NSDI Cooperative Agreements Program
Participation in The National Map
Final *Technical Report*

The goal of this category is to assist organizations and consortia to work with the USGS to develop The National Map. Please use this format to develop a brief and succinct interim or final project report, as appropriate.

List:

Cooperative Agreement Number: 05HQAG0110

Project title: Development of a Model GIS Data Integration Program: Enhancing Oklahoma Roads Data Layer in the National Map

Project start and end dates: September 1, 2005 – August 31, 2006

Lead project organization: University of Oklahoma
Project Lead: May Yuan, Director of Center for Spatial Analysis

USGS Mapping State Liaison: Darryl Williams

Collaborating organizations (list): no contractually-involved collaborators; numerous cooperating organizations.

Data themes: (list) Transportation (Road Centerlines)

Project Summary

a. Describe the project; its tasks, highlights, challenges, and accomplishments. What are your approaches to overcoming impediments to participation in The National Map? Based on your experience what would you recommend for implementation and development for project success (technical, institutional and organizational)?

The project aimed at developing a high-quality geospatial database of street centerlines for general purposes. The centerline database met the following objectives:

1. Developed a standardized data storage and access protocol at http://geo.ou.edu (a geospatial data warehouse in the state of Oklahoma) and with accessibility extended to the USGS National Map website. The site is maintained by the Center for Spatial Analysis (CSA) at the University of Oklahoma. Henceforth, the site (http://geo.ou.edu) is referred in the report as the CSA data warehouse site.

2. Achieved high geographic accuracy within approximately 2 meters as assessed with digital aerial photography.

3. Encoded comprehensive street addresses associated with each centerline segment.

4. Ensured topological integrity across street centerlines to enable robust routing analysis and topological integrity among related geospatial data

sets (such as municipalities, precincts, school districts, and census enumeration units) to assure coincidence among common boundaries.

5. Prepared for project sustainability by establishing a method and plan to seek additional funds for data maintenance and updates as new streets and new E911 addressing become available.

Key Tasks:

1. Adopted data standards.

2. Incorporated local data into the development of high-quality street centerline data.

3. Where local data were not available, TIGER files were used. Features between all data sources and TIGER were adjusted as necessary ("rubber-sheeted") to assure feature continuity for routing applications.

4. Compared and made adjustments to ensure coincidence of common boundaries between centerlines and other existing boundary data sets (such as municipal boundaries, etc) as well as to ensure proper intersections among data sets.

5. Loaded data resources to the CSA data warehouse website and the National Map as they were developed. When necessary, planned for data sharing agreements with local jurisdictions before uploading the data to the web.

Accomplishments:

1. Completed street centerline data set for Cleveland County (including City of Moore, City of Norman, and the portion of Oklahoma City in Cleveland County).

2. Completed cross-checking these centerline data sets with the following boundary data sets and digital aerial photographs:

    a. Municipal wards boundaries
    b. Municipal boundaries
    c. Precinct boundaries
    d. School districts boundaries
    e. NAIP aerial photographs

3. Assigned each centerline to a unique identifier (CLID) and status code (1: centerline road not on any boundaries; 2: centerlines coinciding with other boundaries; 3: edited centerlines in reference to the boundaries; 5: centerlines with corrected addresses and left/right values; and 9: centerlines outside city boundaries).

4. Completed data quality assurance for Cleveland County.

5. Leveraged the CAP project with other related projects with support from the Oklahoma Election Board, Oklahoma Tax Commission, and Oklahoma Department of Commerce.

6. Explored opportunities with the Oklahoma OneCall System, Inc. (http://www.callokie.com), a non-profit organization, to seek legislative support for funding to sustain the project beyond the current USGS CAP.

Formulation of data sharing agreements with local jurisdictions has been initiated, but the process is more lengthy than expected. Discussions are

underway to determine what would be the best fit for the Oklahoma centerline CAP program. Once these agreements have been executed, the layer will be added to the CSA data warehouse website and the National Map.

Impediments to Participate in the National Map and Recommendations

1. Privacy concerns about publicizing local data on the national website. Extra care is needed in developing proper data sharing agreements with local jurisdictions.

2. The current funding level ($50,000 with $50,000 cost match) constrained the project coverage to one county which covered two major cities and a portion of a third within the county in Oklahoma. A multi-year (3-5 years) project at $150-200K per year will allow workforce development to ensure sustainability and continuity of project progress across the state of Oklahoma.

3. As the National Map project grows, community outreach programs become important to win public support for CAP projects. A closer partnership between USGS, state, and public universities can greatly promote the National Map efforts, in both data feeds and data use.

b. Describe the data themes provided through The National Map. Are there any use restrictions? Are your map services and data documentation (metadata) registered in The National Map and Geospatial One-Stop? What is the status of maintaining, updating and serving themes of data that are included in The National Map? Based on your perspective and project experience describe user requirements for a national level spatial data infrastructure.

Data themes that are provided through the National Map include:
1. Oklahoma County Boundaries and County Labels
2. Oklahoma School Districts and School District Labels
3. Oklahoma Railroads
4. Oklahoma Roads and Major Road Labels
5. Oklahoma Miscellaneous Ground Transportation

There are no use restrictions on these themes. All themes are distributed with meta-data. The map services have been registered with Geospatial One-Stop and the National Map.

Maintenance and update routines were documented in the interim report. These routines have not been changed since, except for Oklahoma Roads and Major Road Labels. Street centerlines for Oklahoma City, City of Moore, City of Norman, and the rest of Cleveland County have been updated and quality assured. The updated centerline data sets are ready to be uploaded to the National Map. Below is a recap from the interim report on the maintenance and updates of other data sets at the CSA data warehouse site and concurrently at the National Map.

1. County data seldom require updates, but if any updates did take place they would be reflected in the CSA data warehouse site and therefore on the National Map.

2. Oklahoma School Districts have occasional updates due to district consolidations or modifications.

3. Oklahoma Railroads are seldom updated, but a recent effort to update the Oklahoma City area data (to a more precise accuracy level based on imagery) is being incorporated into the site.

4. Oklahoma Miscellaneous Ground Transportation is a layer that is not well maintained and perhaps should be eliminated from the CSA data warehouse and the National Map sites due to limited usability.

5. There are several other data layers that are currently maintained by the CSA that should be considered for inclusion in the National Map. For example, "Incorporated Places" and "Minor Civil Divisions" are both maintained by the CSA, and Oklahoma Rivers are provided to the CSA by the Oklahoma Water Resources Board.

c. Describe the operational capability to maintain and update data through periodic updates of data made available through The National Map.

The CSA has six full-time GIS professionals working on GIS data compilation and maintenance on various government projects. Data updates for most of the data sets related to the CAP project are processed daily at the CSA. Some of the data sets are updated as frequently as several times a week, and workflow procedures ensure that updated data are posted at the CSA data warehouse and the National Map sites in a timely manner. In addition, procedures have been established to guarantee data concurrency across the CSA data warehouse and the National Map sites. The CAP project provided the opportunities for the CSA GIS professionals to carefully examine individual streets in three major cities and the entire Cleveland County and developed expertise and protocols to meet the challenges for state-wide street centerline data sets.

d. Discuss the issues, difficulties, and challenges (both technical, institutional and organizational) that were encountered. How can the CAP program be improved.

Challenges to the CAP project were three fold. The first can be attributed to an unexpected learning phase of the project. While the CSA GIS professionals have extensive experience and technical skill in state-wide data compilation and mapping, the CAP project, as our first CAP project, demanded intensive data evaluation, editing, and quality assurance at the local scale. Significant effort was devoted to learning, communication and consultation with other state and local officials at the beginning of the CAP project.

The second source of challenge is related to the tedious and laborious nature of the CAP project. Even though the tasks are meticulously demanding, the CSA GIS professionals have undertaken every step in the procedure with care and patience. In the last phase of the project, the professionals have become more skillful and effective throughout the data processing procedure. With the CAP funds, we have strengthened our expertise in local geospatial database development and have built a protocol to streamline data evaluation, editing, quality assurance, and maintenance. We are now well prepared for state-wide implementation of the street centerline database development.

Finally, some challenges emerged in the formulation of the data sharing agreements needed at the end of the project to provide a legal base for posting the data at the CSA data warehouse and National Map sites. We are working with

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the state GIS council, the university, and respective local governments to resolve the issues and are confident that a solution will be reached in a short time.

To further improve the CAP program, multi-year funding support is necessary to sustain the skills and expertise developed in this project and retain the experienced GIS professionals to develop a state-wide database of high-quality street centerlines.

e. Describe your relationship and issues with the USGS. Has a formal ongoing agreement been established to provide data and web services through The National Map? Describe your plans for follow-on activities. What are the terms and mutual commitment of resources? Please attach copy of written agreement if available.

The CSA is committed to continued development of the data warehouse as well as web mapping services for the State of Oklahoma and the National Map. The CSA data warehouse has been registered on geodata.gov and links have been established to the National Map and geodata.gov on the web mapping server at the data warehouse. Plans are under development to significantly improve the CSA data warehouse site by transforming the site to a web-based GIS collaboratory. The GIS collaboratory will incorporate geoprocessing tools for the user to perform scenario analysis and modeling, compare outcomes, and promote public participation and decision-making processes.

A formal Memorandum of Understanding was established with respect to the National Map Partnership in late 2003. (The "final draft" copy of that MOU is included below). Darryl Williams, the new Oklahoma USGS mapping liaison, has visited our office and we look forward to continuing a mutually beneficial relationship with the USGS staff and programs. Efforts are still underway to obtain sustainable program funding in order to continue the project beyond this pilot program.

The rapid growth of major cities in Oklahoma and disturbances from natural hazards (especially tornadoes) are only two of the many reasons for the need for frequent updates on the street centerlines in the region. A state-wide implementation of street centerline database development is critical to community development, emergency preparedness and planning, voting redistricting, as well as homeland security and geospatial infrastructure. With the emergent needs for E-911, accurate street centerlines and addresses play the central role in social services and emergency rescue. The USGS CAP grant has afforded the CSA GIS professionals to lay the foundation for Oklahoma centerline projects to take what is learned from the cities in the pilot project to a state-wide endeavor.