



# carbon graphics

Power Tools for Dynamic 3D Content

## Geo Technical Specification

### Application Desktop

- Familiar windows look & feel
- Designed to minimize window clutter
- True WYSIWYG interface
- Use mouse to interactively control rotation, pan & zoom
- Tree view for 2D hierarchical view of database
- Multiple simultaneous views of scene
- Orthographic/perspective views
- Always on-screen property panel
- All operations act on current selection
- Multi-monitor support
- Status display...
  - Current pickmode
  - Current behavior state
  - Current color
  - Current layer parent
  - Current selection
  - Current texture
  - Current texture unit
- Current & delta coordinate readouts
- Distance & Angle readouts
- Fine grain picking control..
  - Inhibit X,Y & Z axis coordinate usage
  - Inhibit 3D object picking
  - Inhibit grid picking

### File I/O

- New (empty) file
- Open/save/saveas in open "geo" format
- Multiple files open at once
- Instantly switch between loaded files
- Copy/paste geometry/hierarchy/behaviors/extensions
- Import/Export
  - DWB@ version 2.0 - 4.1
  - OpenFlight@ version 14.1 - 16.1
  - Obj
  - Aechelon Hie@, Pto, db
  - VRML 2.0
- Import only
  - AutoCAD@ DXF
  - Discreet@ 3ds
  - ESRI@ Shape files
- Export only
  - Camber Radar Toolkit (from Camber)
- Other formats easily supported through Read/Write API
- Texture image support..
  - SGI rgb (1-4 component)
  - BMP
  - Targa
  - JPEG
  - Gif
  - DDS Compressed Textures
  - Other formats easily supported through SDK

### Edit Operations

- Global unlimited UNDO for all operations
- Cut
- Copy
- Paste
- Delete
- Preferences
- Calculate Normals
  - With smoothing angle
  - Per face
  - Per vertex average

### View Control

- Tree (hierarchy) view
- Perspective/orthographic views
- Hide/show tree view
- Up to 4 simultaneous 3D views "side-by-side"

### Snap camera to view...

- XY plane
- XZ plane
- YZ plane

### Fit on selection

Fit on point

Isolate selection

Hide selection

Show all

Set near/far clip planes

Draw styles...

- Solid
- Wire outline over solid
- Wire on move
- Detexture on move
- Proxy on move

Zbuffer, Backface, Texture, Blending on/off

Show normals

Show bounding boxes

Show Large LightPts

Set front-face polygon direction

Shrink Polygon mode

Precise normal calculation control

Show DOF's

Snapshot

### Scenegraph Structure

Set layer parent

Create new..

- Group
- LOD
- Switch
- Sequence
- LightGroup
- Instance
- Page
- External
- BSP
- DCS
- Cull group
- Z offset group
- Multi-sample AA group
- Line AA group
- Fade group
- Terrain
- Clip Region
- Render Group
- Multi-tex shader
- Decal Group

Render Nodes

- Polygon
- Mesh
- Prim Set
- LightPt
- Slim/Fat Vertices

Expand/collapse tree

Attach

Move after, last, before & first

Select first, last & all siblings

Re-parent selection

Drag and drop editing in tree view

Multi-select in tree view

Convert externals

Generate/Degenerate Prim Sets

Insert/Delete level

### Optimizations

- Flatten node hierarchy
- Create shared vertex palette
- Delete empty nodes
- Calculate Bounding Boxes
- Within Group/Multi-Group Texture sorter
- Flatten transforms
- Convert to/from slim vertices

### Grid Control

- Grid display on/off
- Snap to grid on/off
- Zbuffer display on/off
- Draw grid before/after
- Expand/shrink grid
- Snap grid to...
  - XY plane
  - XZ plane
  - YZ plane
- Place grid on polygon or plane
- Translate grid
- Move grid to origin
- Center grid
- Set dimensions
- Grid perpendicular to axis
- Set grid viewport depth

### Selection

Simple pick modes...

- Groups
- Prims (Polygons & derived types)
- Vertices
- Text
- Externals

Select/Deselect all

Select Parent

Select Prev/Next sibling

Select Child

By Property

Keyboard selection shortcuts

By Property

Info

Concave polygons

Polygons w/ coincident vertices

Polygons w/ colinear vertices

Non-planar polygons

Decal Polygons

Select by clicking in tree or 3D views

Pick control

- Vertices
- Along edges
- On surfaces
- On grid

### Appearance Control

- Get/put color
- Get/Put material
- Get/put texture mapping
- Get/Put texture
- Get/Put shader
- Remove texture
- 3-Pt Planar texture mapping
- Per Face texture mapping
- 2-Pt Grid texture mapping
- Cylindrical texture mapping
- Face color to verts
- Copy UV's
- Modify UV's
- Get/put texture mapping coordinates
- Compress spare texture unit usage
- Apply face color to vertices
- Insert default DWB color palette
- Change texture paths
- DWB palette matching tools

### Create Tools

- Line
- Irregular polygon
- Mesh
- Fan
- Circle
- Rectangle

Prim Set (Stripped multi-prim)  
 2D raster text  
 3D vector text  
 Cube  
 Cone  
 Cylinder  
 Sphere  
 Extrude  
 Mirror  
 Duplicate  
 3-View template  
 Tube  
 Loft  
 Plant  
 Strip face  
 Surface of Revolution  
 Light pts by mouse  
 Light Pt string by number  
 Light Pt string by delta  
 Light Pt string by number & delta  
 Random light Pts  
 Surface of Revolution

### Helper Points

On selection average  
 On selection vertices  
 By mouse placement  
 On edge  
 By string  
 At edge/edge midpoint/intersection  
 Line/Plane intersection  
 Point/Line intersection  
 Point/Plane intersection  
 Clear helper points

### Modify Tools

Rotate  
 Translate  
 Move vertex  
 Place  
 Scale  
 Flip face  
 Generate/Degenerate Prim Sets  
 Adjacent polygon Orientation fixer  
 Slice  
 Bevel  
 Merge  
 Triangulate  
 Turn edges  
 Collapse edges  
 Point Manipulator (translation)  
 Rotate Manipulator  
 Align left  
 Align right  
 Align top  
 Align bottom  
 Align furthest  
 Align nearest  
 Distribute along X  
 Distribute along Y  
 Distribute along Z  
 Weld Vertices  
 Project  
 Modify 2D clip region  
 Remove
 

- Coincident vertices
- Collinear vertices
- Non Coplanar faces

 Modify light pt vector  
 Change font paths  
 Unstrip  
 Translate by mirror reflection  
 Scale to size  
 + many provided GeoScript tools

### Color Palette

True color  
 Color palette for selection  
 Palette has 1024 highest-intensity colors  
 Each color has 128 shades (to black)  
 Total of 131071 indexable colors  
 Colors stored as floats ( 0.0 - 1.0 )  
 Current color As index & rgb values

Larger palette view mode  
 Edit colors

### Material Palette

Current material index  
 1 to unlimited material definitions  
 Add/delete materials  
 Edit individual material properties:
 

- Ambient
- Diffuse
- Specular
- Shininess
- Emissive

### Texture Palette

Current texture index  
 Current texture file name  
 1 to unlimited texture definitions  
 Load textures  
 Replace texture  
 Reload textures from dir  
 Delete selection  
 Delete unused  
 Delete duplicates  
 View actual size  
 Set individual texture properties

### Shader Palette

Current shader index  
 Current Shader type:
 

- GLSL
- Cg
- CgFX

 Create shader  
 Shader Info:
 

- Vertex program name
- Fragment program name
- Vertex program entry point (Cg)
- Fragment program entry point (Cg)

 Animate shader uniform variables  
 Delete shader  
 View GLSL shaders in scene

### Properties

Node-specific standard properties  
 Node-specific extension properties  
 Comments  
 Behaviors  
 Global attribute changes  
 Add your own user properties
 

- No programming required
- Set property label
- Set property type
- Set default value

 Saved/restored in ".geo" format

### Coordinate Input

Current & delta XYZ input/display fields  
 Distance-last two points  
 Angle-last 3 points

### Model Palette

List of model parts  
 Drag into current database  
 Auto snapshot generated

### Behavior

Apply multiple behaviors to any node  
 Each behavior can have multiple actions  
 Data actions:
 

- Clamp
- Range
- Arithmetic
- Conditional
- Linear
- Inverse
- Trig
- Periodic
- Truncate
- Discrete (switch statement)
- If-Then-Else (single var)
- If-Then-Else (block statement)
- Absolute

- Sqrt
- State machine Rule

Display actions:

- Rotate
- Translate
- Scale
- Color
- String Content
- Visibility
- DCS (DOFs)
- State-Machine driven

Each action driven by variable values.

Supported variable types are:

- Internal vars
- User vars
- External (simulation-driven) vars

Debug & test behavior within Geo

Drive input variables

Watch (interactive) variable values

State machine behavior editor

Test individual or all behaviors

View all DOF extents and influence

Load/save vars file

State machine driven behavior

State machine logic editor

### Software Development Kit (SDK)

All tools built using SDK

Allows users to develop Geo plugins

Plugin types:

- Create tools
- Modify tools
- HelperPt tools
- Appearance tools
- Optimization tools
- Task (global per-frame)
- 3D File format import/export
- Image format import
- Introduce new node types
- Renderers

Development projects, libraries & header files provided:

- Mem (memory manager)
- Db (scene graph)
- App (cross-platform Geo application specific functionality)
- Gui (gui implementation, widgets etc.)
- Behavior( articulation & control)

### GeoScript Embedded Scripting Language

90% of SDK exposed thru GeoScript

Interactive and immediate results

Built-in syntax-highlighted script editor

Invoke GeoScript by:

- Command-line batch proces
- Interactive command-line
- As a GeoScript tool "plugin"
- From the script editor
- Automatic pre/post file import/export execution

**For More Information:**

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