INTEGRATING GIS INTO AN AML PROGRAM

A CASE STUDY IN ALABAMA

By

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Abandoned Mine Land Reclamation Program
WHAT DO YOU NEED TO BUILD A GEODATABASE FOR AN AML PROGRAM?
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- Geodatabase was built from the ground up.
- Started out with 125 U.S.G.S. 1:24000 topographic maps covering our 21 county area.
- All of the maps were scanned, rectified, and edge clipped.
- Generally these topographic maps served as the “master maps” for an AML program’s project inventory, both reclaimed and unfunded.
- Should consist of Planning Units, Problem Areas, and some features such as highwalls, portals, spoil areas, etc.
- ArcGIS license from OSM and DOQ shapefile to georeference the topographic maps at their four corners.
- Determine your universal map projection early.
  - State Plane is the best.
AML TOPOGRAPHIC MAPS WITH EDGE CLIPPING

All of the GIS basics for AML.
PHASES

- Phase 1: Topographic map scanning, rectification, and edge clipping.
- Phase 2: Planning Unit Digitization
- Phase 3: Problem Area Digitization
- Phase 4: Problem and Project Digitization (both completed and unfunded)
- Phase 5: Underground Mine Map Integration

- Phases 1-3 are completed.
- Phases 4-5 are ongoing.
PHASES 1-3
PHASE 4
PHASE 1-3 ADDITIONAL REQUIREMENTS

- Phase 2 (Planning Unit Digitization): Will have to rely on old maps and mylar maps to determine some boundaries.
- Phase 3 (Problem Area Digitization): Will have to rely on PAD Sheets and old maps for boundaries.
- Phase 4 (Project and Problem Site Digitization):
  - PAD Sheets
  - Project Files
  - Engineering Data (if available)
  - Satellite imagery, such as that available through ArcGIS Online.
  - “Institutional Knowledge”
  - Symbology
Once I arrived at Phase 4, I realized that there is no set symbology for OSM features.

Realized this after discussing it with OSM professionals.

This necessitated the development of a symbology for AML Problem Features.

Symbology was derived from three sources:

- Symbology existed for such features as vertical openings, portals, mine openings, etc.
- Some symbology was borrowed from other fields such as dangerous impoundments, hazardous water bodies, and surface burning.
- Some of the symbology, such as dangerous highwalls, clogged streams, and subsidence was created in the office using ArcMap.
SYMBOLOGY

- Bat Caves
- Dangerous Impoundments
- Hazardous Equipment
- Other Equipment
- Polluted Water
- Polluted Water: Agricultural etc...
- Vertical Opening
- Water Supplies
- Water Problems
- Mine Opening
- Centroids
- Problem Sites
- Clogged Stream
- Dangerous Piles and Embankments
- Dangerous Slides
- Industrial/Re... Waste
- Subsidence
- Surface Burning
- Underground Mine Fire
- Bench
- Gobs
- Haul Road
- Industrial/Re... Waste
- Pits
- Slump
- Slurry
- Spoil Areas
- Project Sites
- Section Lines
- PAD Areas
- Planning Units
- Counties
- AL DOQs
- Permit Hatch

Access Road
Alabama Highways
Clogged Stream
County Road
Dangerous Highwall
Highwall
Interstates
United States Highways
Water Extension Lines
Water Extension Lines
PHASE 5: UNDERGROUND MINE MAP INTEGRATION

- This phase can be complicated.

- Before my arrival at AML all of the abandoned underground mine maps had been scanned, and some had been georeferenced and digitized by the Alabama Geological Survey.

- The scanned images consisted of over a terabyte of data.

- The process is ongoing of digitizing the mine footprints, mine openings, coal outcrops, and faults that are documented on these maps.
PHASE 5: UNDERGROUND MINE MAP INTEGRATION
GOALS OF PHASE 5

- Integrating the underground mine maps into the geodatabase is imperative.
- This will be of immense value to project selection.
- This will be of immense value when we receive complaints, such as those for subsidence.
- Very important to mobile GIS applications.
- Very important to have this archive of maps preserved digitally.
- Our office is responsible for keeping the repository for these maps.
- Property owners and citizens frequently want to look at these maps.
- Having these maps in digital form will make it much easier to answer any questions the public might have about abandoned underground mines.
GOALS OF PHASE 5

- Alabama law prevents copies of these maps from being distributed in public, without the expressed written consent of the company who created them.

- This presents an issue because some of these maps are “orphans”, meaning that the company that created the map is now defunct and no known corporate descendant exists.

- Nevertheless, this will much improve the process of public viewing of these maps.
Creating KMZ files of the PU’s, PA’s, PA Centroids, Underground Mine Maps and corresponding Centroids has proved to be a vital piece of the puzzle.

This allows co-workers to view the data in a much more user friendly program, GoogleEarth.

This also prevents accidental changes to the geodatabase.
OTHER DATA INTEGRATED INTO THE GEODATABASE

- Bat Cave Locations (U.S. Fish and Wildlife)
- Endangered Species Areas (U.S. Fish and Wildlife)
- National Wetlands Inventory (U.S. Fish and Wildlife)
- 100 Year Flood Limits (FEMA)
- Integrating this data into the geodatabase results in our mapping capabilities being much more efficient and streamlined.
SUCCESES AND DIFFICULTIES OF THE PROCESS

• Successes
  • Going from nothing to a robust geodatabase in a year and a half.
  • Streamlined and refined our project selection capabilities.
  • Greatly enhancing our mapping capabilities.

• Difficulties
  • Obtaining county parcels data.
  • Conflicting information being present based on the program’s over thirty years of existence.
  • Understanding that GIS has its limitations, making fieldwork all the more important for project selection.
SUCCESS: STREAMLINING AND REFINING OUR PROJECT SELECTION CAPABILITIES

- Project Proposal Methods:
  - Land Owner and Citizen Complaints
  - Office staff finding potential projects and investigating them.
- GIS has revolutionized the latter.
- Using GIS, we have located well over 100 potential projects to investigate.
  - This ranges from highwalls and DPE’s to portals and vertical openings.
SUCCESS: STREAMLINING AND REFINING OUR PROJECT SELECTION CAPABILITIES
SUCCESS: GREATLY ENHANCING OUR MAPPING CAPABILITIES
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FUTURE OF GIS WITHIN AML THE PROGRAM

- Integrating distance functions
- Integrating 3D and ArcScene functionality into analysis and project selection.
- Integration of AML Mobile GIS platform
  - Part of a technology sharing partnership with Ohio Department of Natural Resources.
AML MOBILE GIS PLATFORM

• System developed by Ohio Department of Natural Resources.
• OSM brokered a partnership between Alabama and Ohio in November of 2013.
• System uses ArcPAD with custom applications developed by ODNR.
• System used to document and discover complaints, unfunded, or previously unknown AML features in the field and add them to inventory.
• System can greatly increase an AML program’s unfunded inventory.
• As of July 2014, system now fully deployed in Alabama with the assistance of ODNR personnel.
• The implementation of the system was very smooth, with Ohio being very helpful every step of the way.
• We are looking forward to doing large scale field work with it in the near future.
AML MOBILE GIS PLATFORM

Are there any AML-related unstable steep refuse piles or banks (other than landslides) posing a danger to human life, safety and health?

[Yes] [No] [Cancel]
IMPLEMENTATION PROCESS

- A license for ArcGIS 10.2.1 and ArcPAD 10.0 is necessary.
- Trimble Juno model and Panasonic Toughpad (GPS enabled) mobile units are necessary.
  - Alabama invested in two of these units.
- Support from Ohio and OSM is necessary.
HOW DID WE IMPLEMENT IT?

- We acquired the ArcPAD license from OSM.
- We purchased the two units.
- We worked with Ohio on the implementation.
- This was culminated with Matt Riley of ODNR coming down to Alabama for three work days to deploy the system with us.
IMPLEMENTATION AND TRAINING

- Matt Riley, myself, and Min Kim from OSM worked for two days in the office on launching the system.
- The third day was a training day.
- This consisted of a presentation by Matt Riley to everyone in the office who would be using the units.
- This was followed by a field training exercise at an active AML project in the Birmingham area.
FIELD TRAINING EXERCISE
FIELD TRAINING EXERCISE
CONCLUSIONS

- GIS is very valuable to an AML program.
- A good geodatabase can be developed rather quickly for an AML program, if a good foundation is in place.
- OSM is very supportive of this and will provide you with the tools and information needed to make it possible.
- Interstate cooperation is possible and is a good thing for everyone.
- Questions??
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