and macro support makes Remo 3D extensible in the sense that users can easily record or implement their own tools that can be saved to be used over and over again. Macros can also be imported and exported, enabling users to share macros with each other.

### **3.6. User Influence**

Remo 3D has been developed in close contact with 3D modelers. Remograph has been very careful to let the product evolve according to the needs of its customers. As a Remo 3D user, you have a great influence over the development of the product.

### **3.7. License Levels**

Remo 3D comes in three different license levels - Free, Basic and Pro. The Free level is free for commercial use but limited in functionality and in the size of saved models. The Basic level is unlimited in the size of saved models and contains the most important features required for realtime 3D modeling, while Pro is fully featured with support for scripts and

macros as well as more advanced tools. All this allows for a very cost-effective use of the product.

Here is the detailed list of license levels for Remo 3D v3.1:

	<b>Free</b>	<b>Basic</b>	<b>Pro</b>
General modeling features	x	x	x
Import formats	20	20	20
Export formats	13	13	13
Save limit	max 100 polygons	unlimited	unlimited
Scripts & macros			x
Boolean tools			x
Simplify & Subdivide			x
Soft selection			x
Modify UV			x
Geocentric conversion			x
Present geodetic/projected coordinates			x
Create airport runways			x
Floating license support			x

## 4. End-user perspective

This section describes Remo 3D from an end-user's point of view.

### 4.1. User Interface

The user interface presented in Remo 3D is clear and intuitive. The number of dialogs popping up and covering the view of the 3D model has been minimized. The icons are easy to understand and their size is just right. Several models can be loaded simultaneously, presented in a number of tabs.

#### 4.1.1. Model View

The model view in the center visualizes the 3D model in one, two, three or four viewports. The mouse controls for moving the camera, selecting geometry, etc. are similar to competing products. See Figure 2 for an example of using four viewports.

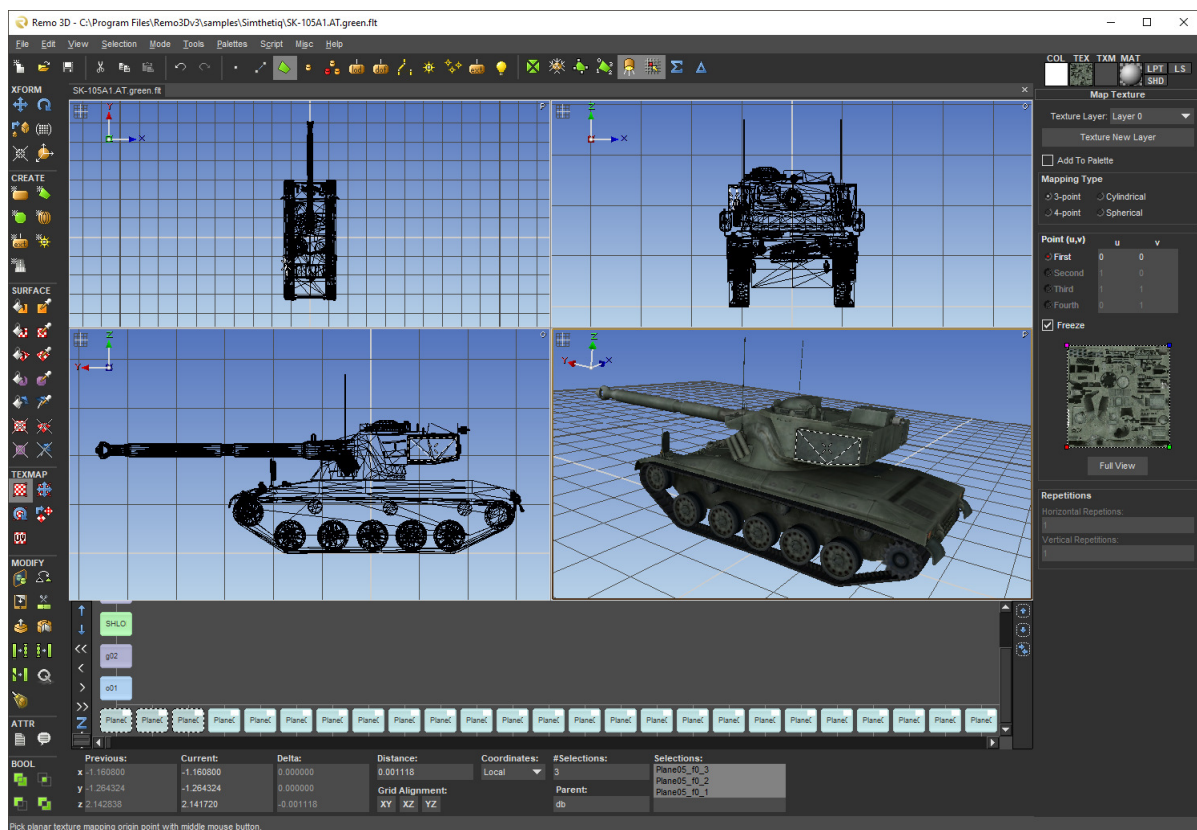


Figure 2: Multiple viewports (3d model by SimthetiQ)

In the model view, the user can control the current grid, which is convenient to use in many of the tools. There are a number of predefined view positions to choose from (top, bottom, front, back, right, left). The view can also be specified as perpendicular to the current grid, and the user can store and recall views across different models and viewports in the same Remo 3D session.

Furthermore, the user can control the visualization with respect to perspective or orthographic projection, wireframe and/or solid rendering as well as toggling of lighting, textures and shaders. Selected geometry can be hidden and isolated. There is also a convenient screenshot feature.

Vertices can be highlighted and vertex normals can be visualized in a convenient and customizable way.

### 4.1.2. Tree View

Below the model view, the scene graph or tree structure that holds the geometry of the 3D model is presented in the area called the tree view. Nodes are presented hierarchically, all the way down to the individual vertices as illustrated in Figure 3.

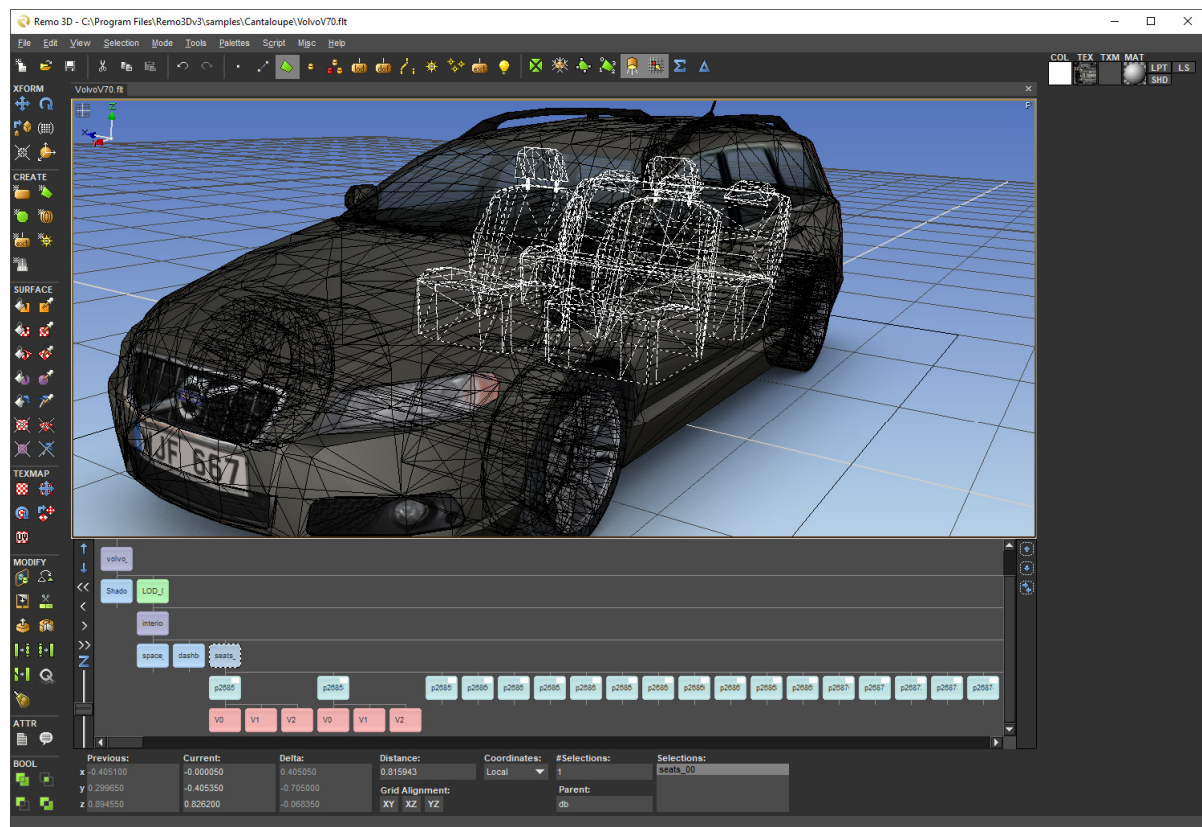


Figure 3: Tree view expanded to vertices (3D model by cantaloupe|3d)

Nodes can be expanded and contracted as well as dragged and dropped. The view can be translated and zoomed in and out in the same manner as in the model view, or by using scroll bars. The tree view area also contains convenient buttons for left-/right-shifting nodes, selecting parents and children of the currently selected nodes, and switching to the previous selection.

### **4.1.3. Icons**

Above the model view, there are icons for common file and edit commands, followed by the available selection modes. Furthermore, there are icons for activating various visual cues such as vertex markings, vertex normals and vertex numbers. The user can also choose to shrink all polygons in order to see them separately – a very useful functionality in 3D modeling.

The Report Statistics feature is very useful for quickly finding out interesting metrics on the 3D model or the part of the scene graph currently selected. Examples are number of polygons or switch nodes, the total polygon area or the size of the bounding box of the current selection.

The Report Differences feature is convenient for comparing nodes or parts of the scene graph, or even whole model files.

To the left of the model view, icons for all available tools are located. Read more about the different tools in section 4.2.

To the right of the model view is an area reserved for the currently active tool. This reserved area prevents tools from popping up dialogs obscuring the model view. Each tool uses different components such as text boxes, tabs and buttons in this area and some tools use nothing.

### **4.1.4. Coordinates and Selections**

The area at the bottom of the Remo 3D user interface contains information about coordinates and selections. This includes the center (pivot) points of the current and previous selections, as well as the distance between them. A list of the currently selected primitives together with the number of selected primitives and the current parent node are also presented here.

In the Pro license level, the current, previous and delta coordinates can be presented as local (default), projected (e.g. UTM) or geodetic (longitude, latitude, elevation), provided that the correct projection parameters are set in the header node.

The bar at the bottom is a status area presenting any status text that is currently of interest, for example information from the current tool or the name of the currently selected node.

### 4.1.5. Palettes

In the top right corner of the user interface, you will find buttons for opening the palettes for colors, textures, texture mappings, materials, light points, light sources and shaders. These palettes will open up in separate windows, allowing for adding, removing and editing of palette entries as well as loading and saving palette files, so that complete palettes can be reused in different 3D models. Figure 4 illustrates the texture palette.

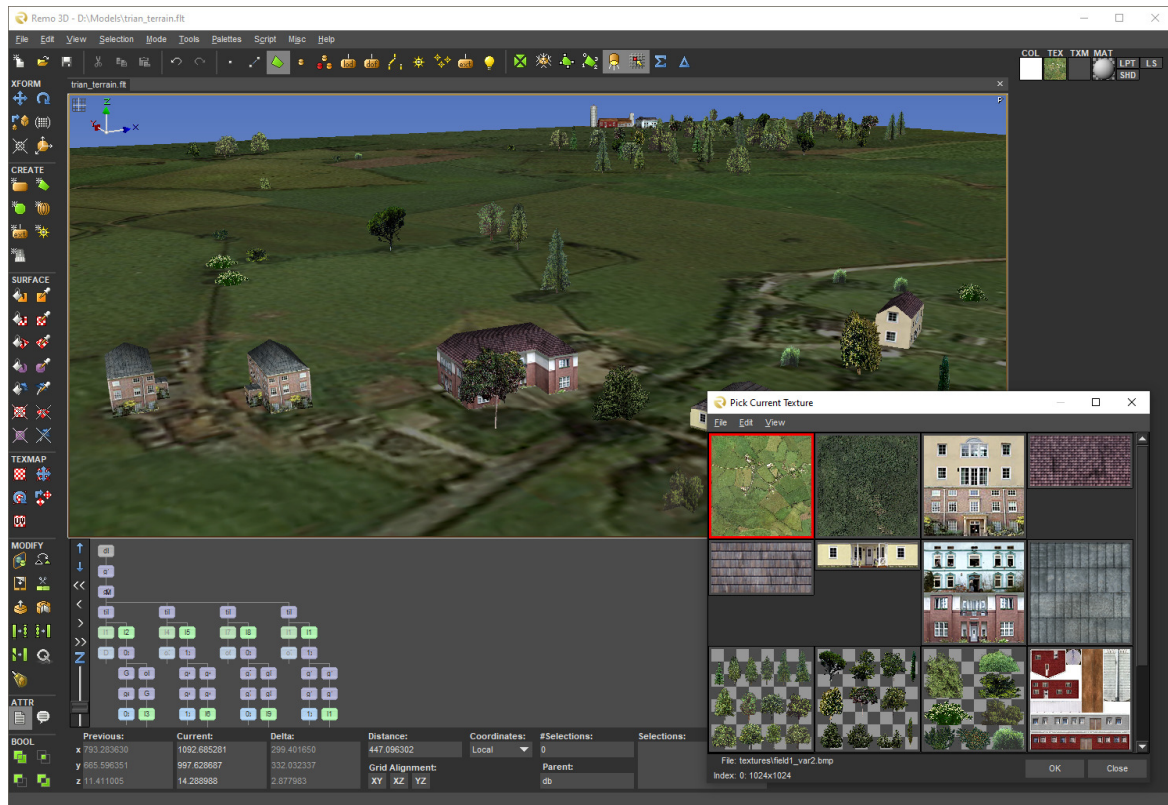


Figure 4: Texture palette (3D terrain model by TrianGraphics)

## 4.1.6. Menu Options and Shortcuts

Through different menu options and keyboard shortcuts you will reach convenient functionality, for example changing the currently visible LOD (level-of-detail), setting a number of preferences saved in your personal profile, previewing sequence and DOF (degree-of-freedom) animations (illustrated in Figure 5) or reading about Remo 3D functionality in the built-in Help system.

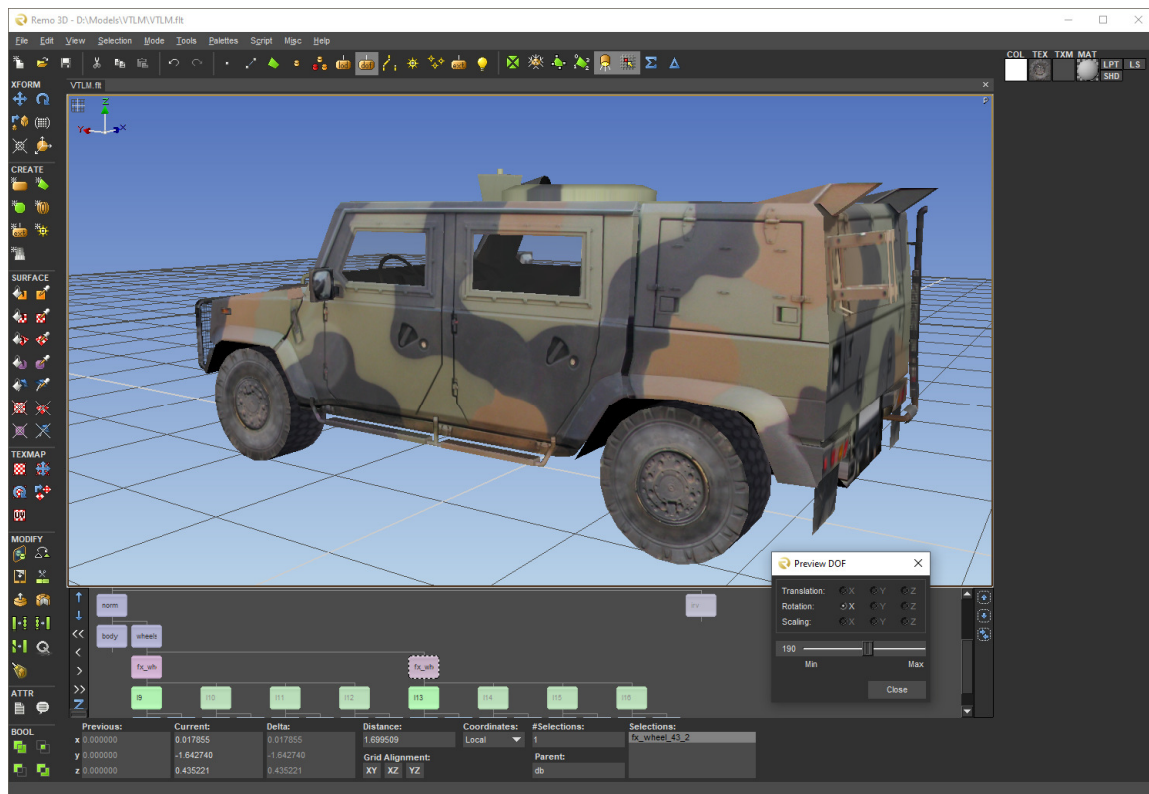


Figure 5: DOF attributes and preview

## 4.2. Tools

Remo 3D provides a set of different tools that together enable you to accomplish everything you might need for creating realtime 3D models.

### 4.2.1. Selections

Tools are activated on the currently selected geometry. Selectable primitives in Remo 3D are vertices, edges, polygons, object nodes, group nodes, LOD (level-of-detail) nodes, DOF (degree-of-freedom) nodes, switch nodes, light points, light point systems, external references and light sources.

Selections can be made interactively in the model view or in the tree view, by giving a node name or by specifying an attribute expression, for example selecting all polygons with a specified texture index or with an X coordinate less than 10. There is a special option for selecting so called sliver polygons, that is thin polygons with a sharp angle less than a given tolerance. One can also select polygons based on their number of vertices and there are separate options for selecting the parents or children of the currently selected nodes, as well as selecting the previously selected nodes.

A selection always has a current pivot point. By default, this point is the average position of the selected geometry, but it can be moved by the user with a simple mouse-click. Some tools, for example Move, Rotate and Scale, will use the pivot point as a reference. This is an easy-to-learn and very effective functionality which eliminates the need for unnecessary dialog boxes and reference point inputs.

#### 4.2.2. Commands

Activating a tool creates a command. Commands can be undone and redone and are also listed in the Command List. Other activities responding to undo and redo are palette operations that modify the model, left- or right-shifting of nodes, all types of selection operations, cutting and pasting of geometry, drag and drop operations, moving of the pivot point and setting the parent node. The number of undoable and redoable commands can be changed by the user.

#### 4.2.3. List of Tools

The tools available in Remo 3D are divided into five groups, as presented in the table below:

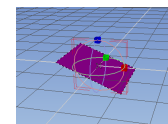
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##### **Transform**

The Transform tools are used for moving, rotating and scaling geometry. A separate tool lets you apply one or more transformation matrices that will move, rotate or scale the geometry beneath a node. This can also be achieved interactively with the Move, Rotate and Scale tools. One can also quickly plant multiple copies of geometry on top of other geometry with the Move tool. Another tool eliminates any transformation matrices and modifies the vertex coordinates accordingly.



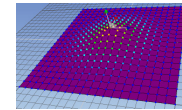
The move, rotate and scale tools can each be used with a so called gizmo; a user-friendly handle that makes geometry transformation easier.



In the Pro license level, the move, rotate and scale tools can also be used with soft selection which is used to smoothly vary the weight of each vertex or primitive, in

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order to create soft and round shapes.



In the Pro license level, there's also a tool for converting a geo-referenced model to geocentric (ECEF) coordinates.

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### Create

The Create group of tools lets you create nodes of all types. There are separate tools for creating polygons, disks, spheres or light points. There is also a tool for creating external references to other OpenFlight files on disk.



In the Pro license level, there is also a tool for creating airport runways.

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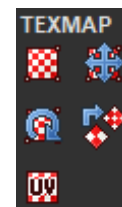
### Surface

The Surface group contains tools for applying and removing colors, textures, texture mappings, materials and shaders. You can also set the current color, texture, texture mapping, material or shader to the one used by the selected geometry.



### Texture Mapping

The Texture mapping group offers a versatile tool for mapping textures onto the selected geometry. The texture mapping tool supports 3-point, 4-point, cylindrical and spherical texture mappings. You can use up to 8 multi-texture layers. The (u,v) texture coordinates can be edited exactly or by clicking in the texture image. You can also choose to add the mapping to the texture mapping palette in order to reuse it for other geometry. There are also tools for moving, rotating and scaling an existing texture mapping.



In the Pro license level, there is also a tool for modifying the texture coordinates in the texture space rather than the geometry space. This Modify UV tool offers a powerful and convenient way of transforming an existing texture map by moving, scaling and rotating parts of the UV-map.

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## Modify

In the Modify group you will find the more advanced and creative tools provided by Remo 3D.

They will allow you to mirror the selected geometry with respect to the current grid, reverse the vertex order of the selected polygons (and thereby the direction in which they face) and quantify the coordinates of selected geometry to a certain accuracy.

The merge tool will merge adjacent polygons sharing the same vertices. Selected edges will be merged to close holes or create walls. Selected vertices will be merged into a triangulated mesh.

You can also extrude selected geometry (that is move the geometry in a certain direction and create walls along the way) and revolve geometry (that is move the geometry along a circle and create walls along the way).

The extrude tool can be used with a gizmo; a user-friendly handle that makes geometry transformation easier.

Furthermore, this group offers very useful tools for slicing and splitting geometry. There is the Slice tool that can slice geometry along the grid plane or along the grid lines, like a cookie-cutter.. It can also slice along a freely specified line, perpendicular to the current plane. There is also the versatile Split/Triangulate tool which can split a polygon between the selected vertices, split an edge by creating a new vertex in the center of the edge, or triangulate convex or concave polygons.

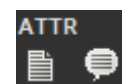
This group also offers a tool for shading geometry, that is calculating normals for flat or smooth shading. And last but not least, in the Pro license level the Simplify and Subdivide tools use advanced algorithms for decreasing and increasing the number of polygons in a model, for example in order to create levels of detail (Simplify) or creating more detailed and interesting surfaces and round shapes (Subdivide).



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## Attributes

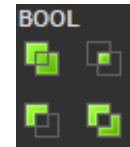
The Attributes group contains one tool for displaying and modifying the attributes of all supported OpenFlight nodes, and another tool for displaying and modifying a comment text for all types of nodes.



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**Boolean**

The Boolean group contains tools for performing boolean operations, namely Union, Intersection, Difference and Symmetric Difference. These tools are only available in the Pro license level.



## 5. Technical Details

### 5.1. System Requirements

Remo 3D is currently available for the Microsoft Windows 64-bit and Linux 64-bit platforms . It has been tested on different versions of RedHat, Fedora Core, Debian, SuSE and Ubuntu. Other Linux systems may be supported, just download the Remo 3D demo version from Remograph's website, [www.remograph.com](http://www.remograph.com), and try it out. Please report any experiences to: [support@remograph.com](mailto:support@remograph.com).

This is the minimal system configuration for Remo 3D v3.1:

- Microsoft Windows 10 64-bit or Linux 64-bit
- Hardware accelerated 3D graphics card
- Minimum 1366x768 screen resolution
- Mouse with three buttons or wheel button

This is the recommended system configuration for Remo 3D v3.1:

- Microsoft Windows 10/11 64-bit
- Intel i5 or i7 processor or AMD Ryzen 5/7
- At least 16 GB RAM
- NVIDIA hardware accelerated 3D graphics card
- 1920x1080 screen resolution
- Mouse with wheel button

### 5.2. Under the Hood

Remo 3D was developed using OpenSceneGraph [OSG], OpenGL [OGL], Fast Lighting Toolkit [FLTK] and Lua [LUA]. These effective and long-lived application programming interfaces vouch for a stable and efficient foundation in Remo 3D.

### 5.3. Documentation

Remo 3D is delivered with an extensive user's guide. The same information is conveniently available in an advanced help system available directly from the Help menu in Remo 3D.

An educational and intuitive tutorial document together with necessary models and textures are also included in the Remo 3D package, as well as a number of OpenFlight sample models containing the most common features like DOF (degree-of-freedom), LOD (level-of-detail) and switch nodes. A number of script and macro samples are also included.

## 5.4. File Formats

Remo 3D supports the OpenFlight file format, versions 15.7 through 16.2. The following 3D model file formats are also supported:

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<b>Import</b>	3DC Point Cloud (.3dc) 3D Studio MAX (.3ds) AC3D (.ac) COLLADA 1.4.1 (.dae) Autodesk DXF (.dxf) Autodesk FBX (.fbx) LightWave (.lwo / .lws) Quake Character Models (.md2) Alias Wavefront OBJ (.obj) OpenSceneGraph 3.6.4 deprecated ASCII (.osg) OpenSceneGraph 3.6.4 deprecated Binary (.ive) OpenSceneGraph 3.6.4 Archive (.osga) OpenSceneGraph 3.6.4 Binary (.osgb) OpenSceneGraph 3.6.4 Text (.osgt) OpenSceneGraph 3.6.4 XML (.osgx) VBS2 P3D (.p3d) Stanford Triangle Format (.ply) StereoLithography Binary (.stl) StereoLithography ASCII (.sta) ESRI Shape (.shp) DirectX (.x)
<b>Export</b>	3D Studio MAX (.3ds) AC3D (.ac) COLLADA 1.4.1 (.dae) DOT (.dot) Autodesk FBX (.fbx) Alias Wavefront OBJ (.obj) OpenSceneGraph 3.6.4 deprecated ASCII (.osg) OpenSceneGraph 3.6.4 deprecated Binary (.ive) OpenSceneGraph 3.6.4 Binary (.osgb) OpenSceneGraph 3.6.4 Text (.osgt) OpenSceneGraph 3.6.4 XML (.osgx) VBS2 P3D (.p3d) StereoLithography Binary (.stl)

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The following image file formats are supported for being used as textures:

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<b>Textures</b>	SGI image file format (.rgb, .rgba, .int, .inta)
	Microsoft Windows bitmap (.bmp)
	Direct Draw Surface (.dds)
	Graphics Interchange Format (.gif)
	Joint Photographic Experts Group (.jpg)
	Portable Network Graphics (.png)
	Portable any map (.pnm, .ppm, .pgm, .pbm)
	Targa (.tga)
	Tagged Image File Format (.tif)

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## 6. Summary

Remo 3D's multi-platform support, its large number of import and export file formats, the complete script and macro support, the quick and ambitious technical support from Remograph, together with the very affordable price-tag, are all advantages that make Remo 3D the best choice compared to its closest competitors. More information about the product and the company behind it can be found at [www.remograph.com](http://www.remograph.com), where you can download a demo version and evaluate it for yourself.

## 7. References

[OSG] OpenSceneGraph, [www.openscenegraph.org](http://www.openscenegraph.org)

[OGL] OpenGL, [www.opengl.org](http://www.opengl.org)

[FLTK] Fast Lighting Toolkit, [www.fltk.org](http://www.fltk.org)

[LUA] Lua script language, [www.lua.org](http://www.lua.org)

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