

## **GIS for PDC and Facilities Management Western Kentucky University**

WKU's Department of Planning Design & Construction (PDC) has developed a Geographic Information System (GIS) and Global Positioning System (GPS) for managing campus facility and infrastructure data, providing sources of infrastructure information for project managers and administrators. Initially the system will cover university owned facilities on main campus; future expansion will include all WKU campuses.

Like other university campuses, the demand for additional space and resources at WKU has increased through the years. The campus planners for the long range master plan have identified GIS as a valuable tool for display and analysis of geospatial data, and are working towards making it available for academic and administrative departments in the near future.

Maintenance of accurate digital facility geospatial data is essential not only for day-to-day work but also for life term data management. There is a need for a comprehensive, integrated, and up-to-date geo-database for all infrastructure, underground utilities, and facilities inventory. Capturing real world locations of these geographic features along with their attribute data is critical for our integrated system.

PDC is very happy to participate in this new effort, taking the initiative under the leadership of our director with immeasurable support from the university upper administration.

### **Goals and Objectives**

#### **To Create a Departmental GIS with possibility to expand to an University Enterprise GIS**

The immediate goal for PDC is to develop and maintain a mapping system for managing facilities and infrastructure on WKU campus and make this information accessible to project managers and administrators.

Provide guidance, expertise, and oversight data production and acquisition such as ground control points, new orthophotography, basic layers, and others. Request for Proposals (RFP) were issued to consultants to produce high resolution color orthophotography and high accuracy horizontal and vertical control.

Coordinate Data conversion from PDC archives. Use CAD and other resources as well as GPS data collection to produce the most accurate information for the system. Data conversion and GPS field verification are being conducted in house by PDC staff.

Having all geospatial data current, accurate, and complete is the key of success of our GIS system. PDC staff will maintain the GIS data. The decision to house the GIS maintenance at PDC is based on staff expertise within the office on archives, documentation, and technical knowledge on this type of technology and reduced recurring maintenance costs in the years to come.

**To promote GIS use and GIS end-users within PDC and FM**

Develop in-house training to perform GIS task and become familiar with GIS, GPS technologies, and working knowledge with available geospatial data.

**To provide easy access to geospatial data for staff that is not GIS trained.**

Use of GIS interactive mapping services to end users through easy-to-use applications.

**To provide opportunities to students for GIS education and real world project involvement.**

Support an intern program to provide students with hands-on GIS/GPS experience and to assist them in the completion of GIS/GPS projects. Currently, PDC staff is working with an intern this spring semester and anticipate having more in the summer.

**To promote inter department participation in the sharing of standardized GIS data and GIS resources to reduce cost to the university**

To Develop and maintain metadata according to standards for GIS data development and assist others with metadata to bring more data into the university GIS geodatabase.

At least four categories of standards will apply to our GIS - application standards, data standards, information technology standards, and education and training (professional) standards. Data standards, including data transfer, quality, and metadata, or data documentation.

Develop guidelines and manuals for geo-referencing tabular data.

Review, update, and publish standards as necessary.

Staffed data maintenance processes to secure data integrity and completeness.

**Secure geospatial data in one place- Only authorized staff can make changes.**

Migrate all geospatial data to a designed geodatabase, centrally stored and backed up daily. (Implementing the use of SQL, ArcSDE, and ArcServer for this task)

## **Provide real time capability for data verification and location with GPS.**

### **(Navigation)**

Once underground utility and other no visible features have been mapped, we will be able to navigate, located and marked them. Currently, we have experienced several utility expensive interruptions.

## **Promote GIS/geospatial technology training and education opportunities in order to develop and maintain appropriate skill levels in PDC employees.**

Identify and recommend training needs for PDC staff to keep up with software and hardware changes and upgrades.

## **Benefits of implementing GIS for Facilities Management and other Departments**

By integrating GIS data with facilities management (FM) and other applications, we will:

- Extend the life of the FM data by making it digital.
- Manage critical information that is difficult to do manually
- Increase data accuracy and integrity.
- Maintain easily information that is unpractical to maintain in paper copies.
- Organize, and disseminate data for daily routine maintenance work
- Provide tools to facilitate planning and analysis for different scenarios.
- Allow sharing data more efficient and make data accessible to the departments that needed it.
- Saving man-hours by planning more efficiently seasonal campus maintenance tasks.
- Many of our university departments will benefit from the GIS data; for instance, Campus Safety and Emergency response can use a digital base map to link to the WKU campus emergency response to gather, display, and disseminate real-time information about incidents among respond agencies. This will help us deploy and manage our resources and respond to incidents more quickly and effectively.
- Avoid duplication on data creation and data maintenance. It will save many man hours in keeping up to date campus integrated campus information.
- By using GIS, the time it takes to access critical information can just take few minutes instead of several hours because the data will reside in a single location.
- The **geodatabase** is a common data storage and management framework for ArcGIS Server. Source data is managed in the geodatabase. This minimizes redundant copies and eliminates the possibility of varying versions of data.
- GIS allows incorporating tools and customized applications to bring real benefits to users.
- GIS has tools to interchange data with other software such as CAD. Cad users will be able to bring in and export data between these programs.

- Creating an enterprise GIS will drive the implementation of data and file structure standards at the university so data can be seamlessly displayed and analyzed by authorized users.
- **All scanned paper plat** and record drawing can be accessed by an intermediate table that contains relevant information about the documents about the documents that are stored in the geodatabase.

**Web-Based Enterprise GIS.** End users will be able to view PDFs of official engineering drawings by location. Specific application will furnish the functionality of PDC GIS Explorer as well as georeferenced maps.

PDC GIS/GPS will be the central clearinghouse for the WKU geospatial data. A list of geospatial data will make available when is completed. PDC archive staff will develop workflows for managing spatial data.

Once an Enterprise GIS is completed with an integrated server-Based GIS, users will be able to retrieve information on their desktops using customized interfaces (GIS applications) that fit each department need. The goal is to streamline workflow by identifying tasks, questions, and requests and get answers in very short time for decision making.

University Facilities will use the application to accurately see campus information in one place, covering all buildings ranging from new construction to historic buildings dating back to the archives records. Viewing utilities helps with maintaining new building plans and keeping an accurate record of the land use.

### **Other Future Use of GIS**

Campus administrators can generate emergency notifications to students for real-time events such as building closures, safety notifications, maintain compliance with American with Disabilities Act, create walking tours, and any other projects the university looks forward to implement.

### **Hardware & Software used at PDC**

There are several components such as computer hardware, software, and infrastructure to put together to make this work.

PDC is using Trimble GPS hardware and software to collect data and navigate to existing feature locations for finding and data maintenance. PDC has already purchased a Trimble GeoXH GPS unit.

ArcPad, Trimble GPS Analyst, and GPS correct software are used to collect and process field GPS data.

We are using ArcGIS/ArcInfo, AutoCad Map 3D software to convert, manipulate and view collected information.

Hardware: We anticipate purchasing two new workstations to do in-house data conversion and production.

## **Present Tasks:**

### **Base map Development**

The base map contains all surface features such as: buildings, roads, parking, parcels, light poles, trees, sidewalks, manhole covers, etc. To insure all geospatial data in the system will overlay with a determined degree of accuracy, a high accuracy horizontal and vertical control has been established. Those points were surveyed following national geodetic standards. Eight permanent control points have been place on main campus.

PDC and FM staff are contributing to the data creation and verification in many ways. PDC has prepared underground utility maps with the current information available. The information on the maps will be supplemented and verified with GPS with assistance of FM staff. There is a lot of information that never has been documented and need to be mapped for data integrity and completeness. Once maps are completed, they will be revised again before being incorporated into the official University GIS system and designate the people who will be responsible for the on-going maintenance.

PDC Archives and CAD custodian will be responsible for cataloging and archiving all campuses GIS data and documentation related. He will assist project managers, professors, students working on class projects with their needs.

PDC has two sources for imagery: 1-meter resolution from Planning Commission 2004 and .25' pixel resolution aerial photos flown in December 2010 by PDC. The new imagery is used for quality control and as a source for creating new data. To use the aerials for these purposes, surveyors and engineers must use the same coordinate system employed by PDC.

**Identify existing GIS layers.** Identify existing GIS layers and supporting data available for distribution (this task is partially done). Once is completed, we will prepare a matrix showing data layers, coverage, resolution/scale, and formats.

### **Design GIS/GPS Data Dictionary and testing.**

We are currently revision other universities data dictionaries to determine which one could be applicable to WKU. Findings will be share with the each department to get

comments, delete, or add new attributes. A comprehensive inventory of GIS data can be a large undertaking, so is very important to identify and collect only useable attribute information.[READ MORE >>](#)

Our intent is to provide interested staff GPS data collection training. This will help everyone understand the features and attributes to be collected as well as real taste what data collection is all about. It will also help everyone become comfortable with the equipment and technology.

### **Examples of work done and underway at PDC**

- Geodetic High Accuracy Horizontal and vertical Control
- New Orthophotography- Low flight 0.25' pixel resolution
- University master plan mapping- Produce more than 50 types of maps.
- Produce slides for Board of Region Presentation
- Main Campus Walkways data creation and attribute data.
- Main Campus Roads feature data completion and verification.
- Main Campus Parking feature data completion and verification.
- Main Campus Steam digitizing and GPS field manhole verification.
- Main Campus Water features digitizing and Cad data overlaying for field verification.
- Main Campus Sewer features digitizing and Cad data overlaying for field verification.
- Main Campus Electrical features digitizing and Cad data overlaying for field verification.
- Main Campus Storm sewer features digitizing and Cad data overlaying for field verification.
  
- Main Campus Injection Wells mapping and GPS field verification
- New Utility Inventory
  - University Farm Wastewater extension GPS survey
  - High Voltage Electrical Project GPS survey
  - Underground Utility GPS survey at Music Rehearsal Building.

### **Future tasks:**

Add link to PDC Web site of available Geospatial Data. Create a web page with gif images of files with descriptions of each layer and notes on availability.

**Evaluate existing GIS layers and metadata, with regard to interoperability.**

**Georeferencing.** Georeferencing of unknown information (or geo-registration) is a process that consists in setting an image or any graphical objects (vector file), originally laid out in a plan, in geometric conformity with the reality, in a given projection system. Georeferencing is essential to ensure the validity of the objects localisation in a geo-database.

**Create metadata.** Review and comment on metadata at each source organization and for each dataset. This step is very important for data maintenance, verification, and history of the data.

**Need assessment and implementation**

**Steps for implementation:**

**1. Need assessment**

Result of this step will summarize the specific requirements and uses of the system.

**2. Data conversion**

Existing data from archives maintained by PDC are being used to create ESRI shape files.

**3. Develop Applications**

Examples: Standard Map Maker: Create and publish layouts of campus using standard map templates.

Area calculator: Calculates area and acreage of layer or selected features

**4. Deployment and user Installation**

**5. User training and support**

**Appendix:**

**A. What is GIS?**

**B. What is GPs**

**C. Step by Step GPS manual**

**D. Step by Step Cad to Shape data conversion (Under Construction)**