Skyline it's your world™

TerraExplorer® Pro

Version 5.1.2

Datasheet

www.SkylineGlobe.com

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Overview

TerraExplorer Pro is a powerful, easy-to-use tool for editing, analyzing, annotating and publishing photo-realistic interactive 3D environments. TerraExplorer Pro shapes its own digital world. It can edit and annotate geo-referenced 3D terrain databases created through TerraBuilder. This serves to customize an experience highlighting specific geographic content. TerraExplorer Pro overlays unique or proprietary information onto a 3D map making it an exciting, interactive application. It can highlight 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 imports 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
- Supports autopilot feature - creates pre-defined routes for playback with TerraExplorer
- Controls speed, altitude and viewing angle using any combination of the mouse, keyboard, and Flight Control Panel
- Creates movies, as AVI or a set of frame files, 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
- Has a publishing tool that exports scenes to Internet/Intranet users
- Provides improved level of security for local and remote users
- Includes ActiveX Controls to export the 3D view, information tree, and side map windows as ActiveX controls

Layers

TerraExplorer Pro features the following layer types:

Feature Layer

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 an imported feature layer with a set of attributes containing object level data, advanced layer information can be displayed in the 3D Window.

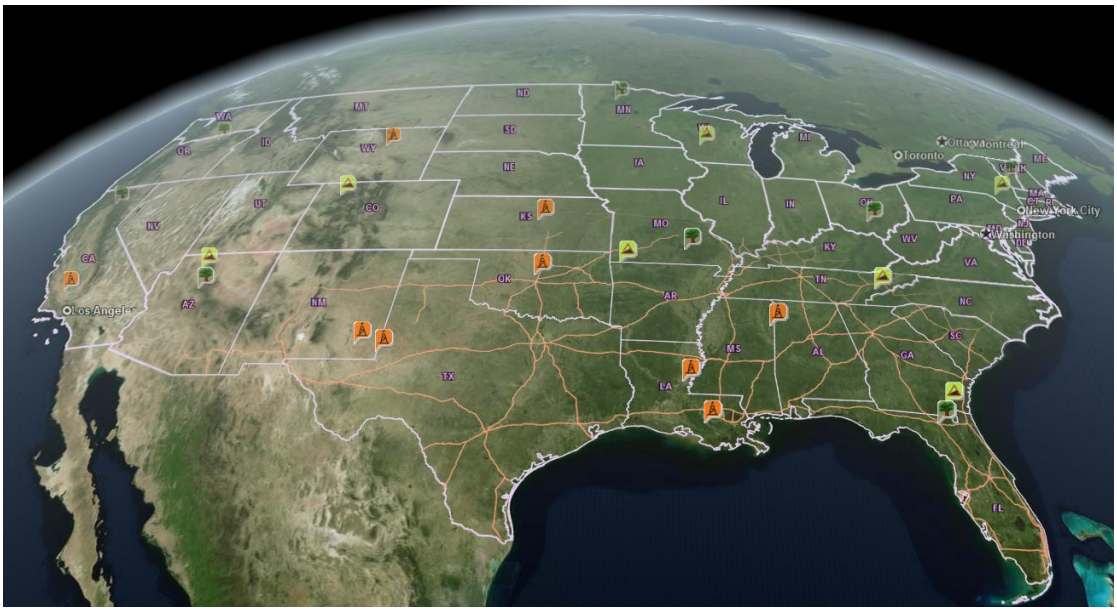

Figure 1: Feature Layers

Layers from the following feature files can be loaded:

- TerraExplorer Project: .fly
- Google Earth: .kml .kmz

- ESRI Shape: .shp
- ESRI Personal Geodatabase - .mdb
- Microsoft Access: .mdb, .accdb
- Excel: .xls
- Text: free format
- AutoCAD DXF: .dxf
- OpenFlight Reference

Feature layers from the following servers can be loaded:

- Web Feature Server (WFS)
- Skyline Feature Server (SFS)
- ESRI ArcSDE Server
- Oracle Spatial Server
- Oracle Database
- SQL Database
- ODBC Database

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

- ESRI Shape: .shp
- TerraExplorer FLY Projects: .fly

Imagery Layer

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.

Imagery Layers from the following files can be loaded:

- Skyline Image MPU (.Ii.mpu)
- MrSid (.sid)
- ER-Mapper (.ecw ,.jp2, .j2k)
- Erdas Imagine (.img)
- Image files (.bmp, .Tiff, .iTiff, .gif, .Jpeg, .Jpeg200)
- NGA formats (.CIB, .CADRG, .ADRG, .Nitf)
- Tile Text file (.tlt)

- Intergraph MFM raster (.MFM)
- Local Skyline terrain database (.MPT)

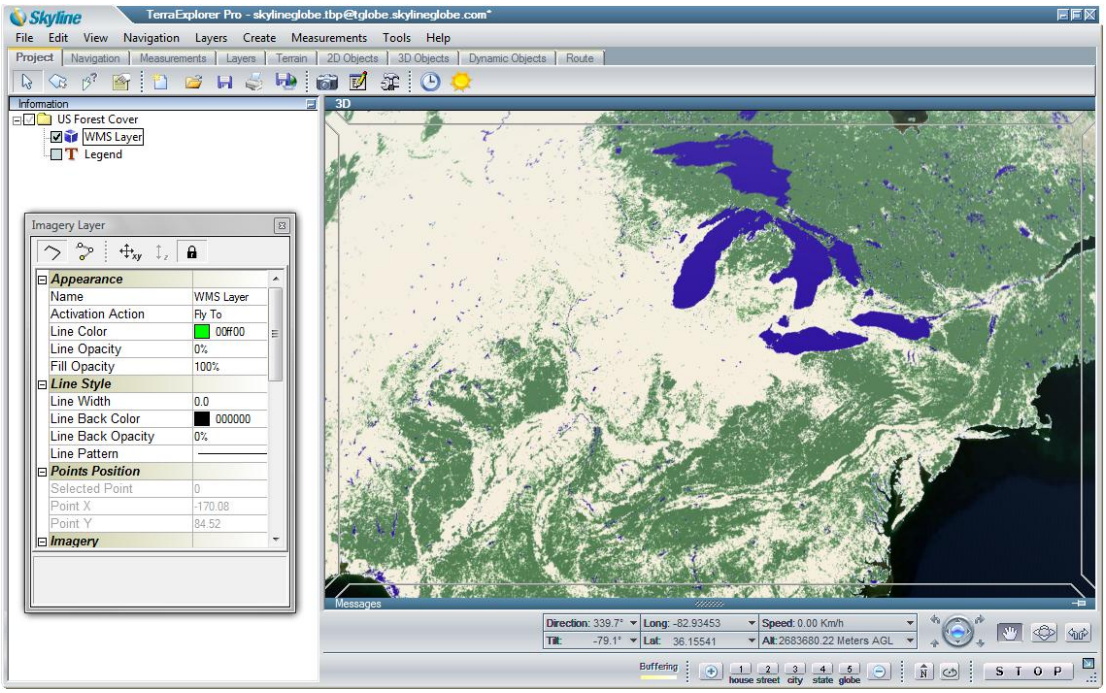

Figure 2: Cloud Coverage Layer from WMS Server

Imagery Layers from the following servers can be loaded:

- Skyline TerraGate Server
- ER-Mapper IWS Server
- Web Map Server (WMS)
- Oracle Image SDO_Raster
- ArcSDE Server

Elevation Layer

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:

- Skyline Image MPU (Ii.mpu)
- Window Bitmap (BMP)
- Dted (DT?)
- USGS ASCII Dem (DEM)
- USGS SDTS Dem (DDT)
- Arc/Info Binary Grid (ADF)
- Erdas Imagine (IMG)
- NGA DTED (DMED)
- Tiff Format (TIF)
- Projection Text File (PRJ)
- Intergraph MFM Raster (MFM)
- Local MPT (MPT)

Elevation Layers from the following servers can be loaded:

- Skyline TerraGate Server
- ER-Mapper IWS Server
- Web Map Server (WMS)
- Oracle Elevation SDO_Raster
- ArcSDE Server

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' parameter 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 Information Window's tree structure.

Import 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. The internal XPL file format provides better performance for Direct X models. TerraExplorer displays the best LOD file based on the viewer position in relation to the object. As a result, the model overall display performance and download rate are improved.

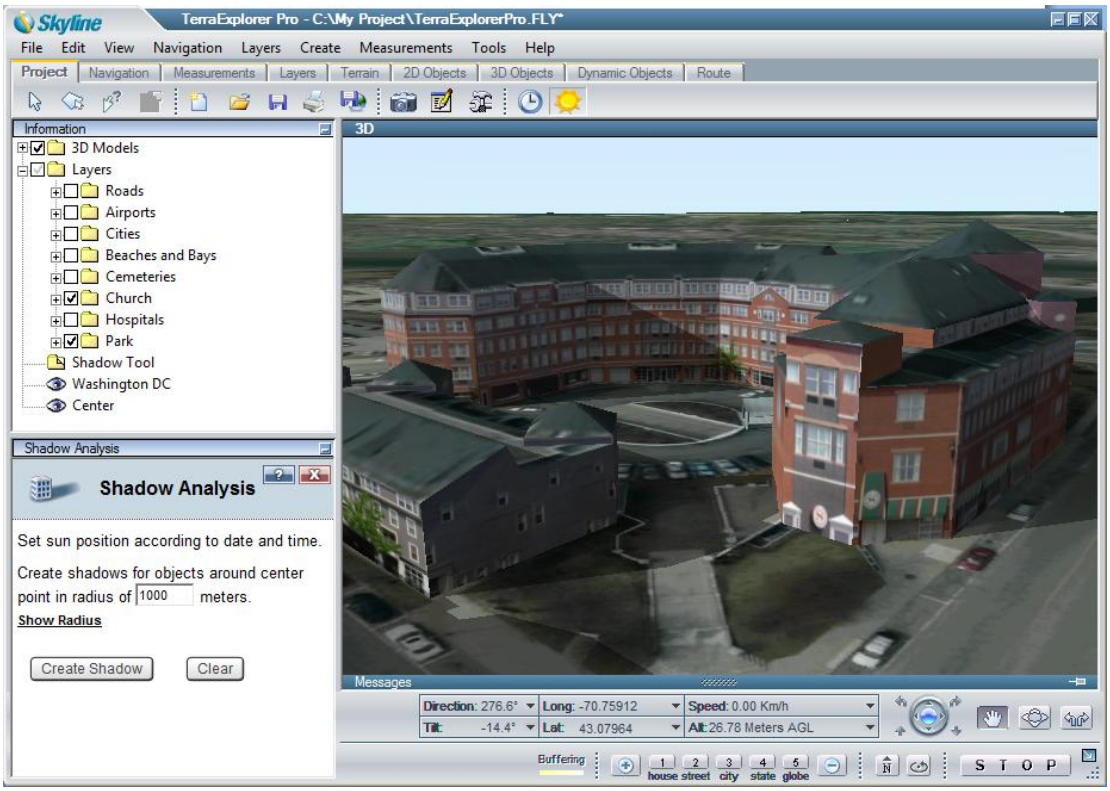

Figure 3: Importing 3D Model Files into TerraExplorer Pro

Supported 3D model formats:

- Microsoft Direct X (.x, .xpc)
- Skyline Multi-Resolution Model (.xpl)
- Open Flights (.flt, .fpc)
- Google Sketchup (.dae , .kmz)

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 the user can add to the project by setting the route of a ground or air vehicle by manually placing way points in the 3D View, or by importing routes from external sources.

There are three 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.
- **Load Dynamic Route**: A Dynamic Route can be created by loading an ASCII file containing a free-format text description of the route's waypoints.

Terrain Objects

A set of objects that affect the terrain model. The user can modify the terrain, create holes in the terrain and play a video file onto the terrain.

- **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 4: 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

Plays a video file onto any selected area of the terrain. A telemetry file can also be used to move the projected video based on recorded readings. 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.

You can use a telemetry file to hold positioning information for the camera based on time stamps. The information is used to automatically determine the position of the video projector in the 3D window. It allows the projected Video on Terrain to be draped over the same area that is captured in the video.

Figure 5: Display Live Video on Terrain

Import 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 import Point Cloud feature supports Skyline's proprietary Point Cloud files (CPT).

The Import 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.

Measurement and Analysis

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

Measurement Tools

- **Information Query Tool**: Displays the exact location and elevation of any point in the 3D World, and additional information about objects.
- **Horizontal Distance Tool**: Displays the horizontal distance, elevation difference and slope angle between two or more points in the 3D View.
- **Aerial Distance Tool**: Displays the aerial distance, elevation difference and slope angle between two or more points in the 3D View.

- **Vertical Difference Tool**: Displays the elevation difference between two points in the 3D View.
- **Area Tool**: Displays the measurement of the horizontal projection of an area in the 3D View.

Terrain Analysis Tools

- **Contour Map Tool**: Displays a colorized terrain map and contour lines on a rectangular area, or the entire terrain.
- **Terrain Profile Tool**: Displays the terrain elevation profile along a path.
- **Best Path Tool**: Displays the best path between two locations on the terrain with slope limits.
- **Line of Sight Analysis Tool**: Displays a visual marker for the existence of a line of sight between two points.
- **Viewshed Analysis Tool**: Marks all the visible segments, within a field of view, from a given viewing point.
- **Threat Dome Tool**: Displays the visible volume from a given point on the terrain with a specified scan field and elevation angle.

Figure 6: Contour Maps

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 Visual Basic).

The Skyline Globe API (**SGAPI**) describes the classes and objects required to use TerraExplorer API in JavaScript. SGAPI can be used to build a Skyline Globe tool, develop a Skyline Globe client application or develop scripted HTML pages for TerraExplorer.

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:

- The 3D Window
- The Project Information Windows
- The Navigation Map Window

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

Advanced Functionality

Terrain Opacity

You can set the opacity of the terrain in the 3D View. The opacity is defined as a percentage, where 100% is opaque and 0% is transparent. When the opacity is other than 100% (opaque) objects that are submerged in the terrain become visible through it.

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.

Atmospheric Effects

The Atmospheric Effects sets the appearance of the atmosphere in the 3D Window. You can control the horizon distance, fog color, as well as the sun and moon display. The sun, moon and sun flare objects can be displayed and positioned based on a given date, time and time zone. The sun is used as the light source for the project according to its position. The sunlight affects the lighting on the terrain and on building objects.

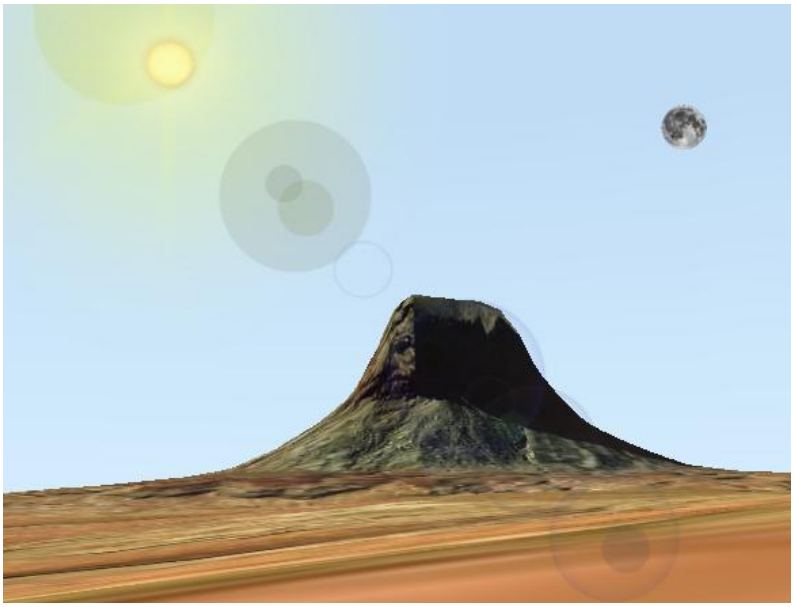

Figure 7: Sun Light Source

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.

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.

Shadow Analysis

The Shadow Analysis tool calculates the shadow cast from buildings and 3D objects in a given radius based on the sun's position. The sun is positioned according to the time, date and time zone you set using the Date and Time controls. The shadows dynamically update when the system date and time is changed.

Figure 8: Shadow Analysis of the Golden Gate Bridge

Collaboration

Allows the user to lead, follow, and share in real-time, interactive TerraExplorer fly-through sessions, chat with other users, mark up areas on the terrain, and toggle information layers for further analysis. This 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, 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

Extract Terrain to MPT: Extracts terrain (MPT) from remote or local sources, as a subset of the terrain source that is accessed to be clipped and saved for distribution on CD/DVD. The Extract Terrain tool cuts and downloads a subset of a local or remote MPT database to the local machine. It can create a CD/DVD size terrain databases for distribution or even create a local MPT from a DirectConnect project.

Extract Terrain to VRML: Creates a VRML model from a local or remote MPT database to the local machine. Using the Extract Terrain tool, the user can create a VRML model for display in VRML viewers, 3D printing etc.

The extracted terrain includes the elevation and imagery information from the terrain database, and buildings created by TerraExplorer Pro.

Extract Terrain to Zebra: Creates a Zebra Imaging model from a local or remote MPT database to your local machine. Using the Extract Terrain to Zebra tool, you can create a Zebra model for producing 3D hologram images. For more information on Zebra Imaging, see: http://www.zebraimaging.com/.

GPS Tracking

Tracks real-time objects that use the NMEA standard. 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.

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

Find Objects

Searches for objects in the project according to the search criteria The Find Objects tool searches for objects in the sub-set or the entire project according to the search criteria. The tool searches for a text string or part of it in the description, Text label, Tool tip, Object Type and the attribute data fields. After getting the search result list, the objects can be displayed, edited, hidden from 3D View, deleted from the project, or moved to a new group in the Information Window.

Duplicate Objects

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.

Draw

Creates simple and/or customized objects including markers, free hand lines, **Mil-Std-2525b** symbols, and urban design elements. The set of tools in the Standard tab is designed for presentations and white board applications. The set of tools in the Urban Design tab is designed to build roads, junctions and traffic lights in an urban setting. The tools allow you to draw freestyle lines by tracking the mouse pointer movements, to create dashed and thick lines, to simply and quickly add notes, and to point to locations on the terrain using the virtual cursor.

Figure 9: Urban Simulation tool

Build Power Line

This tool creates a power line by placing power poles along a user-defined path and connects them with power lines. The Build Power Line tool allows the user to define a pole at every waypoint and add a pole, fix distance between poles, select a pole type and define other pole parameters to create power lines.

Navigation Aid

Displays the Navigation Aid window for Navigation mode and target locator settings. The Navigation Aid tool locks the TerraExplorer camera in 2D mode and continuously tracks the distance and direction to a specific target.

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.

Data Library

Set of Graphic elements you can add to your project The Data Library is a set of 3D objects, 2D icons, textures and frames that you can use in your project. TerraExplorer Pro presents the data library objects in a set of HTML pages. The Data Library tool displays 2D and 3D objects and adds them directly to the project.

Sextant

ObjectRaku's Sextant Editor and Viewer integrated into TerraExplorer Displays the Sextant viewing and editing window inside of a TerraExplorer container. Displays Sextant models in the 3D World.

FalconView Interface

A Command & Control and Mission Planning tool for Military and Defense users.

Blue Force Tracking

A Command & Control and Mission Planning tool for Military and Defense users.

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:

- Falcon View Integration
- Blue Force Tracking Tool
- Mil-Std-2525 Symbols Creator
- Predator UAV Video Interface

C2MP extension for TerraExplorer viewer also adds the following TerraExplorer Pro tools:

- Draw Tool
- Collaboration Tool

System Requirements

Operating System - Windows 98/2000/Me/XP/Vista

System Memory - 512MB RAM (1024MB or more recommended)

Video Card - 64MB of memory (128MB or more recommended)

Internet Connection - Broadband connection (recommended).

Browser - Microsoft Internet Explorer 6 or higher should be installed on machine.

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