

The Use of Field Computing GPS/GIS Technology at the WVDEP, Division of Mining and Reclamation¹

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Abstract. Over the past two years the WVDEP purchased pocket GPS units and associated Pocket PC's for use in the Title V program. Using an ArcPAD platform and GPS Pathfinder, the WV Division of Mining and Reclamation is beginning to move GIS technology out the office and into the field. The use of ArcPAD in the field has proved a very valuable tool. This paper discusses the equipment and software and examines some of the issues faced by the agency along the way.

One of the biggest hurdles in getting these units into general use, in the regional offices, has been training. ArcPAD is inherently complex and also requires a good working knowledge of ArcGIS. All users must be trained in both applications to efficiently and effectively produce a suitable project. Other issues that have hindered GPS/GIS field units arise from data transfer issues, Pocket PC platform stability, acquiring signals and difficulty of use in field.

Despite these issues, these GPS/GIS units are proving very useful. The ability to bring digitized topographic maps, aerial photos, permit outline polygons or any other geo-referenced shapefiles into the field and project real-time GPS data cannot be understated. ArcPAD can turn this real-time GPS data into shapefiles in the field. These points, lines and polygons can be downloaded instantly using Active-Sync. When this data is corrected with base stations it is highly accurate. All of these features are powerful tools that can be used in permit review and hydrogeologic investigations.

Additional Key Words: ArcPAD, ArcGIS, permit review

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Introduction/Background

In the late 1990's the West Virginia Department of Environmental Protection began to compile a GIS database for all coal mine and quarry operations in the state. This was done with the help of West Virginia University's Natural Resource Analysis Center. Much of the funding for this came about because of various federal lawsuits. By 2002 the state had digitized maps for all active surface disturbances in the state. These shapefiles were manipulated originally using desktop ArcInfo and ArcView in a UNIX environment. Later a Windows based system was developed using ArcGIS. The WVDEP purchased a complete set of geo-referenced 7.5-minute topographic maps and three meter resolution aerial images. All the GIS shape files, raster files and grid files maintained by the WVDEP are in the UTM NAD 1983 coordinate system. Most of these files are publicly available and can be downloaded from <http://gis.wvdep.org/>.

Starting in 2003 the West Virginia Department of Environmental Protection, Division of Mining and Reclamation began to purchase PDA and GPS units, which use ArcPad. At this time the WVDEP/DMR has over a dozen units. Using an ArcPad platform and GPS Pathfinder the WV Division of Mining and Reclamation is beginning to move GIS technology out into the field. The use of ArcPad in the field has proved a very valuable tool, but getting there has not been a simple task.

Equipment and Software Used by the WVDEP

The units that the WVDEP/DMR purchased consisted of the following hardware: an iPAQ h450 Pocket PC, an extended sleeve with a battery pack, a storage card (1-5 GB), a secure digital card (128 MB), a serial card, a Trimble Pocket GPS receiver, GPS Antenna, 9 pin D shell male, and a null modem cable. This hardware ran just over \$4,000 per unit.

To operate these handheld (PDA)/PC units the following software was used: ActiveSync (Microsoft), ArcPad (ESRI), ArcGIS (ESRI), GPSCorrect (Trimble), Pathfinder Controller (Trimble), Pathfinder Office (Trimble). ArcPad was configured using the recommended settings from Clark (2002). It is important to emphasize that ArcGIS is the primary interface software for ArcPad. Though ArcPad will run as stand-alone software, it has only limited functionality without ArcGIS. The main reason to load GPSCorrect software is the Trimble SkyPlot toolbar. Pathfinder Controller is used to test and modify the GPS connectivity. Pathfinder Office is needed to make base station corrections to GPS data collected in the field.

Problem Encountered with PDA/GPS Units

One of the biggest hurdles in getting these units in general use in the regional offices has been training. These training issues are two fold. First one must be trained in ArcGIS, after that one can actually begin the use of ArcPad. Two years ago the WVDEP was still using ArcView 3.2. In order to interface with ArcPad across the state, all potential users had to first be trained in ArcGIS. In the past two years the WVDEP has had over 50 people trained in the use of ArcGIS. Knowledge on Pocket PC's and the use of ActiveSync can also be very important. Though ArcPad can be used with limited knowledge about Pocket PC's, many problems can arise due to this. An example of this occurred in our Philippi Office. The employee, who had the PDA/GPS

unit assigned to him, would perform a hard reset every time the screen froze. He had a hard time learning how to use ArcPad, but did learn how to install software on to the Pocket PC very well.

The stability of ArcPad running on a Pocket PC is also an issue. ArcPad running on a Pocket PC environment can be a very unstable platform. Having to perform a soft-reset because of a frozen screen is far too common. Because of this, I find it very useful to save the working project I am utilizing on a regular basis.

In certain versions of ArcGIS 8.3, the ArcPad toolbar does not properly make a world projection file. Because of this, ArcPad cannot view Sid files created with this version.

The biggest problem with using our PDA/GPS units in West Virginia is the inability to find a signal from the needed amount of satellites. The steep slope and forested terrain both make it hard to pick up signals in some locations. West Virginia is the most mountainous and forested state in the east, so this is a serious issue. Local testing shows that tree cover is a far bigger issue than steep slope. Half-hour or longer waits are not uncommon in forested areas. Hundred dollar GPS units with no external antenna often do better. For this reason, it is often easier to get a reading in the nearest clearing and to extrapolate the needed location data from there.

New Horizons with PDA/GPS in Mining Permitting

Despite these issues, these GPS/GIS units are proving very useful. The ability to bring digitized topographic maps, aerial photos, permit outline polygons, or any other geo-referenced shapefiles into the field and project real-time GPS data cannot be understated. Company maps can be scanned and geo-referenced in the office and one can bring this map data into the field and check real world locations to those shown on maps, with accuracy and ease never before possible.

Because you can save your GPS locations as a point, line or polygon shapefile in the field, these shapefiles can be used in ArcGIS as soon as you ActiveSync the Pocket PC. This allows the incorporation of collected GPS data into existing GIS projects seconds after ActiveSync has run.

When this data is corrected with base station data, it is highly accurate. However, by using SkyPlot to ensure good satellite configuration and using five or more averaged GPS reads to create shapefile points, one can ensure an accuracy level far beyond that achieved with a standard GPS unit. Field trails have shown accuracy levels of around five feet are possible on the x-y axis. This is before doing a base-station correction. For most uses this accurate enough.

All of these features are powerful tools that can be used in permit review and hydrogeologic investigations.

References

1. Clark, S., C. Greenwald and V. Spalding. 2002. Using ArcPad, ESRI, 390 p.