# TerraFly: A Web-enabled Application for Visualization and Manipulation of Remotely Sensed Data


## Abstract

*Spatial data is an important resource with a wide range of applications in the environmental, commercial and educational fields. However, effectively dealing with such data often becomes a difficult and time consuming process requiring the availability and usage of specialized software packages. As spatial data becomes more widely available, an increased demand for efficient systems that facilitate the access to and manipulation of such data is observed. We present a Web-enabled tool that allows the efficient visualization and manipulation of spatial data. Accessed via a Web browser and independent of a user's level of expertise, this system allows the integration of remotely sensed data, such as aerial photography and satellite imagery, with digital data while a user is seamlessly flying over such data.*


## Introduction

The availability and use of remotely sensed data has steadily increased since the first commercial imaging satellite was launched several years ago. The amount and varied types of information that can be extracted from remotely sensed data is vast, offering numerous applications to industries in all fields. However, an inherent problem with this is the complexity often involved with the manipulation and extraction of this data.

The spatial data sets available come from varied sources and in many different formats. Data sets available in different formats often require separate specialized geographic systems to view, extract and manipulate. The time, expense and level of difficulty introduced by such applications restrict an average user's access to the data.

In order to allow access to this growing collection of visual information, we have created TerraFly. This system offers a simpler and more convenient method to access spatial data. TerraFly's graphical user interface and portability make remotely sensed data available to the average and expert user. This paper will describe TerraFly and some of the features currently available in this system.

## TerraFly

TerraFly is an interactive fly-over vehicle designed to aid in the visualization of remotely sensed and spatial data via the Internet. TerraFly applies Sem-ODB technology, developed by the High Performance Database Research Center (HPDRC), as well as commercial database technologies for the storage and retrieval of data used by the system, allowing its users to fly over and manipulate the retrieved data. The database used by TerraFly currently contains textual, remotely sensed and graphical data (graphical maps), which can be viewed and manipulated using any standard browser. Textual data is available for the description and location of specific areas of interest. Graphical maps aid in the visualization of remotely sensed data. Internet capability allows the system to access numerous data sets without the installation of any specialized GIS programs. A friendly graphical user interface is provided for ease of use.

Data currently available through TerraFly includes land, urban, and coastal imagery collected by satellites, aerial photography, and other remote sensing means. Remotely sensed data is integrated with digital data. Hence, as users fly over remotely sensed data, associated digital data such as nearest place, place type and/or populated-area/county subdivision may be displayed. This capability is further expanded through the creation of on-the-fly graphical overlays and distance calculations also available through TerraFly.

## System Features

A broad range of features further expands TerraFly's data manipulation capabilities. Shown on the following page are some of the system options and features currently available.

- Internet capability through the use of any Web browser: TerraFly is a portable application that allows user access to spatial data as long as an Internet connection is available.
- Smooth Flight over spatial data: Streaming incremental tiles to a Java applet allows users to “fly” over available data.
- Multiple Data Types & Multiple Flight Windows: Allow users to launch multiple frames with different data types and/or resolutions.
- Synchronized flight: Multiple frames allow users to “fly” in sync over different data sets.
- Compass Control: Allows 360 degree control of flight direction and speed. This feature is also used to control data refresh rate.
- Geolocation ID: Geo-coordinates of center point of data are constantly calculated and displayed in a Flight Control window
- Go-To Coordinate, Place and Street Address Functions: Allows users to query the database for place names and their coordinates. This feature enables retrieval of information on specific points and areas.
- Sensor Band Controls: Used for multi-spectral data types. This feature provides the user with capability to manipulate the sensor band combinations of Landsat data to create false-color images. This provides greater flexibility and availability of information. TerraFly offers two approaches to sensor band control.
    - Pre-defined Three-Band Combinations: These are commonly used combinations that provide interesting data for basic users as well as shortcuts for users with a higher level of expertise.
    - Advanced Custom Three-Band Combinations: Allows expert users to choose any desired three-band combination they wish to analyze.
- Data Dispensing Capability: Used to define an area of interest and to retrieve/order data for that area. Once an area of interest is defined, a complete description of the area becomes available.
- Zoom In/ Zoom Out: Allows the user to view spatial data at varying resolutions.
- Information Overlay: Allows users to highlight specific features form the database and to overlay data from different sources.
- Image Processing Filters: Allow users to customize the display of data. Filters enhance the appearance of images.
- Configuration Lookup: Allows the user to customize a place search by broadening or narrowing down the range location types.
- Help Option: Provides online help and automatic access to user manuals.

## Conclusion

This system simplifies and facilitates the access, manipulation and analysis of remotely sensed and spatial data. It allows users to better use and integrate spatial data while providing an efficient and user-friendly interface. A useful tool for users with different levels of expertise, TerraFly provides an informative vehicle by which the average user can learn about available data, while still being detailed enough for scientists and experts. Finally, its numerous features and options make this system a valuable tool, which reduces the time, expense and difficulty often involved in dealing with more complex GIS software packages.