



# KENTUCKY GIS NEWS

*The Newsletter of Geographic Information Systems in the College of Agriculture at the University of Kentucky*

Summer

1999

## Getting a Different View of the World: Using Aerial Photography and Satellite Data in a GIS

A map represents a graphic representation of a specific feature observed in the world around us. For example, a map of roads shows only roads in a delineated area. The data used to generate the map can come from a variety of sources, such as surveyors' records or a global positioning system (GPS). In many cases, the maps are derived from aerial photographs. Soon, we will see maps compiled from data acquired by satellites that produce images at a level of quality near that of aerial photographs!

Maps used in a GIS are often converted from a paper version to a digital data base through the use of a *digitizing table* or a *scanner*. However, digital versions of aerial photographs are beginning to be used much more frequently in the development of maps for several reasons. First, digital aerial photographs, are scanned from paper photographs and then *georeferenced* (geographic coordinates are embedded in the scanned photograph and allow the digital data set to be used in a GIS). Second, a map created in a GIS, using a georeferenced aerial photograph as a background, will be georeferenced automatically. Third, a user can define his/her criteria for a map, such as a map of houses with garages or areas of clear-cut forest, from aerial photographs. And fourth, new digital imaging technology has been developed to replace the conventional analog aerial photograph used for over 75 years. The new digital images will be less expensive and delivered to the user in less time than aerial photographs.

While many aerial photography contractors can provide georeferenced digital aerial photographs for specific geographic areas, the cost of obtaining these images can be relatively expensive if one has limited financial resources at hand. However, state governments are working with the U.S. Geological Survey to develop black and white digital images that are affordable for most budgets and, in many cases, available free of charge. *Digital Orthophoto Quadrangles*, or *DOQs*, are derived from either black and white or color-infrared



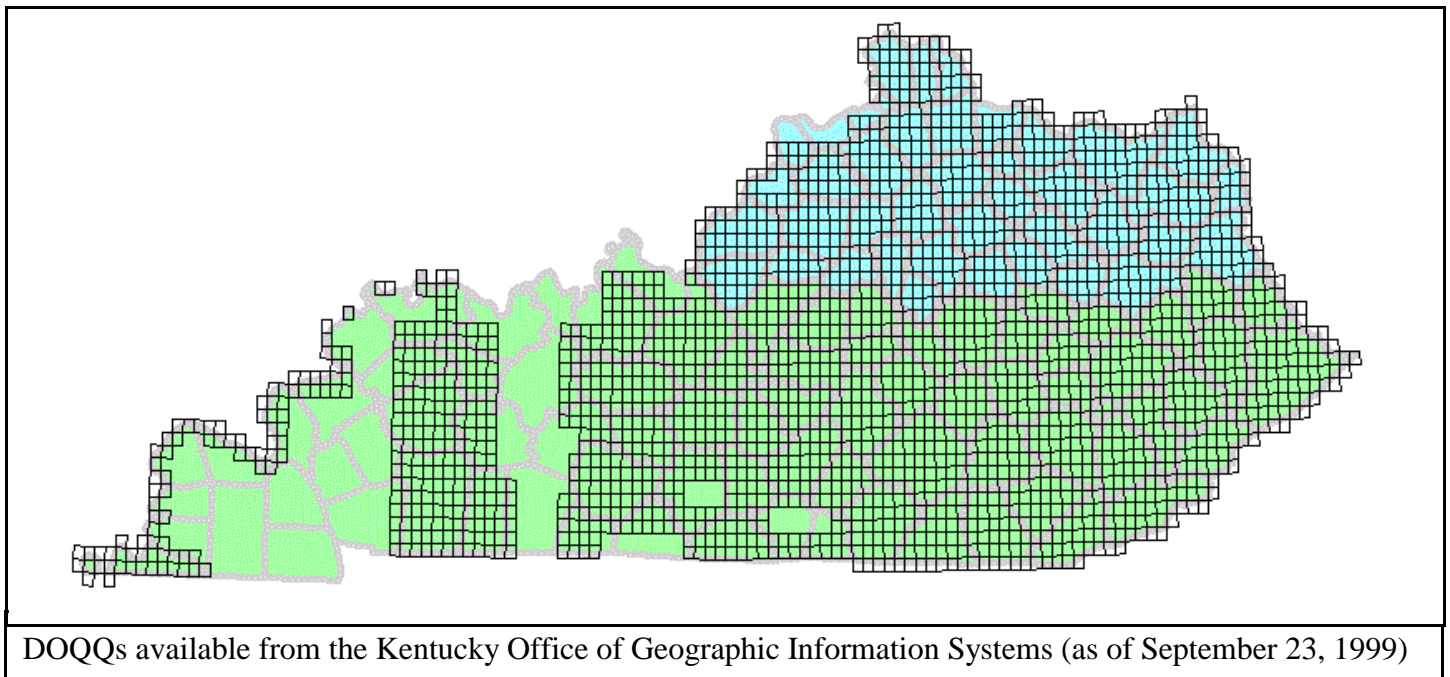
Digital Orthophoto Quadrangle (DOQ) of the University of Kentucky Football Stadium

aerial photographs. The photographs are rigorously calibrated and adjusted for variations in terrain topography before the final digital image is ready for distribution. The detail made available on the final digital image permits objects as small as automobiles to be viewed. The area of a DOQ encompasses the same geographic cover as a U.S. Geological Survey 1:24,000 topographic map. Since DOQs are large data files (about 200 megabytes in size), the digital images are divided into four parts and are often called "Digital Orthophoto Quarter Quadrangles (DOQQs)."

DOQs are available for Kentucky over the Internet from two sources. The Kentucky Natural Resources and Environmental Protection Cabinet provides DOQs at <http://www.nr.state.ky.us/nrepc/ois/gis/>. In order to assist users who rely upon telephone modems to communicate with the Internet, each quarter quadrangle is broken down into 4 separate images, resulting in 16 images per 1:24,000 topographic map. The files are in *TIF* graphic format and are compatible with many GIS software packages.

Another source of Kentucky DOQs is the Kentucky Office of Geographic Information Systems at <http://www.state.ky.us/agencies/finance/depts/ogis/gisdept.htm>. The inventory at this site was more complete than the data maintained at the Kentucky Natural Resources and Environmental Protection Cabinet at the time this newsletter was published. However, the file formats available for download over the Internet are in "MrSID" format, a proprietary compressed data format that requires special software. MrSID data format offers tremendous data compression with minimal loss in data quality. For example, a DOQQ in TIF graphic format requiring 42.7 megabytes of disk storage can be compressed to 2.2 megabytes. While not all GIS software can read MrSID-formatted data files, a free MrSID data viewer can be obtained over the Internet at <http://www.lizardtech.com>. This data viewer also has the capability to convert the MrSID-formatted files into the TIF format. DOQQs from the Kentucky Office of Geographic Information Systems may also be purchased on CD-ROM disks in either MrSID or TIF format.

Below is a status map (as of September 23, 1999) of the DOQQs available from the Kentucky Office of Geographic Information Systems.



Soon, the entire state of Kentucky will have complete coverage by DOQs. However, as with any data base, the data is outdated as soon as it is compiled. This may not have a significant impact on areas where little change occurs over a few years, but it can be of significant importance in communities experiencing rapid growth and other relatively dynamic areas. To obtain updated DOQs for specific areas may require individual communities to contract the services of an aerial photography firm. However, an alternative to aerial photographs may be available from a "higher" source: high resolution image data from the new IKONOS

satellite.

On September 24, 1999, the IKONOS satellite was launched from Vandenberg Air Force Base in California. The world's first commercial high resolution, imaging satellite will soon deliver images of the quality once restricted to "spy" satellites. Investors in Space Imaging's IKONOS system include Lockheed Martin Corp., Raytheon Company, Mitsubishi Corporation, Singapore's Van Der Horst Ltd., Korea's Hyundai Space & Aircraft, Europe's Remote Sensing Affiliates, Swedish Space Corporation and Thailand's Loxley Public Company Ltd. Additional information on IKONOS, as well as other satellite data distributed by Space Imaging, Inc., can be found at

<http://www.spaceimage.com>.

The IKONOS satellite has the capability of delivering the same 1-meter (approximately 3-foot) resolution image data currently obtained from DOQs prepared from black and white aerial photographs. Individual people cannot be observed from this satellite. Each image acquired by IKONOS covers approximately an area 8 miles square. Orbiting at 423 miles above the surface of the earth, IKONOS has the capability to acquire data over the same geographic area every 3 days. This means that activities that require frequent monitoring, such as floods, can be observed from space every 72 hours! The IKONOS satellite also contains sensors that provide 4-meter ground resolution images in color. These sensors will be of benefit for the management of natural resources and agriculture.

Like DOQs, IKONOS image data will be georeferenced and ready to use in a GIS. Unlike a conventional DOQ, though, the images acquired from the IKONOS satellite are electronic (not paper as with aerial photographs), require less processing, and can be delivered to the end-user quickly. Unlike conventional DOQs developed through state and/or federal government agencies, IKONOS data will be *proprietary*, meaning that no copies of the digital data sets may be made.

At this time Space Imaging, Inc., has not issued information on how much the data will cost. However, a potential user of DOQs will need to critically evaluate the cost of generating a DOQ from conventional aerial photography and that of obtaining high-resolution image data from satellites such as IKONOS. In response to an increasing interest in high-resolution images from satellites and due to the cost of processing aerial photography film, many aerial photography providers are switching over to digital aerial cameras. A digital aerial camera is similar to the sensors used in satellites such as IKONOS. No film, no film processing and quick turn-around are some of the advantages to digital aerial cameras. In addition, it is possible to look at the images acquired in the aircraft immediately, saving costs on additional flights if images need to be taken again.

An advantage of the digital aerial cameras over IKONOS image data will be in controlling the time of data acquisition. IKONOS is designed to pass over an area at 10:30am. Should cloud cover be present on one pass, image data must be collected at the next opportunity. However, an aircraft has control over its flight schedule. In addition, some aerial images are obtained with low sun angles in order to use shadows to highlight subtle changes of the topography, such as geologic fault zones.

If you do not have access to a GIS, you can view DOQs (or satellite images) with free data viewers such as ESRI's ArcExplorer (<http://www.esri.com/software/arcexplorer/index.html>) or Intergraph's GeoMedia Viewer (<http://www.intergraph.com/geomedia/viewer/>). Get a new view of the world with aerial images!



The Jefferson Memorial (Washington, D.C.) as viewed from the IKONOS satellite on October 12, 1999

## UK GIS Day

November 19, 1999  
W.T. Young Library  
University of Kentucky

On November 19, the University of Kentucky will join others from around the world in the presentation of various activities relating to the use of geographic information systems (GIS). A full day of invited speakers, paper presentations and a poster session is open to students, staff and faculty on the University of Kentucky campus as well as to the general public. There is no registration fee. Below is a schedule of the day's events. Additional information on the events at the University of Kentucky as well as elsewhere around the world can be found at <http://snril.ca.uky.edu/ukgisday/ukgisday.html>.

- 8:45 - 9:00 Introductions
- 9:00 - 9:20 Official Welcomes from the University of Kentucky administration
- 9:20 - 10:15 Keynote Presentation by Professor Duane Marble, Ohio State University
- 10:15 - 10:45 Break
- 10:45 - 12:00 Poster Session
- 1:00 - 1:30 Government Perspectives of GIS
- 1:30 - 2:00 Industry Perspectives on GIS
- 2:10 - 3:30 Concurrent Paper Presentations
- 3:30 - 3:45 Break
- 3:45 - 5:00 Roundtable Discussion: The Future of GIScience Education at the University of Kentucky
- 5:00 - 6:00 Public Reception

*KENTUCKY GIS NEWS* is written for current users of geographic information systems (GIS) in Kentucky as well as those who are interested in becoming users. Articles will focus on GIS applications, sources of data, software, references, and individuals and organizations using GIS in Kentucky. *KENTUCKY GIS NEWS* will be published quarterly and free of charge to individuals and agencies residing in the Commonwealth of Kentucky. Back issues of *Kentucky GIS NEWS* may be obtained over the Internet in Adobe "PDF" format at the following address: <http://snril.ca.uky.edu/html/gis/kgn.htm>.

Comments from readers of this newsletter are encouraged. Suggestions for topics of future issues are also accepted. All correspondence should be sent to: *KENTUCKY GIS NEWS*, c/o Dr. Scott A. Samson, Editor, Rural Sociology Program, College of Agriculture, University of Kentucky, W.P. Garrigus Building, Room 713, Lexington, Kentucky 40546-0215, Telephone: (606) 257-3767, FAX: (606) 257-4354, E-mail: [ssamson@pop.uky.edu](mailto:ssamson@pop.uky.edu).

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