



Application of Geospatial Technology in an Emergency Management Academic Program



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Abstract

Arkansas Tech University offers a B.S. degree in Emergency Management and an M.S. degree in Emergency Management and Homeland Security. A focus of both degree programs is student exposure to best practice processes and technology in real-life situations. This paper presents the Arkansas Tech strategy to accomplish this which is centered on a state-of-the-art on-campus Emergency Operations Center (EOC) that features a comprehensive GIS-based modeling and simulation capability. The EOC software suite for modeling and simulation includes the ArcGIS product set, the Comprehensive Assessment Toolset (CATS) and HAZUS-MH. The presentation covers how the EOC and these modeling and simulation capabilities are integrated into both the B.S. and M.S curricula and into student research projects. In addition, the presentation describes how students, from a service learning perspective, are involved in supporting local, regional, and state organizations and the University using the modeling and simulation capabilities of the EOC.



Arkansas Tech University



- 6900 Students – Undergraduate/Graduate
- Seven Academic Schools
 - Business
 - Community Education and Professional Development
 - Education
 - Graduate Studies
 - Liberal and Fine Arts
 - Physical and Life Sciences
 - System Sciences

Department of Emergency Administration and Management

- Department Established as a BS Degree Program in 1997
- Master's Program Added in 2006
- Over 160 Students
- 195 Graduates
- Emergency Administration and Management Academy provides Geospatial Focus

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Emergency Management Degree Programs

B. S. Emergency Administration and Management -124 hrs

| | |
|---|--------|
| General Education | 37 hrs |
| EAM Technical Specialty Component | 21 hrs |
| EAM Internship and Externship – Service Learning | 21 hrs |
| Administrative/Professional Coursework | 15 hrs |
| Interdisciplinary Sociology or Environmental Option | 21 hrs |
| Electives | 9 hrs |

M. S. Emergency Management and Homeland Security – 36 Hrs

| | |
|--|--------|
| Professional Specialty Component | 21 hrs |
| Research Design and Methods | 3 hrs |
| Applied Research – Thesis or Practicum | 6 hrs |
| Interdisciplinary Component | 6 hrs |



Geospatial Technology is Essential to Emergency Management Education

GIS is an Enabling Technology for all Phases of Emergency Management

- Planning – Visualize hazards and the effectiveness of planning measures
- Response – Maintain a Common Operating Picture that provides current and comprehensive situational awareness
- Recovery – Identify needs and plan and manage recovery operations using location-based relationships
- Mitigation – Apply geospatial tools to identify needs and plan and perform hazard mitigation initiatives



Integration of Geospatial Technology in Emergency Management at Arkansas Tech

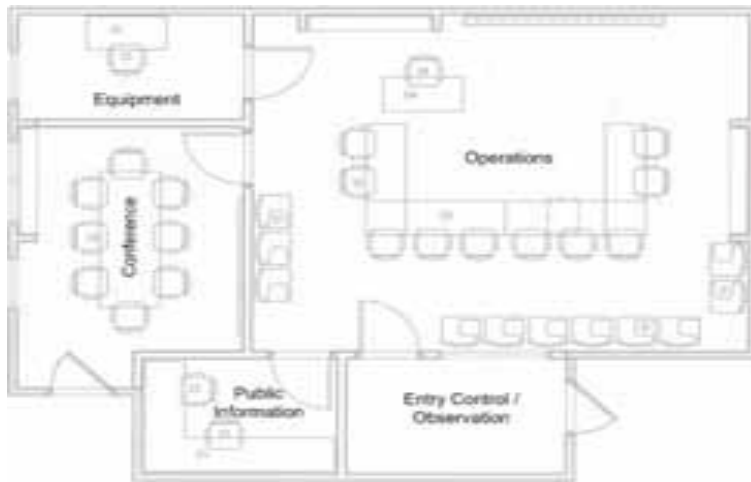
Congressional Grant in 2004 established the Emergency Administration and Management Academy that:

- Provides a wireless Emergency Operations Center (EOC) featuring a modeling and simulation laboratory where EAM majors receive education and hands-on experience using current and emerging technologies
- Serves as:
 - Emergency Operations Center for the University in the event of an emergency situation affecting the campus
 - Resource integrated into the curriculum as a platform for course delivery and academic research
 - Service Learning outreach to government and industry for research, training, and exercises



EOC Modeling and Simulation Laboratory

ATU Emergency Operations Center



- **Planning and Management Software**

- Microsoft ® Office Suite
- Living Disaster Recovery Planning System (LDRPS ®)
- Enterprise Responder for Emergencies and Disasters (eRED ®)

- **Geospatial Applications Support**

- ESRI ® ArcGIS™
- Trimble ® TerraSync™ & Pathfinder

- **Modeling and Simulation Tools**

- Consequence Assessment Tool Set
 - Hurricane Tracking and Wind Damage Assessment
 - Storm Surge Model
 - Earthquake Damage Assessment
 - Rapid Analysis of Chemical, Biological, High Explosives, Nuclear Weapons, and Radiobiological Hazards
 - Manual Hazard Definition
 - Roadblocks
- Areal Locations of Hazardous Atmospheres (ALOHA ®)
- HAZUS® MH



Geospatial Technology Course Offerings

Geospatial and Modeling Course Offerings Need Expansion

Current

Undergraduate

- Information Technology in Emergency Management

Graduate

- Technology for Comprehensive Emergency Management

Proposed - 2007

Undergraduate

- Introduction to Emergency Management Technology
- Information Technology in Emergency Management
- Hazards Analysis and Simulation

Graduate

- Technology for Comprehensive Emergency Management
- Advanced Hazards Analysis and Simulation



Examples of GIS in the Classroom



Map Fire Hydrants on Campus

- Collect locations using handheld GPS
- Create location Shapefile using GPS software
- Download DOQ from GeoStor and create Campus View using ArcMap™
- Add and label location data to the ArcMAP Campus View



Simulate Hazardous Chemical Spill and set Roadblocks

- Download DOQ and create Common Operational Picture using ArcMap
- Run Aloha Simulation of Chemical Spill
- Import Aloha exposure footprint to ArcMap
- Create Roadblock footprint using CATS
- Add Roadblock layer to Common Operational Picture



Geospatial Research Example

New Madrid Fault Earthquake Simulation Northeast Arkansas

☒ New Madrid 8.0

Estimated MMI

I

II

III

IV

V

VI

VII

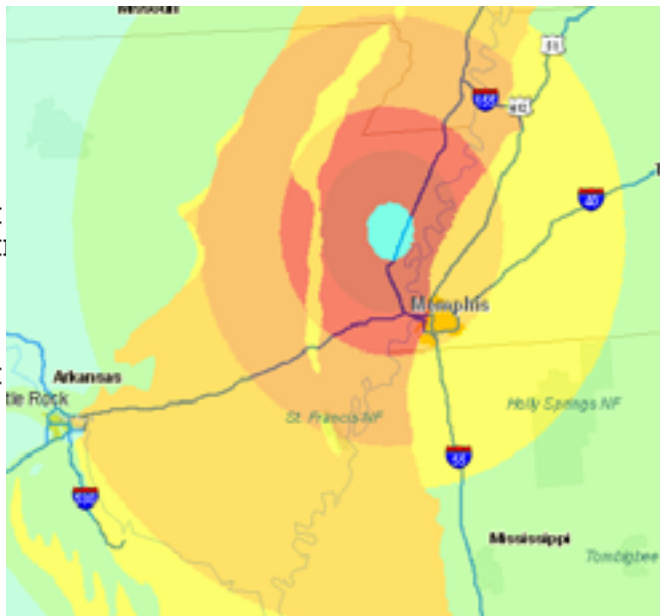
VIII

IX

X

XI

XII



Consequence Assessment Toolset

- Create Modified Mercalli Scale layer

☐ ☒ K Tons - Census Tract

DebrisTotal

0 - 25,6718

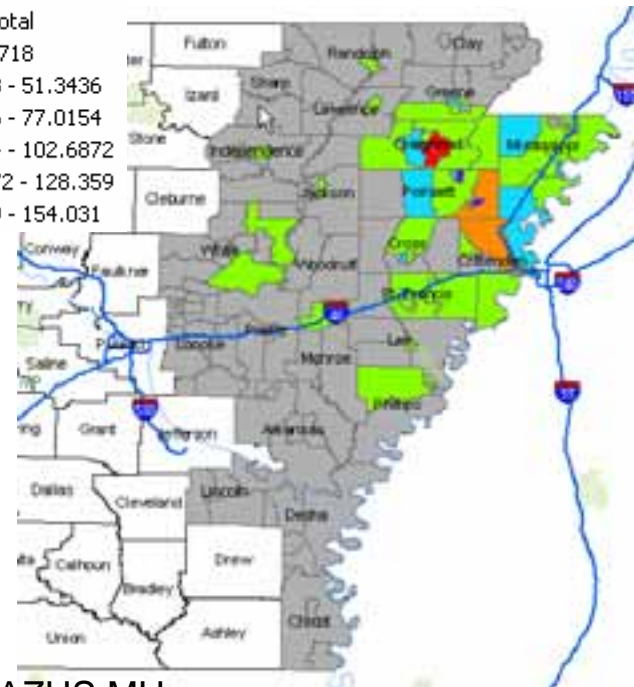
25,6718 - 51,3436

51,3436 - 77,0154

77,0154 - 102,6872

102,6872 - 128,359

128,359 - 154,031



HAZUS MH

- Detailed Earthquake Event Report
- Debris Estimate shown
- GIS Enhanced Product

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Examples of Geospatial Technology in Service Learning



Exercise Support for Government and Industry

- Create overview of exercise location using ArcMap
- Develop GIS based scenario
- Develop GIS Enhanced Products such as roadblocks
- Students and faculty participate in live exercises

Community Awareness

- Presentations to communities and civic groups
- Develop area specific hazard simulations
- Use ArcMap, HAZUS, CATS

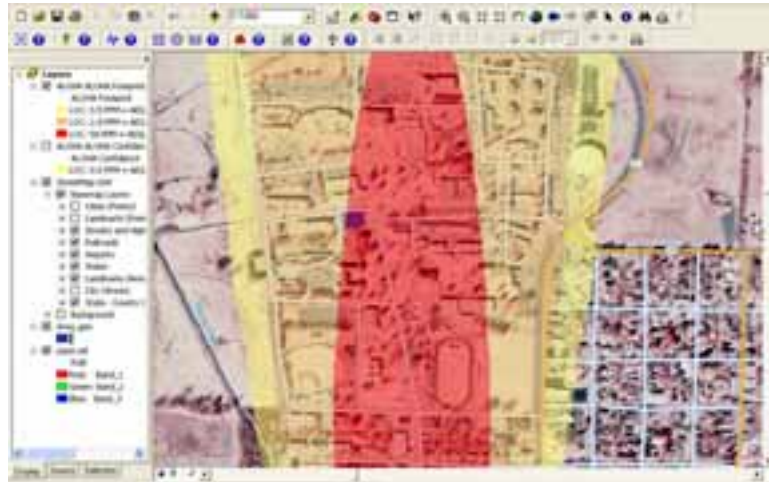
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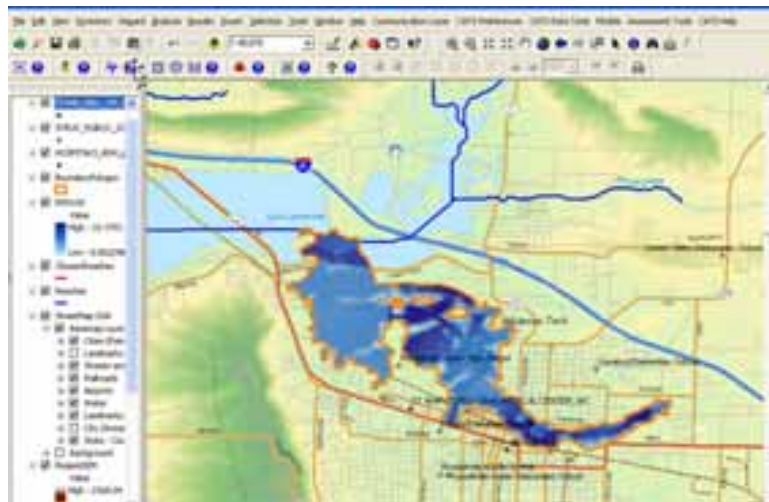


Geospatial Technology for University Preparedness



University Emergency Operations Plan Includes a Hazard Analysis Annex

- Hazardous Chemical
 - Hazardous chemical release from railcar accident
 - Aloha model determines the exposure footprints
 - Exposures overlaid on ArcMap view of the campus



- University 100 Year Floodplain Flood Model
 - Vulnerability of the campus to flooding using HAZUS Flood Model and 100 year return
 - Use USGS DEM to create reaches specific to the study area
 - Determines flood extent and depths and impacts to population, building, infrastructure, and agriculture

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Geospatial Technology Curricula Contribution to Core Competencies

| Core Competency | Contribution |
|---|--|
| Management Skills | Technology product evaluation and selection; mitigation and logistics planning |
| Communication Skills | Enhanced communication skills using geospatial visualization capabilities |
| Leadership and Decision Making Skills | Application of geospatial technology to emergency management decision making |
| Technical Skills | Build student's skills in use and application of geospatial technologies |
| Political, Bureaucratic, and Social Skills | Research and analyze social context of disasters using demographic information |
| Comprehensive Emergency Management Contexts | Application of geospatial technology/products to all emergency management phases |
| Legal and Ethical Contexts | Understanding of legal aspects of data access and product dissemination |
| Experience and Practical Applications | Research and application of geospatial products to real life situations through service learning |



Next Steps

- Increase outreach through the application of GIS to emergency management issues in government, business and industry
- Implement the capability to deliver geospatial courses online
- Integrate additional event modeling capabilities



References

1. ArcGIS™ and ArcMap™, are products of ESRI®, Inc., 380 New York Street, Redlands, CA 92373
2. Areal Locations of Hazardous Atmospheres ,ALOHA®, is a product available from the U. S. Environmental Protection Agency
3. Consequence Assessment Toolset, CATS, is a product available from the Defense Threat Reduction Agency (DTRA)
4. Enterprise Responder for Emergencies and Disasters, eRED®, is a product of United Security Applications, 231 Old Bernal Avenue, Pleasanton, CA 94566
5. HAZUS® MH is a product developed by the Federal Emergency Management Agency through a contract with the National Institute of Building Sciences
6. Living Disaster Recovery Planning System, LDRPS®, is a product of Strohl's® Systems Group, Inc., 631 Park Avenue, King of Prussia, PA 19406
7. Microsoft® Office Suite is a product of Microsoft Corporation, One Microsoft Way, Redmond, WA 98052
8. TerraSync™ & Pathfinder, are products of Trimble Navigation Limited, 935 Stewart Drive, Sunnyvale, CA 94085



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