TerraExplorer® Pro

Version 6.6.1

Datasheet

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OVERVIEW

TerraExplorer Pro is a powerful, easy-to-use tool for editing, analyzing, annotating and publishing geo-referenced 3D terrain databases, created through TerraBuilder. By overlaying unique or proprietary information onto a 3D map, the user creates an exciting, interactive application that highlights specific features of an area, showing function, relation and proximity along with a distinct view of the area.

PRODUCT MAIN FEATURES

TerraExplorer Pro has the following features:

- The project (.fly) editor that works on terrains built by the TerraBuilder and (optionally) streamed by TerraGate

- A professional station and also a publisher tool for creating projects that can be viewed by TerraExplorer Viewer/Plus

- Efficient in streaming terrain and data overlays over any network

- Provides all the tools necessary to create and publish rich, 3D terrain visualizations

- Includes interactive drawing tools to create and add geometric shapes, user-defined objects, buildings, text, bitmaps and animations on a 3D terrain model

- Generates and loads static and dynamic 2D or 3D objects, symbols and geo-referenced information layers

- Loads standard online and offline GIS layers

- Saves layers to GIS standard file formats

- Communicates with external local and web applications using standard COM interface. Controls all static and dynamic objects, information layers and application content

- Provides a robust set of tools for measurement and terrain analysis

- Controls speed, altitude and viewing angle using any combination of the mouse, keyboard, Ribbon commands, navigation controls, and joystick

- Creates movies, as AVI from a recorded flight path

- Takes snapshots of the 3D window and saves them to external files

- Hyperlink feature links specific areas or objects to web pages, applications, and databases

- Integrates text and web content messages

- Publishing tool exports scenes to Internet/Intranet users

- Provides catalog database which can be searched for layers and projects and updated with changes

- Provides improved level of security for local and remote users

- Includes ActiveX Controls to export the 3D View, Project Tree, and Navigation Map as ActiveX controls

- Records a presentation in which you navigate through the 3D World, showing or hiding objects on the terrain, following dynamic objects, displaying messages and performing different operations

- Records and displays warnings, messages, and errors to help you troubleshoot any TerraExplorer issue

- Simplifies the translation of user interface text and graphics

LAYERS

TerraExplorer Pro features the following layer types:

- Feature Layer

- Imagery Layer

- Elevation Layer

- 3D Mesh Layer (3DML)

Feature Layers

A feature layer is a visual representation of a geographic data set like roads, national parks, political boundaries, and rivers using geographic objects such as points, lines, and polygons.

Streaming: TerraExplorer Pro can load the entire content of the feature layer or stream the data directly from a server or local file. Information from the remote layer server or file is retrieved, added to the terrain, and then removed dynamically based on the camera's position. This option enables you to explore the area without waiting for the entire layer to load.

Styling: TerraExplorer Pro can perform layer level operations. On this level, the Properties Sheet can be set for appearance and behaviors of the geographic objects contained within the layer with various other layer parameters. For a loaded feature layer with a set of attributes containing object level data, advanced layer information can be displayed in the 3D Window.

Spatial Queries: Perform a spatial query by selecting all features spatially related to a polygon, line, or point, or to an existing object. You choose whether to include only features that entirely overlap with your selected or drawn geometry, or whether to include also those that partially intersect. You also can define a buffer zone to include features within a certain radius of the selection.

Spatial Operations: You can perform various spatial operations on the layer's features, including deleting selected features, merging features into a single feature, creating a multipart feature, clipping one polygon from another, exploding a multi-part feature into its individual component features, and exporting selected features to a new file. Using the Attribute Table Tool, you can search and filter the data in a map layer to obtain and display only the features and information you require. You can then display only the filtered data on the map or create a new layer that includes only this data. The original layer is not modified. Attribute values can be edited from the Attribute table, so that multiple feature attributes can be easily modified without opening separate property sheets for each feature.

Saving: Since you are always connected to the data source (local or remote), you can easily get the latest source updates by refreshing the layer. For .shp files and SFS/WFS-T (A WFS service with read-write access by enabling transactions), all changes can be saved directly to the original source file. Data source updating is also allowed for streaming layers.

Creating New Feature Layers: You can define a layer type and attribute fields and create a feature layer directly from TerraExplorer. The layer is saved to a local data source in shapefile or SQLite format.

Figure 1: Feature Layers

Layers can be loaded from the following feature files:

- ESRI Shapefile: .shp

- Microsoft Access: .mdb, .accdb

- Excel: .xls, .xlsx

- Text: free format

- File Geodatabase: *.gdb

- MapInfo: Tab, Mif, Mid

- Microstation DGN

- AutoCAD DXF: .dxf

- SQLite: *.sqlite, *.db

- GeoPackage

Layers can be loaded from the following servers:

- Web Feature Server (WFS)

- TerraGate SFS

- Web Catalog Service (CS-W)

- TerraCatalog

- ESRI ArcSDE Server
- Oracle Spatial Server
- Oracle Database
- SQL Database
- SQL Spatial Database
- ODBC Database
- PostgreSQL with PostGIS

TerraExplorer Pro can **save** groups of objects to the following file formats:

- ESRI Shapefile: .shp
- TerraExplorer FLY Projects: .fly
- KML or KMZ

Complex Layers

In addition to feature layer data sources which are composed entirely of homogeneous or heterogeneous geometries (points, lines, and polygons) representing geographic features, TerraExplorer Pro also supports the import of several types of complex feature layers, which combine different data types in one layer. These include:

- **FLY** –Skyline's proprietary compressed binary file that includes pointers to feature and raster data, objects, and models.
- **OGC KML/KMZ** - OGC standard, publically defined layer, which can be composed of feature and raster elements. For more information, **see**: http://www.opengeospatial.org/standards/kml)
- **BIM** – Industry standard for Building Information Modeling (BIM), a model based process (with geometry and attribute data) for planning, designing, building and managing building and infrastructure. TerraExplorer reads FBX files and converts them to the 3DML format for optimized viewing and streaming on desktop and mobile applications, with full support for spatial and attribute queries.
- **3DML –** Skyline's proprietary urban model format that includes point and polygon feature layers and 3D mesh models (generated by TerraBuilder PhotoMesh) which have been compressed and stream-optimized.

Imagery Layers

An imagery layer is a geo-referenced, satellite or aerial image that overlays the terrain imagery. The Imagery Layer feature enables the user to add **unlimited size**, geo-referenced, satellite and aerial images directly to a TerraExplorer project. A source file that has multiple resolution levels (e.g., Skyline MPU, MrSID, etc.) is visible from any altitude. The layer can be of better resolution than the area on which it is placed. Automatic morphing between the terrain imagery and the Imagery Layer is performed.

Projection: If the source file is not rectified to the same coordinate system as the Terrain Coordinate system that the TerraExplorer uses, the user can reproject it on-the-fly using the built in mechanism.

Clip Polygon: A subsection of a raster file can be displayed by loading a shapefile containing the required clip polygon.

Imagery Layers from the following files can be loaded:

- Window Bitmap (.bmp)

- Gdal Gif (.gif)

- Gdal Nitf (.ntf)

- Gdal Jpeg (.jpg)

- Gdal Jpeg2000 (.jp2, .j2k, .jpc)

- Gdal Tiff (.tif)

- Gdal Img (.img)

- Gdal GeoPackage (.gpkg)

- Gdal Webp (.webp)

- Gdal Cib (*.*)

- Skyline Image MPU (.li.mpu)

- ER-Mapper (.ecw ,.jp2, .jpc, .j2k)

- Erdas Imagine (.img)

- Image files (.bmp, .gif, .Jpeg)

- NGA formats (CIB, CADRG, ADRG)

- Tile Text file (.tlt)

- Mip Terrain (.mpt)

- HTC Raster file (.htc)

Imagery Layers from the following servers can be loaded:

- Web Map Service (WMS)

- Web Map Tile Service (WMTS)

- Oracle Spatial Database

- ECW Image Web Server

- TerraGate Server

- ArcSDE Raster Server

- TerraCatalog

- Web Catalog Service (CS-W)

Elevation Layers

An elevation layer is a geo-referenced elevation raster that replaces the elevation data of the terrain database. The Elevation Layer feature enables the user to add **unlimited size**, geo-referenced elevation data directly to a TerraExplorer project. The file can be of better resolution than the area on which it is placed. Automatic morphing between the terrain imagery and the Imagery Layer is performed. A source file that has multiple resolution levels (e.g., Skyline MPU, WMS etc.) is visible from higher altitudes.

Projection: If the source file is not rectified to the same coordinate system as the Terrain Coordinate system that the TerraExplorer uses, the user can reproject it on-the-fly using the built in mechanism.

Elevation Layers from the following files can be loaded:

- Window Bitmap (.bmp)
- ER-Mapper (.ecw)
- Gdal Dted (dt?)
- Gdal USGS Ascii Dem (.dem)
- Gdal USGS SDTS Dem (.ddf)
- Gdal Arc/Info Binary Grid (.adf)
- Gdal Img (.img)
- Gdal Tiff (.tif)
- Gdal GeoPackage (.gpkg)
- Mip Terrain (.mpt)
- Elevation MPU (.Ei.mpu)
- Erdas Imagine (img)
- NGA DTED (DMED)
- Tiff Format (tif)
- Projection Text File (prj)
- Local MPT (MPT)
- TiLe Text file (.tlt)
- Triangle Elevation (.tri)
- No Stream Bitmap (.bmp)
- No Stream Jpeg (.jpg)
- No Stream Gif (.gif)

Elevation Layers from the following servers can be loaded:

- Web Map Service (WMS)

- Web Map Tile Service (WMTS)

- Oracle Spatial Database

- ECW Image Web Server

- TerraGate Server

- ArcSDE Raster Server

- TerraCatalog

- Web Catalog Service (CS-W)

3D Mesh Layers (3DML)

A 3D mesh layer (3DML) is a fully textured urban model that has been compressed and stream-optimized to accelerate loading speed and efficiently handle memory. 3DMLs are created in TerraBuilder CityBuilder by merging 3D PhotoMesh city models together with classification layers, individually modeled layers, and BIM datasets. A simple 3DML from a single point shapefile with individually referenced 3D model files can also be created in TerraExplorer Pro using the Make3DML tool. These photo-realistic, geographically accurate, and stream-optimized databases can be included in local TerraExplorer projects or published to remote clients via TerraGate.

TerraExplorer Pro constructs a 3DML layer as a layer object, which is then displayed in the Project Tree.

After loading the layer from file or server, you can set its appearance and parameters in the layer's property sheet.

Streaming: 3DML layers can be loaded from 3DML files on your own computer or local network or from a database that is served over a network by the TerraGate SFS service.

Styling: When a 3DML layer is loaded, it is read and put in the TerraExplorer Project Tree as a 3DML Object that contains each of the feature layers which was merged in creating it. This layer object enables you to perform layer level operations by using the property sheet to set the appearance and behaviors of the features contained within the layer.

Spatial Queries: Various spatial queries can be performed on the 3DML's feature layers, to select features within a particular geographical area. Using the Attribute Table Took, the layer attribute database files can be searched to easily edit the attribute values of multiple features and to create a new shapefile based on the filtered data.

Saving: Layer changes can be saved to the original shapefile or to a new shapefile.

Creating New 3DML Layers: Using the Make3DML tool, you can create a unified, stream optimized 3D Mesh Layer (3DML) database from point shapefiles with individually referenced 3D model files.

OBJECTS

The TerraExplorer Pro provides a set of tools to manually add 2D, 3D, dynamic, and terrain objects to the project. The user can create new objects, edit single or multiple objects' parameters using the properties sheet, edit objects directly in the 3D window, and copy /move/delete objects in the 3D window. The objects are organized in the Project Window's tree structure.

Load 3D Model

The 3D model feature allows you to place a pre-prepared 3D object at any point in the 3D terrain. These models can be created using external design tools.

Models can be loaded in any of the following formats:

- Collada (DAE)

- Direct X (X) and its compressed version (XPC)

- 3DS - 3D studio format for exchanging 3D data models

- OpenFlight (FLT) – Multigen format for exchanging 3D data models and its compressed version (FPC)

- XPL and XPL2, which provide better performance for the Direct X model (A set of XPL files is created from a single X file where each file contains data for one Level of Detail (LOD) only)

- OBJ

- PLY

All model formats support BMP, JPG, DDS, and PNG texture formats. FLT also supports Silicon Graphics popular texture formats (RGB, RGBA, INT, INTA, BW).

All loaded models can be optimized by conversion to XPL2, either by using the MakeXPL tool or automatically during the publishing process. When a model file is converted to XPL, a set of XPL files is created from a single X file where each file contains data for one Level of Detail (LOD) only. TerraExplorer displays the best LOD file based on the viewer position in relation to the object. When downloaded from a web server, each file is also downloaded independently. This results in an improvement in overall model display performance as well as download rate.

Figure 2: Loading 3D Model Files into TerraExplorer Pro

Supported 3D model formats:

- Microsoft Direct X (.x, .xpc)

- Skyline Multi-Resolution Model (.xpl, .xpl2)

- Open Flights (.flt, .fpc)

- Google Sketchup (.dae , .kmz)

- 3D studio format for exchanging 3D data models (3ds)

Building Object

The Building feature allows you to add 3D models to the project by manually defining the geometry of the building rooftop and stretching it above the basic terrain, or by importing the rooftop geometry from external feature layers. You can define the shape of the roof as a flat surface, or as an angular surface. After defining the building geometry, you can assign fill color and texture from external files, or apply texture from the terrain to the roof and side walls.

2D Objects

A set of 2D primitives and labels can be placed in the 3D World:

- Text Labels

- Image Labels

- Polylines

- Polygons

- Rectangles

- Regular Polygons

- 2D Arrows

- Circles

- Ellipses

- Arcs

3D Primitives

A set of 3D primitives and models can be placed in the 3D World:

- Buildings

- 3D Polygons

- Boxes

- Cylinders

- Spheres

- Cones

- Pyramids

- 3D Arrows

Dynamic Objects

TerraExplorer Pro features a set of ground and air vehicles you can add to the project. You set the route of a dynamic object by manually placing waypoints in the 3D Window. The object's speed is set either by setting a specific speed for the object in the object's property sheet, or by defining a Start and End time.

There are two types of dynamic objects:

- **Ground Vehicle**: Get pitch and roll angles according to the terrain surface under the object while it moves.

- **Air Vehicle**: Get pitch and roll angles according to the altitude differences between the waypoints, regardless of the terrain surface.

Terrain Objects

TerraExplorer provides two objects that affect the terrain itself.

- **Modify Terrain Tool**: Changes the elevation values of the terrain based on a polygon. The surface of the terrain is raised or lowered according to the elevation values of the polygon's points. Different elevation behaviors allow replacing or cropping above/ below the original values of the terrain. The interior of the polygon can be flat or irregular in shape.

Figure 3: Modify Terrain Tool

- **Hole on Terrain**: Cuts holes in the terrain based on a polygon that exposes the other side of the terrain through the opening.

Video on Terrain and Video Billboard

The Video on Terrain/Video Billboard commands play a video file either on a selected area of the terrain (Video On Terrain), or on a floating billboard (Video Billboard). The positioning of the projector and the projected video can either be set in the Video property sheet or determined using a telemetry file that holds positioning information for the camera based on time stamps.

Supported video file formats are determined by the codecs that are installed and registered on the computer. Most files that Windows Media Player can play (e.g., .avi, .mpg, etc.), including streaming Microsoft Media Server (MMS) content, can be draped on the terrain.

Figure 4: Display Live Video on Terrain

Load Point Cloud Model

The Point Cloud model allows you to add a pre-processed point cloud model at any point in the 3D Terrain. These models are created from a list of points in a 3D area that are collected by various 3D scanners. The load Point Cloud feature supports Skyline's proprietary Point Cloud files (CPT).

The load Linear Point Cloud Set allows you to add a pre-processed point cloud model set. These sets are created from lists of points in a 3D area that are collected by various 3D scanners, and GPS route reading of the collecting instrument's movement while scanning the data. The Load Point Cloud feature supports Skyline's proprietary Linear Point Cloud Set files (CPTR).

Timespans

Timespans can be set for groups and objects, limiting the display of the object or group on the terrain to the specified start and end time values integrated in the object or group's property sheet. The project's time and date are adjusted using the time slider.

NAVIGATION

TerraExplorer offers a wide range of navigation options:

- Free flight
- Presentations with predefined flight paths
- Locations and favorites
- GPS tracking
- Online address geocoding and reverse geocoding
- Navigation map
- Underground navigation
- Indoor navigation
- Target tool

- <u>Look around tool</u>

Free Flight

The mouse is the main tool for controlling the free flight in the 3D World. With the mouse on the 3D Window, you can control the direction and tilt angle of the camera, slide to the sides, zoom in and out, and fly around points of interest on the terrain.

TerraExplorer Pro also supports free navigation using a mouse, keyboard, HUD navigation controls, joystick, or touch screen gestures.

Presentations with Predefined Flight Paths

Presentation capabilities enable you to record a presentation in which you navigate through the 3D World, showing or hiding objects on the terrain, following dynamic objects, displaying messages and performing different operations. You can create a route either by flying through the terrain recording an exact route or by adding each waypoint separately. For each step in the presentation, you display the map in the state you want:

- Current camera position and extent.

- Visibility of raster layers.

- Visibility of feature layers.

- Visibility of map items (objects, groups).

- Popup messages and captions.

- Set environment variables such as underground mode and system time.

An easy to use editor enables you to set step timings and transitions and modify step sequence. Presentations can be played back according to the transitions set in the Presentation Editor or in Auto-play, advancing from step to step automatically.
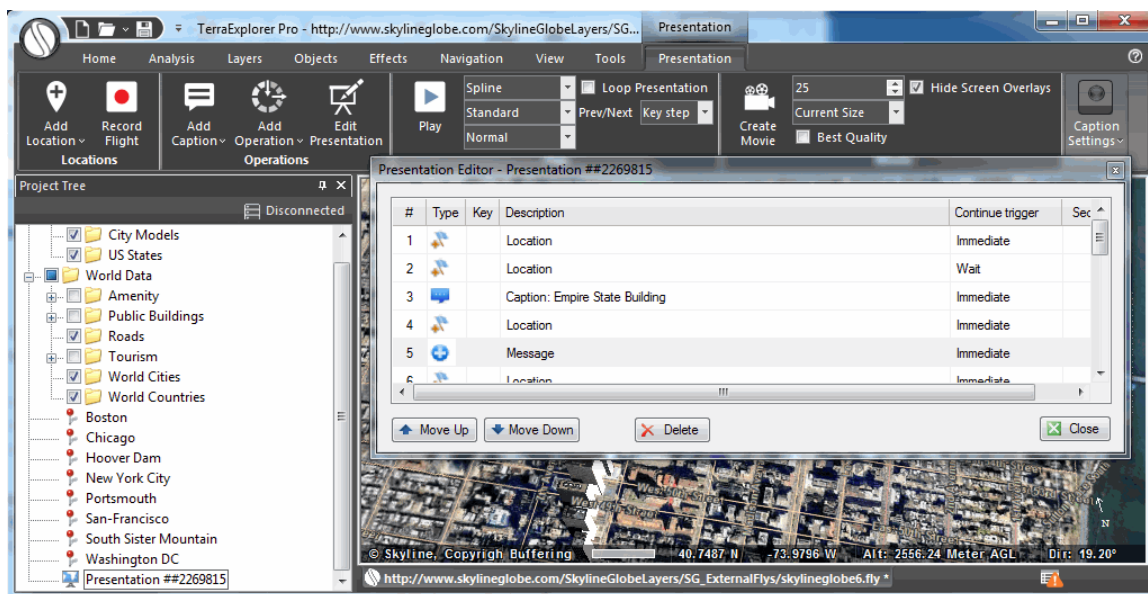

Figure 5: Editing a Presentation

Locations and Favorites

The Project Tree makes it easy to directly fly or jump to predefined locations or objects.

GPS Tracking

The GPS Tracking tool creates 2D or 3D objects and moves them according to position information, in NMEA format, it reads directly from a GPS or communication device through a USB or COM port or from a local or remote file.

The GPS tool supports multiple entities in a single device and allows fast forwarding capabilities when reading the information from files.

You can display the GPS-moving objects in a variety of 2D or 3D graphic representations, and add trace lines trailing the object routes.

GPX Reader

GPX is an XML schema designed as a common GPS data format to describe waypoints, tracks, and routes. The GPX Reader reads GPX files and displays their waypoint and track data in the 3D Window, storing the GPX data in the project either as groups of point objects or as feature layers.

Online Address Geocoding and Reverse Geocoding

The Address search enables you to search for a specific address or location or obtain address information for any point on the terrain. TerraExplorer provides both address geocoding and reverse geocoding for all OpenStreetMap (OSM) data.

Navigation Map Window

The two-dimensional Navigation Map window provides quick and easy navigation through the entire terrain. It displays the location and direction view of the camera. The Navigation Map window offers a simple mechanism to integrate file-based maps into the application. With the support of the TerraExplorer Pro COM interface, web based maps can also be integrated as part of the HTML window.

Underground Navigation

The underground navigation mode allows you to explore the subsurface of the terrain. You can navigate under the terrain's surface and through buildings. A subsurface grid navigation aid appears when you navigate below the terrain, allowing you to navigate the same way as above ground.

Indoor Navigation

The Indoor Navigation controls enable easier navigation within confined spaces, x-ray vision and collision detection. Direction control buttons provide for greater control and finer adjustments to movement. Indoor locations can be created and then accessed from a special Indoor Locations navigation pane, to support easy movement from one indoor location to another.

Figure 6: Indoor Navigation

Target

The Target tool continuously tracks the distance and direction to a specific target.

Look Around

The Look Around tool serves as a virtual stationary observation deck, enabling you to analyze the view from a specific position. Intuitive controls enable you to easily adjust your yaw and tilt and zoom in and out.

Multiple Coordinate Systems

The Multiple Coordinate Systems tool projects the current camera/cursor coordinates to a user-selectable coordinate system. The tools always display the Lat-Long and MGRS coordinate systems.

MEASUREMENT AND ANALYSIS

TerraExplorer Pro provides a robust set of tools for measurement and terrain analysis.

Measurement Tools

Measurements can display dynamically or be created as measurement objects that are listed in the Project Tree and can be exported to FLY, KML/KMZ, or shapefiles.

- **Information Query Tool**: Displays the exact location and elevation of any point in the 3D World, and additional information about objects.

- **Horizontal Distance Tool**: Measures the horizontal distance, elevation difference and slope angle between two or more points in the 3D View.

- **Aerial Distance Tool**: Measures the aerial distance, elevation difference and slope angle between two or more points in the 3D View.

- **Vertical Distance Tool**: Measures the elevation difference between two points in the 3D View.

- **Terrain Area Tool**: Measures the horizontal projection or the surface area (taking into account terrain contours) of an area on the terrain.

- **3D Plane Area Tool**: Measures the area of a polygon on an arbitrary surface.

Terrain Analysis Tools

- **Contour Map Tools**: Topographic map that portrays differences in terrain elevation by connecting points of equal elevation with contour lines or by coloring terrain according to varying altitudes. The following options are available:

  - Global Contour Map - Applies contour colors to the entire terrain with dynamically placed contour lines that provide coarse contours when zoomed out and detailed contours when zoomed in.

  - Custom Contour Map - An advanced map in which parameters such as coverage area (specified rectangular area or entire terrain), contour palette, and contour line interval can be customized and a contour map object is added to the Project Tree.

- **Slope Map Tools:** Provide slope information for a specified area or the entire terrain. The following options are available:

  - Global Slope Map - Applies default palette colors and direction arrows to entire terrain according to slope degree and aspect.

  - Slope Map Query – Graphically represents slope values in a specified area, outputting a highly-accurate color coded point feature layer that is listed in the Project Tree and can be exported to a shapefile or SQLite layer.

  - Slope Map Cursor - Displays slope information in a specified radius around a selected point.

  - Custom Slope Map - An advanced slope map in which parameters such as coverage area (specified rectangular area or entire terrain), slope palette, and arrow color can be customized and a slope map object is added to the Project Tree. The custom slope map can show degree and/or aspect (direction).

  - **Slope Query**: Displays information about a selected location including: its coordinates, altitude, and maximum positive/maximum negative slope values in a specified radius around the selected point.

- **Flood Tool:** Assesses the land area covered by water in different water flooding scenarios. The result of the flood analysis process is a set of polygons showing the flooded areas.

- **Volume Analysis Tool:** Analyzes the amount of terrain removed or added by selected Modify Terrain objects.

- **Terrain Profile Tool**: Displays the terrain elevation profile along a path, and related information on this profile such as maximum and minimum elevation values and slope. The terrain profile can also compare between the base terrain and an elevation layer.

- **Best Path Tool**: Displays the best path between two locations on the terrain with slope limits.

Line of Sight Tools

- **Line of Sight Analysis Tool**: Displays a visual marker for the existence of a line of sight between two points.

- **Viewshed** – Viewshed tools calculate the view from a selected observer point or multiple observer viewpoints:

  - 3D Viewshed – Calculates and marks all areas on the terrain and on 3D models and objects that are visible from a selected point on the terrain.

  - 2D Viewshed - Calculates and marks all areas on the terrain that are visible from a selected point on the terrain.

  - Viewshed Query - Analyzes the visibility of a selected area from multiple viewshed observer viewpoints.

- **Viewshed on Route** - The Viewshed on Route tools provide a graphical representation of the view on the terrain from a series of points (route):

- 3D Viewshed on Route By Speed – Provides an animated representation of the terrain and objects that are visible as a dynamic object progresses along a defined route according to a set speed.

- 3D Viewshed on Route By Time – Provides an animated representation of the terrain and objects that are visible as a dynamic object progresses along a defined route over a defined time frame.

- 3D Viewshed on Route Query– Analyzes the visibility of a selected area from multiple viewshed observer viewpoints along a route.

- 2D Viewshed on Route - Provides an animated representation of the terrain that is visible as a dynamic object progresses along a defined route.

- **Threat Dome Tool**: Displays the visible volume from a given point on the terrain with a specified scan field and elevation angle. Several display options for the threat dome are available so that the particular information required can be easily visualized (i.e., sphere that defines the outer boundaries of the volume that is visible from the viewpoint, dome base that divides between visible and non-visible areas, or skyline that highlights obstructions to the field of view).

Shadow Tools

- **Global Shadow**: Displays a shadow effect for an entire scene (including terrain and all 3D models, objects, and buildings) based on the sun's position. Shadows dynamically update when the system date and time is changed.

- **Selection Shadow**: Casts shadows for selected objects based on the sun's position, enabling visualization of the shadow effect of a particular object on surrounding buildings and terrain. Shadows dynamically update when the system date and time is changed.

- **Shadow Query:** Calculates the sun-shadow ratio in a specified area, over a selected time span. The area is defined by a drawn line or polygon, or by a selection of points, lines or polygons. Shadow analysis can be based on the shadow effect of selected objects (Selection Shadow) or of all the project's objects.

Comparison Tools

- **Imagery Comparison Tool:** Helps you detect changes between two aerial images of the same location by allowing you to dynamically compare the 3D view with and without an Imagery layer.

- **Snapshot Comparison Tool**: Helps you create and compare snapshots showing different versions of the area in view in the 3D Window by showing or hiding objects in the Project Tree.
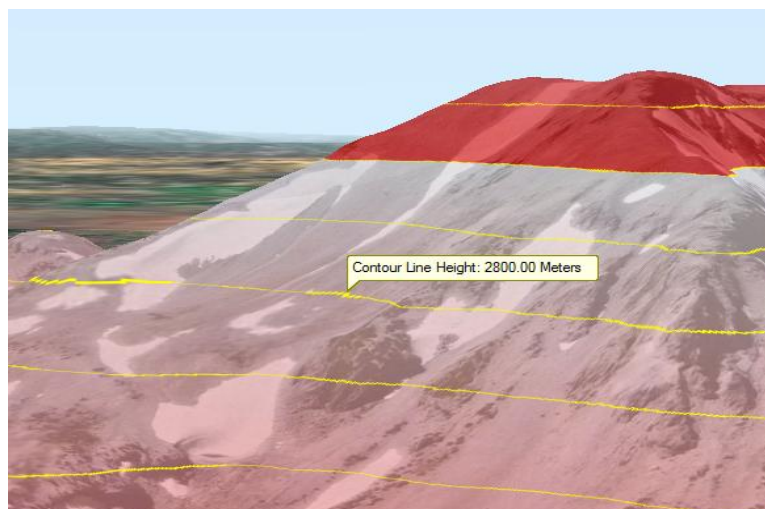
Figure 7: Contour Map

PUBLISHING

TerraExplorer's publishing tools enable the publishing and extraction of projects to web, desktop, and mobile devices.

The Publish TerraExplorer Kit process collects all the files that are used in the project and stores them in the target directory. This directory is ready to be distributed to external users by local media such as CDs or a remote server over the Intranet or Internet.

The following publishing options are available:

- **Publish Project as Local Kit** - Gather local files and objects to a kit folder, maintaining references to all network resources. When required, a TerraExplorer installation setup can be included in the kit.

- **Publish Project as Internet Kit** - Gather local files and objects to a kit folder and prepare the kit folder for publishing to a web server.

- **Extract and Publish Area as Offline Kit** - Extract a geographic subset of the project and copy all of its local and network resources to local files, for use in a disconnected environment.

- **Publish Project as KMZ** - Export a TerraExplorer project to an OGC KML/KMZ file.

- **Publish Project as Mobile Kit** – Gather local files and objects to a kit folder, maintaining references to all network resources, for use on a mobile device, and then upload the kit to a mobile device.

- **Extract and Publish Area as Mobile Offline Kit** - Extract a geographic subset of the project, copy all of its local and network resources to local files, for use on a mobile device, and then upload the kit to the mobile device.

- **Upload Existing Kit to Mobile Device** – Upload an already published kit to a mobile device.

USER INTERFACE

TerraExplorer uses a Ribbon interface that organizes all commands in easily-accessible, intuitive groups, which are collected together under tabs. A customizable Quick Access toolbar makes the commands you most frequently use always available to you.

At any time during a TerraExplorer session, the Navigation Map, Project Tree or any of the TerraExplorer Tools can be repositioned on the screen so that you can create the application layout that is most convenient for you.
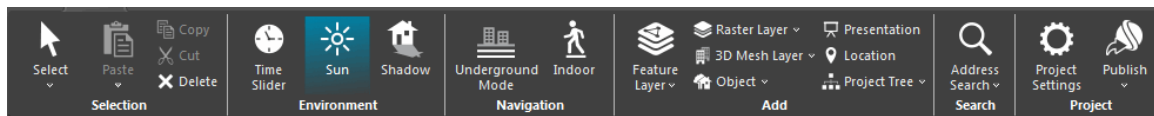

Figure 8: TerraExplorer Ribbon - Home Tab

PROGRAMMING WITH TERRAEXPLORER PRO

TerraExplorer API

The TerraExplorer Application Programming Interface (API) provides a powerful tool for integrating TerraExplorer, TerraExplorer Pro and custom applications. It also provides a way to create extensions that can access external information sources such as databases or Geospatial files. All of the interfaces, based on the **COM** protocol, can be managed through a scripting language (e.g., JavaScript) as well as non-scripting languages (e.g., C++ or C#).

The following main issues are addressed by the TerraExplorer API:

- Navigating in the 3D world.

- Project management.

- Feature and raster layers.

- Objects management.

- Terrain analysis.

- Events notifications.

- Embedding TerraExplorer ActiveX controls in web pages and windows applications.

In addition, TerraExplorer's API allows a variety of other operations such as controlling the content of the containers, querying the terrain for height information, taking snapshots, controlling the mouse and more.

Embedded Mode

TerraExplorer can run as an embedded **ActiveX control** in any **Windows application** or **Web page**. Using the power of the TerraExplorer API, developers can interact between the application or the Web page and the TerraExplorer controls.

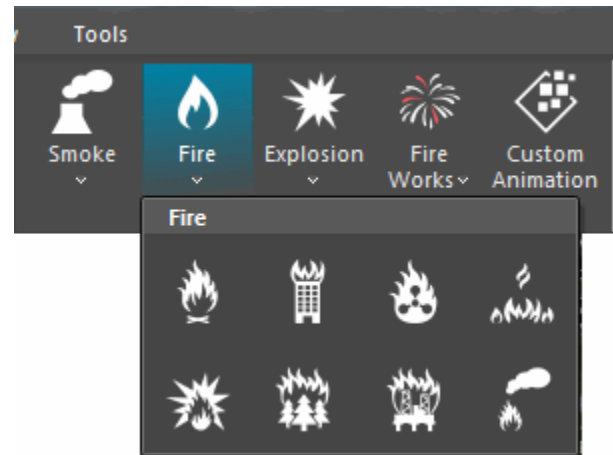TerraExplorer has three ActiveX controls:

- 3D Window

- Project Tree

- Navigation Map Window

TerraExplorer embedded mode is an integrated feature in all TerraExplorer products.

VISUALIZATION EFFECTS

TerraExplorer offers three categories of visualization effects to enhance realism of the 3D visualization.

- **Weather Effects** – Simulation of meteorological phenomena such as clouds, wind, sky, sun, rain, snow, and fog.

- **Animation Effects** - Simulation of natural phenomena such as fire, smoke, and explosions, or fireworks, by modeling the underlying physical processes of these phenomena.

- **Water Effects** – Simulation of naturally or artificially flowing water such as rivers, oceans, waterfalls, and pools.

The latter two categories are rendered in TerraExplorer using a powerful and robust particle system. Particle system effects are based on very small graphic objects that fade out quickly and are then re-emitted from the effect's source to simulate certain kinds of "fuzzy" phenomena, such as fire, explosions, smoke, moving water, fog, and snow. Each particle effect is composed of one or more emitters (each of which can use a distinct graphic object with distinct emitter properties).

When selecting an animation effect, you can use the default properties that are specific to the particular effect, or you can modify these properties using the Particle Editor. This editor gives you the ability to customize nearly all particle properties including: base image, color, size, rotation, speed, and lifetime. Changes made in the editor take effect immediately

Figure 9: Snow Effect

CATALOG DATABASE

TerraCatalog is a catalog database that helps you access, manage and organize your raster, feature, and 3DML layers and projects. TerraCatalog maintains detailed information about its layers including type, dimension, dates, tags, metadata, and custom data, enabling clients to easily query the catalog for the specific layer required for a TerraBuilder or TerraExplorer project. TerraCatalog's data sources can be located on a local disk, on the network, on Oracle or on an SQL Server.

TerraGate Web Catalog Service (CS-W) provides TerraCatalog search interface for remote users, so that data that is stored on files and in remote databases can be easily searched and located using TerraCatalog. The raster, feature, and 3DML data are then served to the client by their respective services.

Two modes are available for working with TerraCatalog:

- **Connect to Catalog** (only) - Catalog layers can be loaded into your project.

- **Bind to Catalog** - Every source or project loaded to your project and all modifications to the project are automatically updated in the catalog every time the project is saved.

TerraCatalog simplifies the interaction and collaboration of different users working with the same data sources. When a data source is modified, it can be easily updated for all projects using the same source. If alternative versions of a data source exist in the catalog, a user can easily replace the project's current version with any of the alternates.

TOOLS

TerraExplorer Pro provides a set of tools that extend the editing and interoperability functionality. The TerraExplorer Pro Tools use an advanced API to provide an extended set of features to the user.

Collaboration

The Collaboration tool connects TerraExplorer users on one collaborative network. Connecting over the internet/intranet, users can chat, annotate the terrain with text labels and free hand drawing, toggle

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information layers for further analysis, point using a virtual cursor, and synchronize their flight. One user serves as the manager of the session, and the rest connect as clients. The collaboration server can also reside on a TerraGate server to better manage and control and solve security problems when accessing end-user computers behind firewalls.

Extract Terrain to MPT

The Extract Terrain tool extracts and creates a subset of a local or remote MPT database for distribution on CD/DVD. The Extract Terrain tool can even create a local MPT from a DirectConnect project.

Extract Terrain to VRML

The Extract Terrain tool extracts and creates a VRML model from a local or remote terrain database that can be displayed in VRML viewers, 3D printing etc.

Extract Terrain to Zebra

The Extract Terrain tool extracts and creates a Zebra Imaging model from a local or remote terrain database, which you can use for producing 3D hologram images.

Drawing Tools

Terra Explorer Pro provides a set of drawing tools to perform any of the following:

Urban Design

The Urban Design tool enables you to create an urban scenario with its own roads, junctions and traffic lights.

Duplicate Objects

The Duplicate Objects tool creates multiple instances of the same object along a broken line, or fills a closed polygon shape area. The tool allows the user to set the basic graphic representation of the object and the spacing between the instances.

Figure 10: Urban Simulation tool

Build Power Lines

This tool creates a power line by placing power poles along a user-defined path and connecting them with power lines. The Build Power Line tool allows the user to define distance between poles, pole type and other pole parameters.

Build Pipe Lines

This tool creates 3D pipe lines along a user-defined path. The output of a build pipe line operation is either a group of TerraExplorer objects or two Points layers, one for the pipes and the second for the connectors.

Build Fences and Walls

This tool creates fences and walls in the precise dimensions, shape and texture you require. The output can be saved as a TerraExplorer group of objects or as a feature layer (shapefile).

Data Library

The Data Library has four primary sets of graphic elements (icons, models, online models, and building textures) that you can add to your project. In addition to the local data objects, the Data Library also includes online models that can be accessed if there is an Internet connection.

Snapshot

The Snapshot Tool copies the current 3D Window to a floating window so you can edit it in a Paint program before saving to image file.

MakeCPT

The MakeCPT tool converts point cloud data from various formats to a unified, visualization and stream-optimized Skyline-proprietary Point Cloud file (CPT) format. LAS files containing lidar point cloud data are among the supported input formats.

MakeXPL

The MakeXPL tool converts 3D model files to the Skyline proprietary XPL2 file format, creating a set of XPL files where each file contains data for one Level of Detail (LOD). When displaying an XPL model, TerraExplorer dynamically selects and displays the best LOD file based on the viewer position in relation to the object. When downloaded from a web server, each file is also downloaded independently. This results in an improvement in overall model display performance as well as download rate.

Make3DML

The Make3DML tool creates a unified, stream optimized 3D Mesh Layer (3DML) database from point layers with individually referenced 3D model files.

Figure 11: Make3DML

Timespan

Timespans restrict the visibility of data to a specific period of time. Timespans are usually used for data sets that appear in multiple locations (e.g., placemarks moving along a path). The data associated with a timespan is visible only when the time slider is showing the time interval defined in the timespan tag.

The timespan for an individual object, and likewise for a group can be set in its property sheet, when you want all objects in the group and all subgroup objects to have the same timespan. The Timespan Tool is

necessary when you want to evenly split a timespan, either between a group's subgroups or between all the objects in all of a group's subgroups.
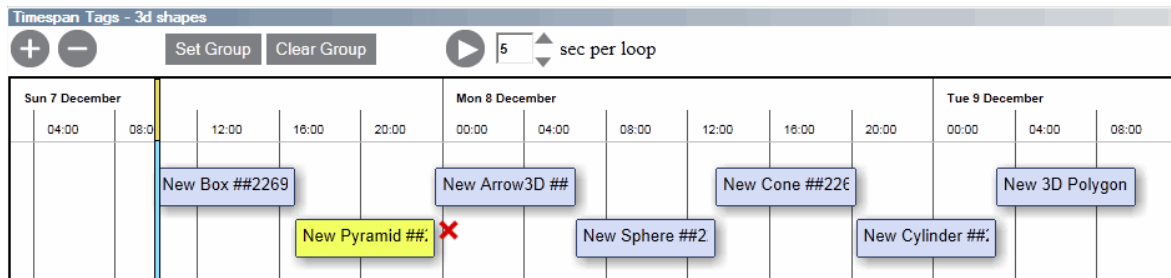

Figure 12: Timespan Timeline

Create Resolution Pyramid

TerraExplorer Pro requires a number of resolution levels per layer, also known as a Resolution Pyramid or a Multi-Resolution file, in order to display the layer in different altitudes. Without a resolution pyramid, the layer will not be displayed when attempting to zoom out from the original resolution level. If a layer source file does not include any or sufficient resolution levels, TerraExplorer can generate a resolution pyramid for such sources.

Block Width

The Block Width tool calculates an appropriate block width for streaming a layer efficiently. The selection of the Block Width for a layer is determined based on the maximum height at which you want the layer to be visible, as well as the required density and precision level of the data.

TERRAEXPLORER PRO EXTENSIONS

TerraDeveloper Extension

The Skyline TerraDeveloper software development kit is a set of ActiveX controls that provide full customization of TerraExplorer Pro applications. Utilizing the TerraExplorer Pro environment, developers can build their own applications in 3D by integrating many of the TerraExplorer Pro capabilities into any application or HTML page.

TerraDeveloper enables the addition of powerful 3D geospatial interfaces to any application for Windows-based systems, (including desktops, laptops, wireless and land lines) solutions.

C2MP Extension

A set of Command & Control and Mission Planning features for Military and Defense users. The C2MP extension can be added to TerraExplorer Pro or TerraExplorer viewer. The extension includes the following tools:

- **MultiTracking** (Cursor-on-Target, Predator, Blue Force Tracking): Extensions to the core MultiTracking interface to support Cursor-on-Target, Predator, and Blue Force Tracking protocols. Allows user to identify choice of representation per-feed, and combine multiple tracking feeds into one full common operational picture.

- **FalconView Interface**: Provide links between FalconView UI and TerraExplorer, including synchronizing display across GUIs and importing of common FalconView types such as Threats and Local Points.

- **MilStd2525B Annotator**: Gives the user the ability to annotate the terrain with many common MilStd2525B symbols.

- **ACO Import**: Gives TerraExplorer the ability to import most Air Combat Order (ACO) features directly, to allow users to interpret objects in a full 3-dimensional view.

- **GRG Creation**: Tool to initiate the creation of official Gridded Reference Graphics (GRG) using TerraExplorer. Assist in outlining the grid with varying distance (meters or feet) offsets, labeling objects, and preparing the view for a snapshot, ready for printing or further annotation as needed.

- **Coordinate Marker**: Tool for interrogating and annotating the terrain. Assist in simplifying MGRS coordinate usage for military users, as well as provides very quick and intuitive coordinate drop capability for locations.

Note: C2MP extension is subject to export restrictions

SYSTEM REQUIREMENTS

Operating System	Windows[®] 7/ 8 /10 – 64 bit recommended.
Browser	Microsoft Internet Explorer 7 or higher.
Processor	Dual-Core (4 or 8 cores recommended).
Memory (RAM)	2GB of RAM (4 GB or more recommended).
Video Card	512MB of video memory (1024 MB or more recommended). Pixel and vertex shader v3.0.
Internet Connection	Broadband connection (recommended).