

TerraFly

A TOOL FOR VISUALIZING AND DISPENSING GEOSPATIAL DATA

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TerraFly is a geospatial database research project at Florida International University, with applications to industries ranging from real estate and urban planning to emergency preparedness and disaster mitigation. An interactive software tool for visualization of remotely sensed and spatial data, TerraFly allows users to experience virtual “flight” over imagery or maps by streaming incremental imagery tiles to a Java applet.

Presently, TerraFly delivers high-resolution imagery of the entire United States and selected cities and regions elsewhere on the globe, with increased international coverage coming soon. It manages its content via database and file system technologies developed by the High Performance Database Research Center and the NASA Regional Applications Center at Florida International University in Miami, Fla.

Virtual flight can be performed at various speeds, in all compass directions, and at various altitudes (spatial resolutions). Non-obstructing overlays are supported over the imagery including NAVTEQ NAVSTREETS Street data, property parcels, zip code contours, Geographic Names Information System (GNIS) objects, hotels, real estate listings, fire instances, and other data that have associated geographic coordinates. TerraFly’s data-mining tools deliver an extensive amount of data related to user-specified geographical locations.

All the data services are provided via an Internet-based Java applet, giving TerraFly a much broader user base than conventional geographic information systems. The above-mentioned functionality suits the information needs of public users related to local geography, demography, quality of life, economics, and the environment.

However, TerraFly can also be customized for specific applications. Professionals, researchers and educators are among the groups that use customized TerraFly for their work. Among typical customization requests are:

- » support for a relatively small geographic area with recently acquired high-resolution proprietary imagery (for example, to assist water management in the area);
- » temporal imagery support: the same geographic

area over a period of time (urban construction and infrastructure development);

- » non-obstructing custom data overlays (real estate, environmental studies, education);
- » extra security and restricted access to sensitive imagery and datasets (homeland security, disaster management and mitigation).

The cornerstones of the software are its portability, its fly-over technology, and its ability to integrate multiple sets of data into customizable, multi-layered products.

Fast and convenient access to a map or a remotely sensed image is achieved by the dispenser subsystem, providing an easy and intuitive way for users to choose, mark and dispense satellite images or aerial photos of any size. TerraFly’s dispenser can also provide the user with textual geo-referenced data associated with a dispensed image. When combined with the requested imagery, this data gives the user a unique information package associated with the geographical area of interest. See **Figure 1**. This is important in many applications, including emergency preparedness and response.

TERRAFLY’S DISPENSER:

- » searches TerraFly’s imagery database for all image tiles which can be used to generate the imagery for the user-defined area;
- » searches the Space Imaging Carterra Archive for availability of IKONOS imagery over the selected area;
- » searches TerraFly’s information databases for all the possible data reports related to the area of choice;
- » generates the web page to present users with all the unique product options available for the dispensed area.

Among the TerraFly products and services are: aerial photography and satellite imagery (prints and digital files), posters, TerraAtlases, demographic reports, and autopilot flights.

TerraAtlas presents digital satellite imagery and aerial photos in a brochure format optimized for printing on standard letter-size paper or other user-defined paper formats. It can be downloaded by the user in a PDF format. As an option, street names and other data can be overlaid on the imagery. When additional data overlays are requested, an index is produced. The resulting TerraAtlas looks like a typical map-based street-finder atlas consisting of a background of imagery and a customized index. See **Figure 2**.

Preparing for emergencies, and planning and documenting evacuation routes are valuable applications of TerraAtlas, as is teaching the public about these routes, facilities and emergency services. The printed document

helps emergency response teams in the field, where a wireless connection to data servers is unavailable or where a shortage of electric power does not allow using computers.

TerraFly's autopilot technology supports the automation of features otherwise run by a user in manual mode. These features can be scripted to show automatically a pre-defined flight sequence that allows the user to experience TerraFly's multimedia capabilities without direct interaction. The applications for autopilot are numerous in the field of e-education, including environmental education, training for emergency preparedness in urban areas, and the study of crops in rural areas via the Internet.

Several user-specific applications have been created with TerraFly. One of these allows the software to be used as a flight planning service. Pilots can prepare future flight plans from any computer that has Internet access. TerraFly also has a set of unique features that will enrich the functionality and visualization capabilities of the flight planning process and computer training for future pilots.

Another application of this tool benefits realtors. Our application automatically downloads real estate listings from a Multiple Listing Service and places overlays onto the TerraFly imagery depicting such variables as property types, prices and square footage. Users can click on properties to get additional information via TerraFly's data mining tools. This application allows realtors to take their clients on virtual tours of neighborhoods.

TerraFly attempts to meet the challenge of making geospatial imagery and information available to consumers in an intuitive and useful manner by utilizing the latest Web and database technologies. It has received notice from the journals *Science* and *Nature*, and accolades from a variety of sources, including the Yahoo! Top Pick of the Week and *USA Today* newspaper's Weekly Tech Pick.

As databases of Earth information continue to grow, TerraFly will demonstrate the crucial role that research advances in database technologies can play in bringing high-quality, remotely sensed data directly to end users around the globe. ❖

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FIGURE 1: TerraFly shows IKONOS imagery over Havana, Cuba with place and street name overlays.



FIGURE 2: TerraAtlas page shows USGS Urban Areas Aerial Photography over Atlanta with street names and U.S. Census city block population layers.



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