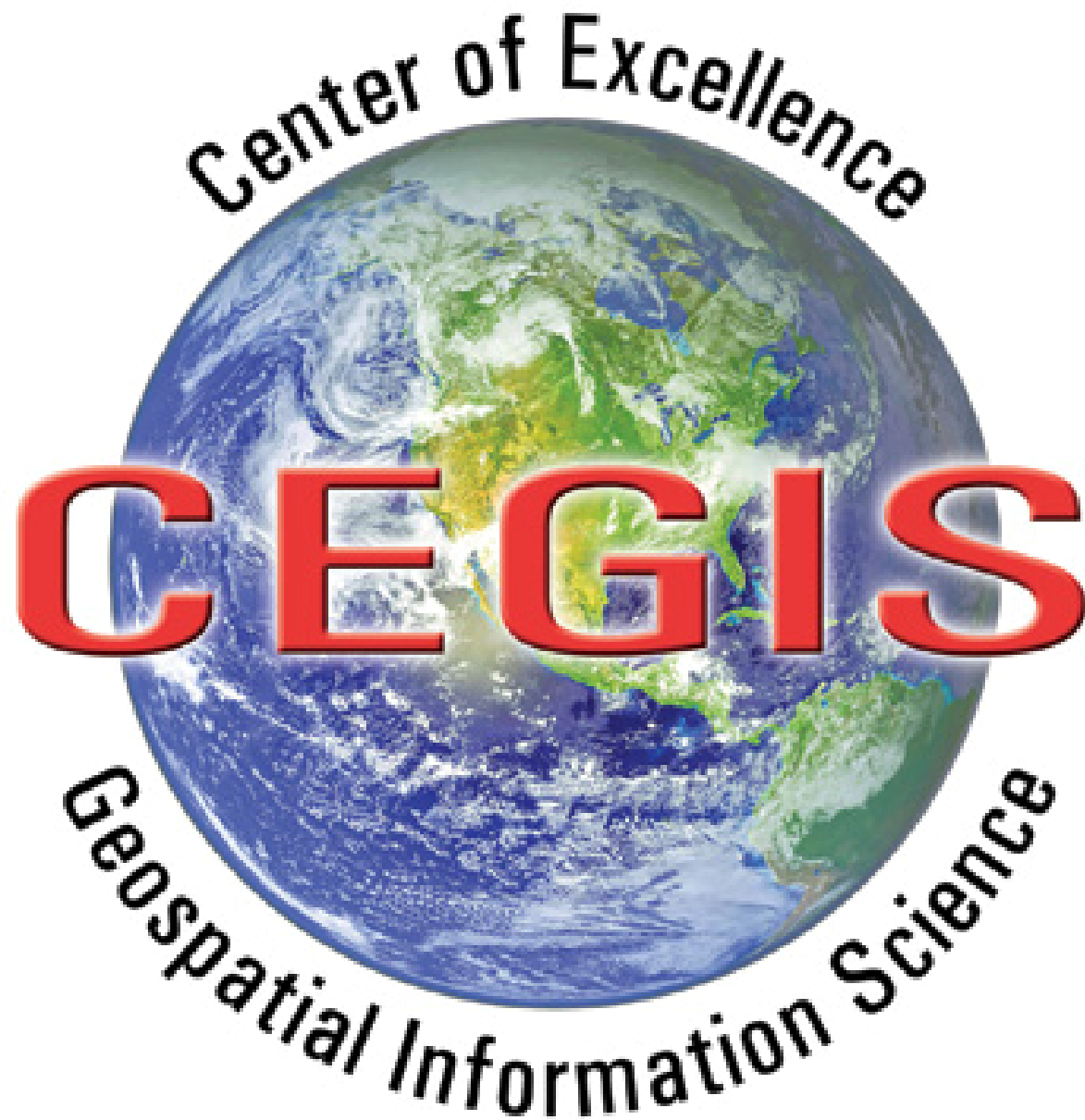




The USGS Center of Excellence for Geospatial Information Science

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Outline

**GIScience Research in the USGS
Center of Excellence for Geospatial
Information Science (CEGIS)
Implementing the NRC Report
The CEGIS 2007 Prospectus**

Geography Science Plan's Nine science goals:

Goals 8 and 9 and parts of Goal 5 are GIScience

<http://geography.usgs.gov/gcw/>

Science Goals

Basis of CEGIS Research

Goal 5 -- Develop credible and accessible geographic research, tools, and methods to support decision making related to the human and environmental consequences of land change.

Goal 8 -- Provide timely, efficient, and intelligent access to new and archived USGS geographic data needed to conduct science and support policy decisions.

Goal 9 -- Develop innovative methods of modeling and information synthesis, fusion, and visualization to improve our ability to explore geographic data and create new knowledge.

Center of Excellence for Geospatial Information Science (CEGIS)

CEGIS established in January 2006

CEGIS conducts, leads, and influences the research and innovative solutions required by the National Spatial Data Infrastructure (NSDI) and the emerging GeoSpatial Web

Virtual center with USGS and affiliated scientists from other organizations

CEGIS Mission

Provide leadership to identify, conduct, and collaborate on GIScience research issues of national importance

Assess, influence, and recommend for implementation technological innovations for geospatial data and applications.

Maintain world class expertise, leadership, and a body of knowledge in support of the NSDI.

The NRC Report

GIO contracted the National Research Council to prepare a research agenda for GIScience in the USGS, i.e., an agenda for CEGIS

The report includes 12 recommendations including both short-term and long-term research

Report available at:

http://books.nap.edu/catalog.php?record_id=12004

The NRC Study Overview

Short-term high priority projects

Already begun

2 to 4 year timeframe for research

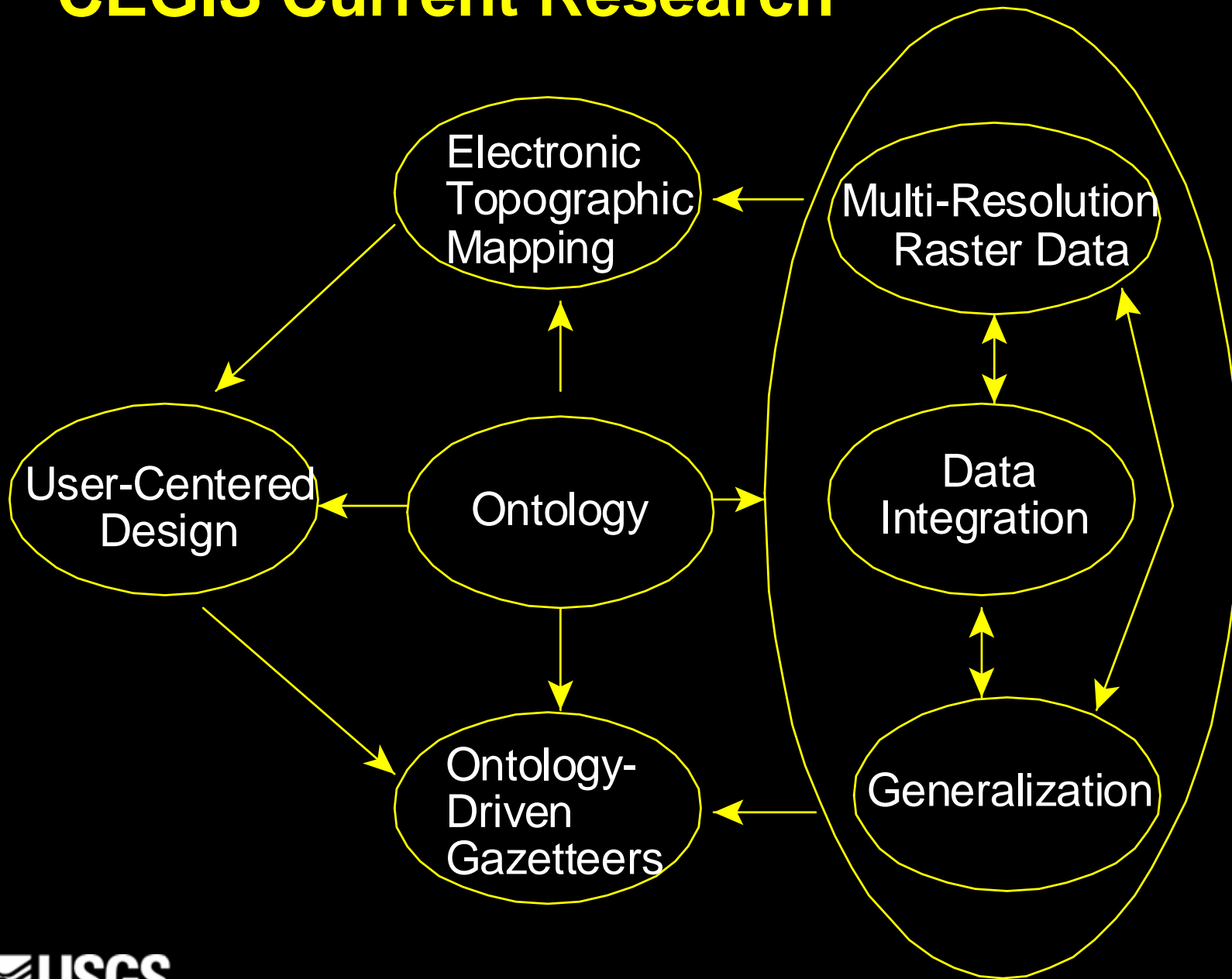
Basis of The National Map 3.0

Long-term projects

Begin on completion of short-term or after 2 years

Build the NRC vision for CEGIS and TNM

CEGIS Current Research



1) Geographic Feature Ontology

Objective: Research and design of a complete description of all semantic characteristics and relations among geographic features that are part of *The National Map*

Approach:

Feature Lists, Attributes, Relationships – Develop complete list of features for all data layers. The list includes attributes with possible values and relationships within a data layer and across data layers.

DB Implementation – Implementation of the features in a database environment. This will use the Best Practices Data model and interface to the Arc Geodatabase environment.

Ontology Examples/Problems

Stream

Mouth

Source

Bank

Shore

Direction

Terrain Features

Canyon

Walls

Ridge

How to define from a DEM?

Ontology Project Status

Comparison of feature, attribute, relationship lists done

DLG-E/DLG-F

SDTS

FGDC Framework

Beginning software testing

OWL

Protégé

Review of Best Practices Model

**Specialist meeting with UCGIS Winter Assembly, Feb
2009**

2) User-Centered Design for Web Services

Objective: Research and design of a human intuitive interface for *The National Map* viewers and access to all USGS data

Approach

User Survey – Complete interviews with users to determine needs and design of the Web interface and services. Coordination with Larry Sugarbaker’s user study.

Viewer Interface – Development of a viewer for *The National Map* based on the results of the user survey and the design.

3) Electronic Topographic Map Design

Objective: Research and design of symbology, type, layer structure, color hierarchy, and map layout for electronic topographic maps

Approach:

Design Review – Comprehensive evaluation of design requirements for Web-based topographic maps. This includes design of geopdf for control of layer presentation and design for both electronic and print versions of topographic maps.

Color Hierarchy – Development of rules for the hierarchy of colors to be presented for electronic topographic maps.

Current Work

Building 6 datasets complete with all TNM layers.

Becomes basis for the design

Also used for generalization

4) Data Integration -- Objective

Determine if different data layers can be integrated based on resolution, accuracy, and other metadata and explore automated methods to achieve horizontal and vertical integration of the 8 data layers of *The National Map*

Data Integration -- Current Results

Approximately 6 m RMSE appears integrated at 1:24,000 scale.

Can we use this as a specification to automatically decide if two layers can be integrated?

Generalization is the problem with smaller scales

We can automate transportation with images in urban areas (Contract to Knoblock, Geosemble?)

Data Integration -- Approach

Current Results to TNM – Implementation of the rules for integration developed thus far by CEGIS research to provide for broader testing with many different datasets. Implementation of test cases for automated integration of transportation and orthographic images based on the results of the USC research.

Other Layers – Extend methods for both determining possibilities of integration and automation techniques to layers other than transportation and orthographic images. Particular attention to hydrography and elevation.

5) Generalization

Objective: Research and design algorithms and procedures to change resolution/scale from high levels of detail to lower, e.g., from 1:24,000 to 1:100,000 scale

Approach:

Initial work with NHD to prune stream network and maintain characteristics to support current applications

NHD to TNM – Complete preprocessing requirements for the entire country for the NHD procedures. Develop any required new procedures for NHD.

Other Layers – Extend methods of generalization to other layers, particularly transportation.

Current Status

Preprocessing in process for NHD

Six test areas

Building all 8 layers for these areas

Support generalization and electronic topographic map design

6) Multi-Resolution Raster Data

Objective: Research and design rapid, web-based projection of multi-Gb datasets through *The National Map*

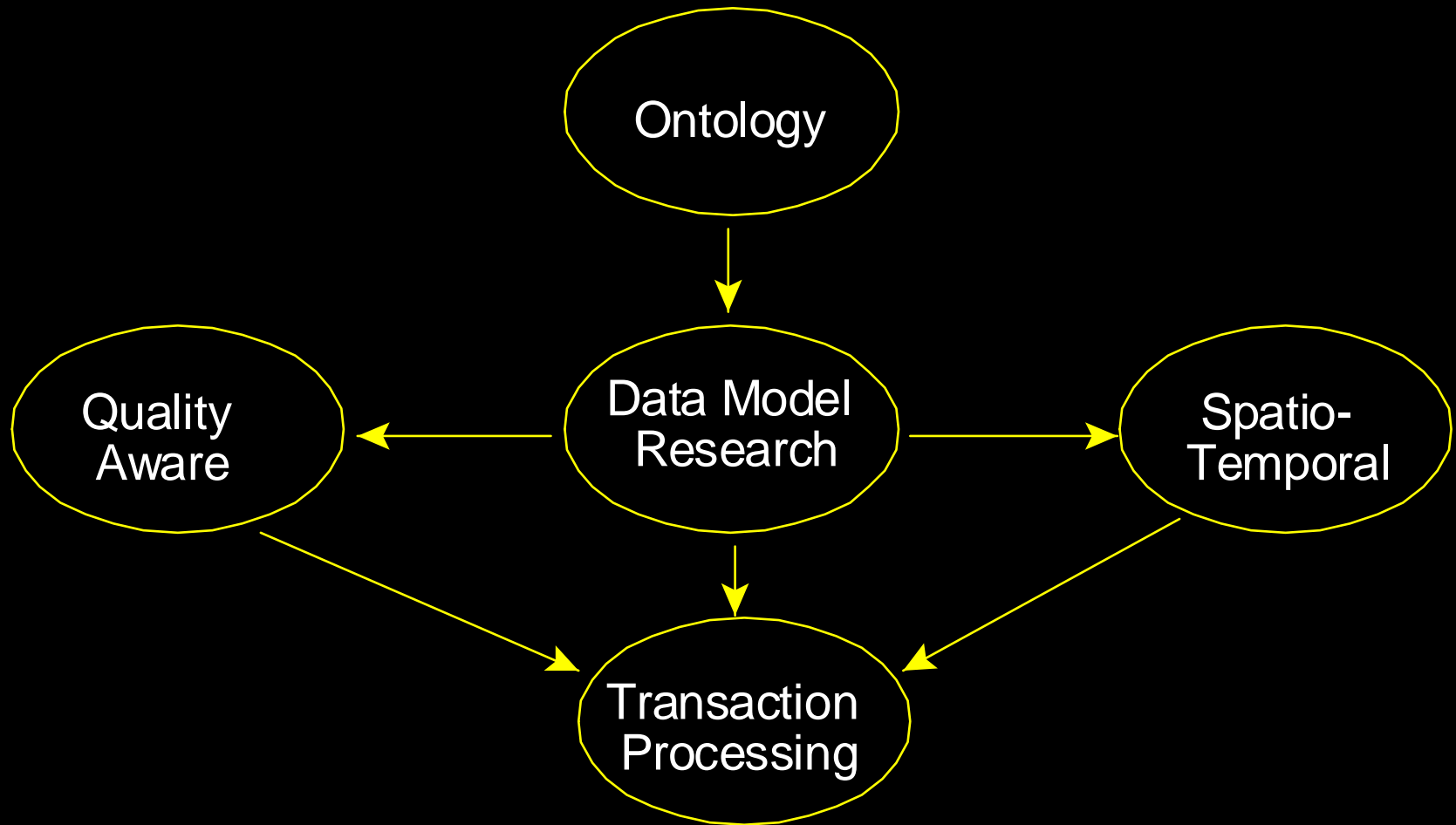
Approach

mapIMG refinement – Development mapIMG to work with local and regional data as well as global. Refine *mapIMG* to work with *The National Map* data.

Parallel/grid version.—develop a version of mapping *to work in parallel computing environment. Extend to Grid computing version.*

Web-based – Develop a Web-based version of mapIMG that ties to the UCD viewer interface and uses the parallel/grid version.

CEGIS Long-Term Research



7) Ontology-Driven Data Models

8) Quality-Aware Data Models

9) Spatio-Temporal Data Models

10) Transaction Processing

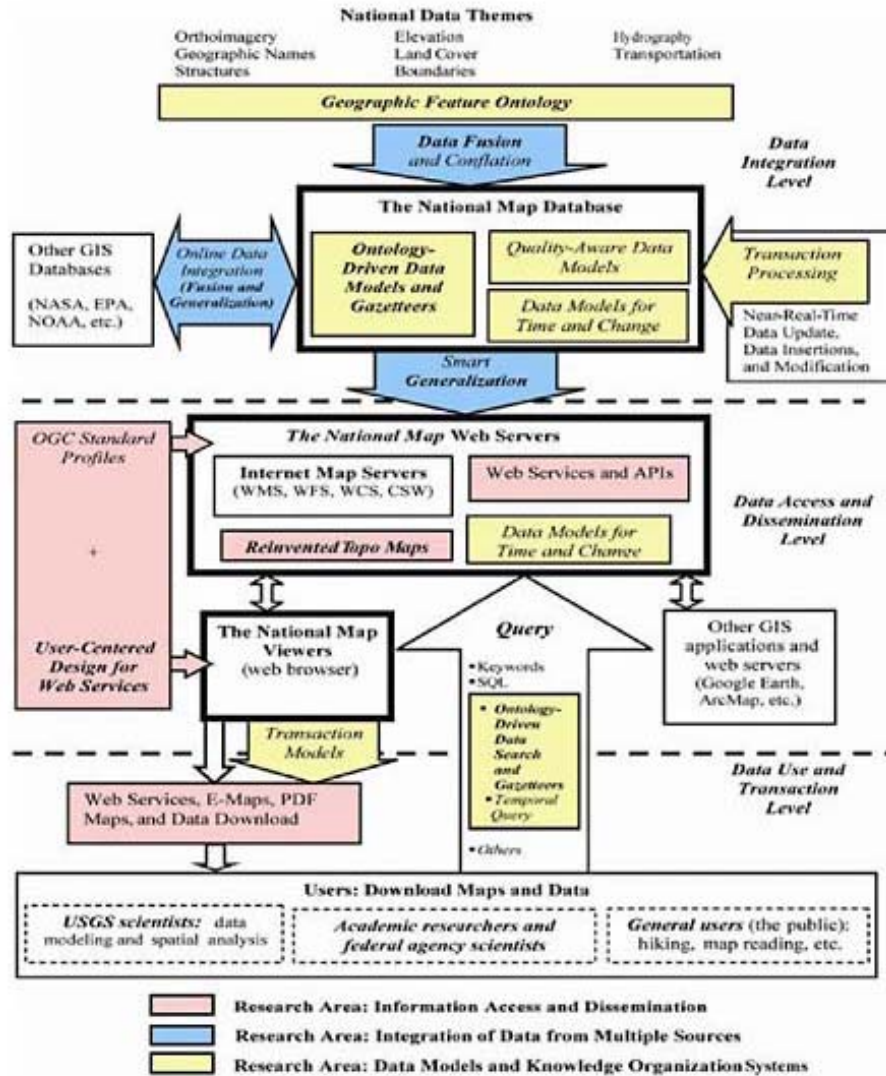
Milestone Descriptions

DM Design – Design of the appropriate data model.

DB Implementation – Implementation of the data model in a stand-alone environment.

DM in TNM – Implementation of the data model with *The National Map*.

TNM DM Operations – Establish operational capability of the data model with *The National Map*.



CEGIS Prospectus 2007

**Call for proposals Bureau-wide for GIScience
research projects**

71 proposals received

NSF-like review process

**Funded seven proposals totaling near \$1
million**

**Results will be presented in Reston in Summer
2008**



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