

Geographic Information System Applications

Outputs

- Propagation coverages for one or more transmitters draped over surfaces created by the program or imported by the user.
- Interference and overlap coverages of multiple transmitters.
- 2.5-D or full 3-D coverage predictions with interfaces to 3-D visualization tools.

ITS maintains a suite of Geographic Information System (GIS) based applications which are available to public and private agencies for propagation modeling and performance prediction studies. A GIS efficiently captures, stores, manipulates, analyzes, and displays all forms of geographically referenced information in a user-friendly and flexible manner. Databases for use in GIS systems are becoming more commonly available at affordable prices and include such data as terrain, satellite photo imagery, roads, communications infrastructure, building locations and footprints, land type and use, water bodies, streams, population densities and many others. These are maintained in commonly used relational database management systems (RDBMS) which can be connected to a GIS. The Institute has modified and distributed this tool to several groups with modifications tailored to a specific application. These groups include government agencies, private cellular companies, paging system providers, public and private television systems, private consultants and transportation companies such as the railroads of the United States.

One form of this GIS tool is called the Communication Systems Planning Tool (CSPT). CSPT is a menu-driven propagation model developed for applications at frequencies as high as 50 GHz. The accuracy of the results and the usefulness and flexibility of the presentation of the

results are enhanced by the power of the GIS background. CSPT allows the user to import digital stereo photographs or other remote sensing data which have been converted to 3-dimensional models of the region. This environment is then taken into consideration as the model calculates the results of the desired analysis. Contained within CSPT are propagation “engines” valid at frequency ranges used by cellular, personal communications services (PCS), radio, TV, pagers, microwave, and other communication links. New propagation models can easily be connected to the GIS with minimal effort, providing the user with greater flexibility and future growth.

A graphical description of CSPT is shown in Figure 1. The output shows an analysis area of Dupont Circle in Washington, DC, made from an imported digital elevation model and image at 1 meter resolution. The image shows the coverage of a transmitter placed in the center of Dupont Circle.

The general flow of CSPT is as follows. The user defines an area within which a study will be performed. This analysis area can be defined

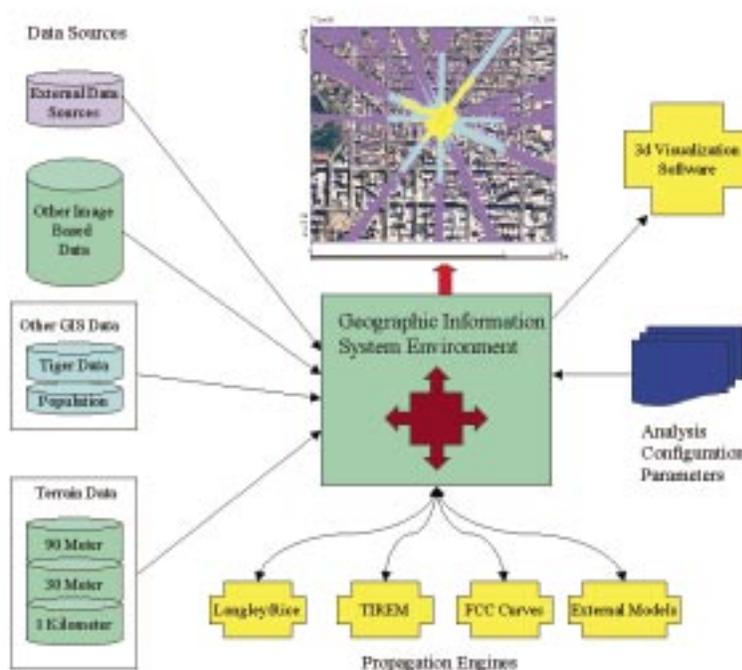


Figure 1. Overview of the CSPT model.

graphically by zooming into a map of the world or of the U.S. or by defining the latitude and longitude of the boundaries of the desired area. The user then imports desired GIS information such as political boundaries, roads, rivers, special imagery, or application specific GIS data. Then the user creates or imports transmitter, receiver, and antenna data. Lastly, the user selects the type of coverage and the propagation model to be used in the analysis.

The CSPT software can be configured to produce propagation predictions in 2.5-D or full 3-D. A 2.5-D prediction includes the calculation of signal strength at the surface of the analysis area but not above the surface. A full 3-D propagation prediction includes all of the space from the surface to a user specified altitude. This data can then be exported from CSPT into one of two additional tools that permit the user to view the combined imagery and propagation prediction. The first tool, shown in Figure 2, allows the user to fly into the 2.5-D analysis area and view not only the terrain and buildings but also the propagation prediction draped over the image. The second tool, shown in Figure 3, allows the user to fully manipulate the area of interest and the 3-D propagation cloud. This tool is useful only in relatively small regions since the amount of data is extremely high, but it allows for the most visually appealing and accurate results possible.

CSPT is available on a UNIX or Windows® NT platform. CSPT contains an extensive help system: most menus have a “help” button which displays an explanation of the options on that menu. A user’s manual is available. We suggest that users have an account with ITS on our TA Services computer so that we may provide phone support.

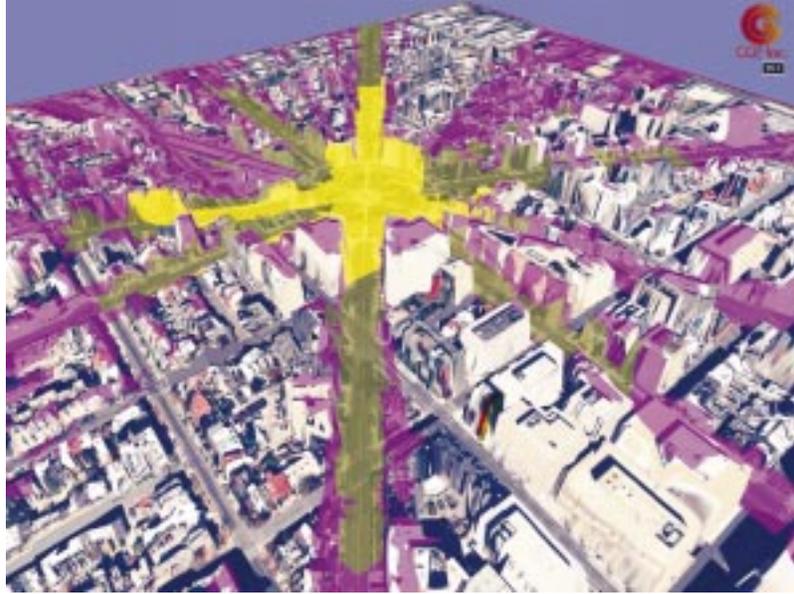


Figure 2. CSPT fly-through analysis showing Dupont Circle in 2.5-D.

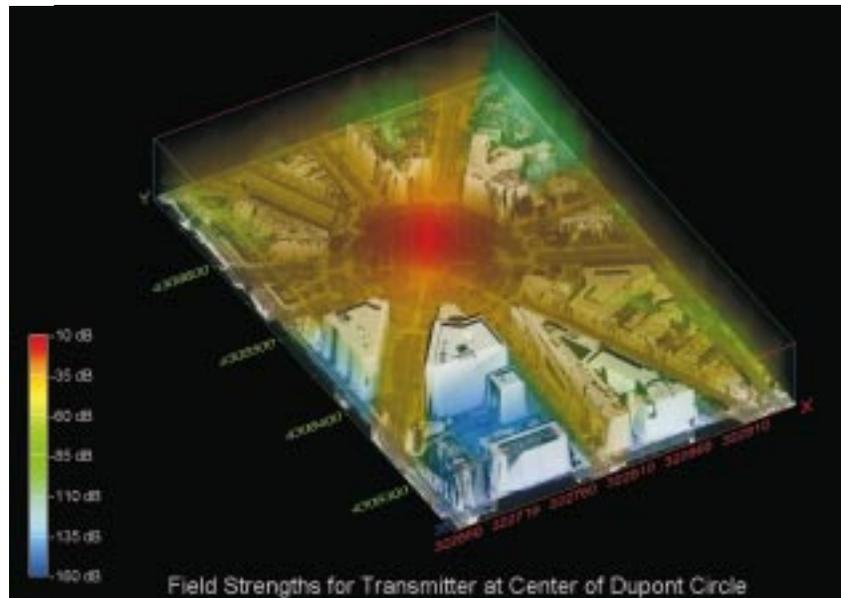


Figure 3. Same area of coverage shown in Figure 2, in full 3-D.

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