

## TARGETED EXCELLENCE COVER SHEET

### I. Project Title:

Geospatial Technology Infrastructure Enhancement Program – Phase II

### II. Brief Project Description:

Competency in geospatial technology and GIScience allows students/faculty to acquire, use, and interpret geographic information at multiple spatial and temporal scales. In addition, GIScience competency is critical in analyzing and communicating knowledge about the world around us. The goal of this proposed *Geospatial Technology Infrastructure Enhancement Program – Phase II* is to **establish a research Center of Excellence for Geospatial Technology and Applications** and continue the diffusion of GIScience and geospatial technologies throughout the general university community. Approval of this “Phase II” program will elevate Kansas State University to a leadership position in geospatial research for agricultural biosecurity (including food safety), biosciences, and environmental quality and serve as a necessary step toward international recognition of K-State for cross-disciplinary application of geospatial technologies. Though K-State may be considered to be “late adopter” in terms of geospatial technology, we now have the opportunity to leap forward and be an active participant and leader in what Dobson (1993, p. 437) has called “an intellectual revolution comparable to earlier intellectual revolutions prompted by the printing press and the computer.” This is especially true for the emerging research area of agricultural biosecurity.

The field of GIScience and supporting geospatial technologies fully compliments the university’s core missions, is an integral component of several other Targeted Excellence efforts and proposals, and will provide a springboard for the development of unique disciplinary and multidisciplinary programs (e.g., agricultural biosecurity, plant and animal disease modeling, spatial economics, interdisciplinary water resources assessment and modeling, and GIS-related certificate programs). The impacts resulting from approval of this proposal fit hand-in-glove with the published evaluation criteria for the Targeted Excellence initiative and include:

- Provides for the critical research faculty, facilities, and equipment needed to make K-State a premier institution in the application of GIScience and geospatial technologies, especially in the areas of agriculture and the environment.
- Builds from the existing strength of multidisciplinary GIScience research in the applied biological, physical, and social sciences to include geospatial research in business, veterinary medicine, and other areas currently under-utilizing this important technology.
- Provides comprehensive geospatial support for proposed/funded research projects, including several Targeted Excellence programs.

- Begins development of GIScience education and outreach services, including K-State Online GIS modules for a diverse array of large enrollment classes and graduate/undergraduate certificate programs in GIS and GIScience.

**III. Potential Impact and Intellectual Merit**

Complementing existing research strengths, approval of the proposed *Geospatial Technology Infrastructure Enhancement – Phase II* program will elevate Kansas State University to a leadership position in GIS-based research in the specific areas of agriculture, agricultural biosecurity, and environmental quality. The field of GIScience and supporting geospatial technologies fully supports the university’s core missions, is an integral component of several other Targeted Excellence proposals, and will provide a springboard for the development of unique disciplinary and multidisciplinary programs. Strengthening the human and equipment GIScience infrastructure will enhance the status of K-State in the areas of GIScience and geospatial technologies while helping students and faculty/staff to maximize the effectiveness of geospatial technologies in the curriculum, basic research, applied studies, and outreach services. Approval of this proposal will update the university’s GIScience research infrastructure and further strengthen K-State’s contribution to the ongoing discussion of national security through innovative research and applications with the additional internal benefits of improved cross-campus research collaboration and the potential to attract significant extramural funding.

**IV. Amount Requested, Proposed Matching Funds (Estimate) and Duration:**

1. Total Amount Requested: \$931,599 over 5 years.
2. Mean University Geospatial Extramural Funding (1995-2004): \$2,037,822/yr

**V. Team Members (Indicate Project Director) (Name, Title, Department)**

Project Director: J.M. Shawn Hutchinson, Assistant Professor and Director,  
 Geographic Information Systems Spatial Analysis Laboratory (GISSAL)  
 Co-Project Director: John A. Harrington, Jr., Professor and Head, Department of  
 Geography

**VI. Amount Requested, Proposed Matching Funds (Estimate) and Duration:**

1. Total Amount Requested: \$931,599 over 5 years.
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**VII. Potential Reviewers**

1. Dr. James K. Koellier, Department of Biological and Agricultural Engineering, Kansas State University
2. Dr. Dennis Law, College of Architecture, Planning, and Design
3. Dr. Jerome Dobson, Department of Geography, University of Kansas

**VIII. Submission Date: February 14, 2005**

**Approvals:**

**Project Directors**

Shawn Hutchinson \_\_\_\_\_

John Harrington \_\_\_\_\_

**Department/Unit Heads**

John Harrington \_\_\_\_\_

John Harrington \_\_\_\_\_

**Deans**

Stephen White \_\_\_\_\_

Stephen White \_\_\_\_\_

**Team Members:**

Eric Bernard \_\_\_\_\_

Rob Caffey \_\_\_\_\_

Bradley DeGroot \_\_\_\_\_

Larry Erickson \_\_\_\_\_

Curtis Kastner \_\_\_\_\_

Mary Knapp \_\_\_\_\_

John Reese \_\_\_\_\_

James Stack \_\_\_\_\_

Marty Vanier \_\_\_\_\_

Donald von Bergen \_\_\_\_\_

Steve Welch \_\_\_\_\_

College of Architecture, Planning and Design

Office of Mediated Education

College of Veterinary Medicine

College of Engineering

Food Safety and Security Program

K-State Research and Extension

College of Agriculture

College of Agriculture and Great Plains Diagnostic Network

National Agricultural Biosecurity Center

College of Technology and Aviation

College of Agriculture

## PROJECT SUMMARY

*Geospatial Technology Infrastructure Enhancement – Phase II* will assist Kansas State University in our goal of being a top-ten land grant institution. This Targeted Excellence proposal is an interdisciplinary effort to advance Kansas State University's focus on and capabilities in geospatial technologies and geographic information science (GIScience). The primary purpose of this effort is to **formally establish a research Center of Excellence in Geospatial Technology and Applications and continue the diffusion of GIScience and geospatial technologies into the general university community.**

GIScience is an emerging interdisciplinary field that aims to advance basic understanding of the use of digital geographic information to acquire and communicate knowledge about the world. GIScience bridges multiple disciplines including agronomy, computer science, ecology, economics, geography, landscape architecture, psychology, mathematics, statistics, engineering, surveying, marketing, tourism, and the earth sciences. Faculty, staff, and students who actively use geographic information systems (GIS) and related technology reside throughout the university. Geospatial technologies form a vital suite of methods and tools applicable for nearly all academic units. While the current environment for geospatial technologies is certainly positive, many peer institutions have been able to gain a competitive edge over K-State in terms of the number of trained educators among the ranks of tenure-track faculty, distance education courses, extension workshops, and continuing education opportunities.

In the context of geospatial technologies, specific suggestions are made to address weaknesses and enhance strengths in each of the three core mission areas of Kansas State University, with an **emphasis on the research domain.** Administered by a multidisciplinary GIS Steering Committee, acceptance of this proposal will dramatically increase the realization of our individual and collaborative research goals and allow for initial steps to be taken in the establishment of a Center of Excellence for Geospatial Technology and Applications. First, it provides for the necessary staff, centralized services, and data-sharing capabilities that will significantly strengthen our ability to compete both more frequently and more successfully for outside funding. Second, it strengthens our teaching mission by making available learning tools and faculty who will specialize in the application, methods, and theory of spatial data. Finally, this proposal establishes the means by which this university can more effectively serve off-campus students, professionals, and the citizens of Kansas. By providing for the critical faculty, facilities, and equipment, K-State will have the opportunity to become **a premier institution in the both the instruction and application of GIScience and geospatial technologies.** Building from the existing strength of multidisciplinary GIScience research in the biological and physical sciences, additional strengths can be achieved in the social sciences, business, and veterinary medicine.

*Geospatial Technology Infrastructure Enhancement Program – Phase II* will help elevate Kansas State University to a leadership position in GIS education and service for the State of Kansas, the United States, and the world. The field of GIScience and supporting geospatial technologies fully compliments the university's core missions, is an integral component of several other Targeted Excellence proposals, and will provide a springboard for the development of unique disciplinary and multidisciplinary programs (e.g., agricultural biosecurity, plant and animal disease modeling, spatial economics, and a new Undergraduate Certificate in GIS).

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# 1 GISCIENCE INFRASTRUCTURE PHASE II – MOVING FORWARD

*“Science has discovered geography.”*

Douglas B. Richardson (2004)  
Former Executive Director of the Association of American Geographers

Recognized as one of the “ten geographic ideas that changed the world”, GIS has surpassed traditional cartography as the basic tool of spatial research and visualization and spawned even spawned its own distinct field of inquiry (Goodchild 1997). Geographic Information Science (GIScience) is an emerging interdisciplinary field that aims to advance basic understanding of the use of digital geographic information to acquire and communicate knowledge about the world. GIScience bridges multiple disciplines including agronomy, computer science, ecology, economics, geography, landscape architecture, psychology, mathematics, statistics, engineering, surveying, marketing, tourism, and the earth sciences. Faculty, staff, and students who actively use geographic information systems (GIS) and related technology reside throughout the university. In order to fulfill its historic educational mission in teaching, research, and public service, K-State faculty must recognize the research and educational value of GIScience and related geospatial technologies, spatial analysis, and geographic visualization in its continuing effort to build a top-ranked land grant university.

Administrators and some faculty at K-State recognize the importance of this vital suite of technologies to nearly all academic units. Comments regarding GIS include, “**GIS is as important as composition**” in terms of basic student preparation and “**GIS represents a core of our future vision**” as we reshape courses and curricula to meet the challenge of the new millennium. Our university must provide students with at least a basic understanding of what geospatial technologies are, why they are important, and how to use them correctly in field ranging from sociology to civil engineering. We cannot have students leave Kansas State University without having some basic competency with geospatial technology and spatial analysis methods identified in 2004 by the U.S. Department of Labor as one of the three most important emerging and evolving field in both the private and public sectors (Gewin 2004).

Funding awarded through last year’s successful Targeted Excellence proposal, *GIScience Infrastructure Enhancement Program*, has enable K-State to take initial steps to “upgrade” our collective GIScience capabilities. Although not yet through the first year of the grant, the \$330,000 award (over five years) has been used to hire a Applications Developer/Geodatabase support person and pay for data, production, and deployment servers devoted to geospatial research, data storage, and internet mapping service (IMS) communication and outreach services. Other significant accomplishments include:

- Membership in the University Consortium for Geographic Information Science (UCGIS)
- Formation of a campus-wide GIS Steering Committee to foster communication and advise the Provost and VPAST concerning geospatial technologies
- Contributing a GIS page to the university Congressional Briefing Book seeking an appropriation of \$4.9 million
- Approval of the Undergraduate GIS Certificate and continued growth of the Graduate Certificate in GIScience programs
- Conducting informal GIS briefings for Deans and other administrators

An extension of that project, this year’s proposal, *GIScience Infrastructure Enhancement Program – Phase II*, seeks to provide the groundwork for a research **Center of Excellence in Geospatial Technology and Applications** with emphases in the areas of agricultural biosecurity (including food safety), biosciences, and environmental quality. *Phase II* emphasizes research over teaching and outreach to significantly strengthen, both in the short and long-terms, K-State’s ability to successfully compete for

geospatial technology-based extramural funding. Also identified in this proposal are “spin-off” or secondary benefits that will make incremental improvements in GIScience teaching and outreach.

## 2 LAND GRANT VALUES WITH AN EMPHASIS ON RESEARCH

Since the first remote sensing course was offered at Kansas State University in 1976, the broad field of geospatial technologies, and now GIScience, has grown tremendously (Nellis et al. 1992). In the early 1990s, the major geospatial research foci were in natural resource assessment and GIS approaches to landscape ecology analysis (e.g., Nellis and Briggs 1989; Nellis et al. 1990; Su et al. 1990; Briggs and Nellis 1991). The Geographic Information Systems Spatial Analysis Laboratory (GISSAL) was created in August 1990 as the university made its first concerted effort to develop adequate hardware and software infrastructure to support remote sensing, GIS, and computer mapping research and education. Developments at K-State were paralleled at the state level in terms of administrative coordination. The Kansas GIS Policy Board was created in 1989 by an executive directive issued by then Governor Hayden, and continues to operate today (Bannister et al. 1998).

Until last year’s successful Targeted Excellence proposal, *GIScience Infrastructure Enhancement*, there has not been a clearly defined and organized proposal for the campus-wide advancement of geospatial technologies since 1995 – the year when the Departments of Agronomy and Geography initiated the university GIS software site license with Environmental Systems Research Institute (ESRI). As highlighted in last year’s proposal, *Geospatial Technology Infrastructure Enhancement*, the importance of expanding the geospatial technology curriculum, establishing a sound education base in geospatial technology for later application courses, providing leadership in continuing education and extension services, faculty assistance, and technical advisory support remain critical to the advancement of GIScience and GIS-assisted applications at Kansas State University and our collective ability to conduct sound, cutting-edge multidisciplinary research.

The primary purpose of last year’s effort was to provide the means to facilitate the diffusion of GIScience and geospatial technologies into the general university community and included specific objectives to enhance university status and capabilities in the traditional land grant areas of research, teaching, and outreach. The conceptual model for that proposal is illustrated in Figure 1 and remains as our long-term planning framework. **This year’s proposal represents a much more narrow focus that targets key infrastructure improvements in the research domain.** In addition to emphasis placed on self-sustaining basic and applied GIScience research, objectives are also proposed that will enable us to continue integrating geospatial technology into the university’s teaching and outreach missions. The proceeding sections detail the motivation for, and plan to accomplish, specific tasks in each area.

### 2.1 Research – Excellence in Geospatial Technology and Biosecurity

*“Geographic information technologies such as GIS, combined with the power of the Internet for rapid sharing of information, create an exciting range of possibilities for those charged with anticipating and responding to terrorist acts.”*

Michael F. Goodchild (2003), University of California, Santa Barbara  
Member, National Academy of Science

Established in 1990, GISSAL is the university hub for spatial research and geospatial education/outreach activities at Kansas State. Owing largely to the “activism” of faculty directors of GISSAL and key researchers in few select departments (such as agronomy, biology, and geography), Kansas State University has been remarkably successful at earning extramural support (>\$18 million since 1995) for research projects with a significant GIS or geospatial component. Expert faculty in GIS-based applications and GIScience theory are able to garner considerable support for research. Not surprisingly, GIS and geospatial technologies play significant roles in several other Targeted Excellence projects, both this year and last.

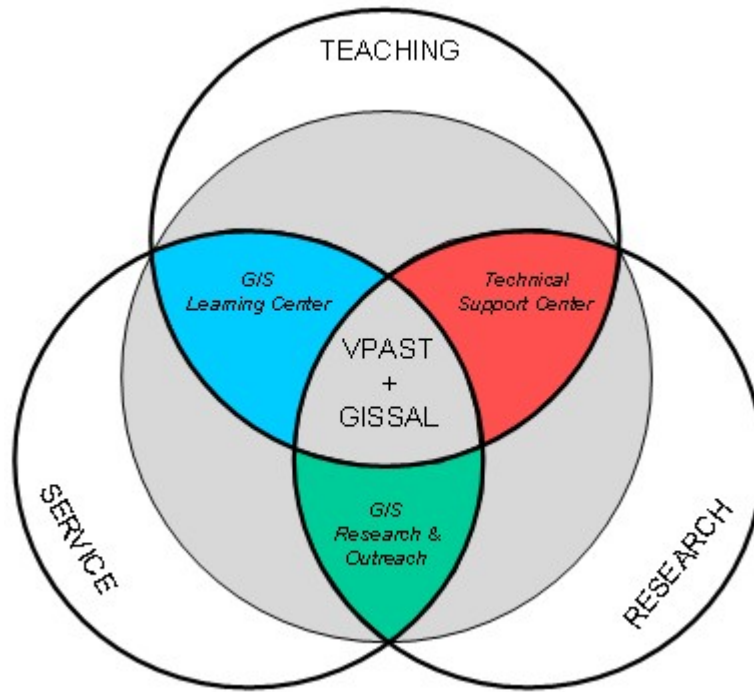


Figure 1. Conceptual design for the integration and management of proposed geospatial technology enhancements at Kansas State University.

Kansas State University has historically recognized the importance of pre- and post-harvest food safety and agricultural biosecurity research and continues to commit significant resources further strengthen this aspect of university operations. Similarly, in the post 9/11 world, geographers were quick to identify how place, culture, and environment are critical components to better understanding the causes of, and how to best respond to, terrorism (Cutter et al. 2003). An important common linkage between these “geographical dimensions” of terrorism is the use of geospatial data, technologies, and techniques in basic research, decision support, and communication.

Kansas State University is in an ideal position to further our understanding of how to apply geospatial techniques and technology to reduce the significant threat posed by “agrorterrorism”, including the vulnerability of the U.S. food supply and production system and impacts on public health and safety. Agricultural communities, and natural systems on which they rely, are vulnerable to animal/plant pathogens and invasive organisms. Assuring secure food supplies requires dynamic monitoring, mapping and reporting, analysis, and prediction of disease, disease vectors, and chemical/biological indicators over large geographic areas (NRC 2002, Thomas et al. 2002). Current GIScience efforts at Kansas State are contributing to improved applied research and risk reduction through vulnerability analyses, incident response, and detection/prevention technologies by addressing the geography of human and agricultural systems.

Projects funded by the USDA Animal and Plant Health Inspection Service (USDA-APHIS) and affiliated with the National Agricultural Biosecurity Consortium include using geospatial techniques to screen potential animal carcass disposal sites and analyze plant pathways. Carcass disposal efforts identify and map locations where models predict minimal environmental and human impacts resulting from disposal. Introduction of non-native disease vectors into agricultural production systems, whether intentional or accidental, also poses a significant threat (Hutchinson et al. 2003). Rapid detection and containment minimizes economic/public health impacts of agricultural disease outbreaks. Kansas State

researchers have used GIS and ecological niche models to predict and map the spread of exotic soybean aphids (*Aphis glycines*). Accurate predictions of future aphid distributions improved the efficiency of field monitoring and guided producers in pesticide application decisions.

Similar dynamic mapping, monitoring, and modeling capabilities are currently being evaluated by the USDA-funded Great Plains Plant Diagnostic Network (GPDN) to assist in plant disease risk management. With support from the USDA and Kansas Animal Health Department, Kansas State has partnered with Sandia National Laboratory to develop an Internet-based system for the rapid detection and reporting of infectious bovine disease outbreaks called Rapid Syndrome Validation Project-Animals (RSVP-A). Using cellular telephones or personal digital assistants (PDAs), veterinarians can access RSVP-A to enter clinical information observed in the field. Incorporation of geospatial techniques promises to improve detection and monitoring capabilities. Additional USDA funded research has leveraged the coalescence of groundwater and climate data for use in models of economics, water quantity, and water quality – key components of vulnerability and risk assessment.

The examples cited above document a small, but excellent start in merging the power of geospatial technology with important research questions and practical applications. The objective of this proposal is to formally **establish a Center of Excellence in Geospatial Technology and Applications** to further strengthen existing agricultural biosecurity, bioscience, and environmental quality programs with the goal of minimizing threats to plant and animal health and to mitigate terrorist attacks on U.S. agriculture. Areas of future research emphases include the design of multidimensional agricultural risk assessments, continued disease and exotic species predictive modeling, and development of a GIS-based agricultural security data model. General priorities in agricultural security research include improved methods for identifying attacks and confirmation of pathogen/agent, identifying exposed animal and plant populations, monitoring and controlling the movement of infected or at-risk animals and plant products, and analysis of effective and safe methods for disposing of diseased animals/plants and where that disposal should occur. Additional areas of emphasis include species neutral surveillance techniques and methods to enhance agricultural security “situational awareness” – especially when dual benefits are possible from a pre- and post-harvest food safety perspective. Examples of priority areas of collaborative geospatial application research mentioned by members of the campus GIS Steering Committee include (in no particular order):

- Disease and disease vector modeling (post-hoc, real-time, and prediction) using genetic algorithms, BIOCLIM, and agent-based techniques
- Incident analysis – intentional or accidental; does the spread follow a “normal” or “expected” pattern?
- Event response and management – GIS data needs on-hand before an emergency for decision support; increased responsiveness during a crisis
- Environmental impact analysis – carcass disposal decisions (where, what form), fate and transport of carcass contaminants
- Biosecurity data model development – an “ArcHydro” for agricultural biosecurity
- Livestock tracking – implement K-State animal ID system in GIS setting, backtrack locations/source of diseased animals, consumer notification
- Food Safety and Security Program initiatives
- Groundwater-based agriculture economies
- Demonstration of GIS data management/analysis capabilities supporting NEON, CUAHSI, and EKAT

Campus departments and research units who have already collaborated on similar research, or who will be key contributors in future grants include (in alphabetical order):

- Department of Agricultural Economics

- Department of Agronomy
- Department of Animal Sciences
- Department of Biological and Agricultural Engineering
- Division of Biology
- Department of Civil Engineering
- Department of Computer and Information Sciences
- Department of Entomology
- Department of Landscape Architecture and Regional and Community Planning
- Food Safety and Security Program
- Department of Geography
- Center for Hazardous Substance Research
- National Agricultural Biosecurity Center
- Plant Pathology
- K-State Research and Extension
- College of Veterinary Medicine

Researchers from many of these organizations have been involved in the planning of this proposal and are included as team members of this proposal.

### 2.1.1 Phase I Accomplishments

A brief summary of research-related objectives realized during the first year of *Geospatial Technology Enhancement Program – Phase I* are listed in Table 1. Approximately 97% of all funding received through *Phase I* will be used for the salary of a support staff member and the purchase computer hardware and software.

PHASE I OBJECTIVE	NOTES
Recruit and Hire Application Developer/Geodatabase Specialist	<ul style="list-style-type: none"> <li>▪ Mr. Rick Chubb hired and began work in January 2005.</li> <li>▪ Employed by the Office of Mediated Education with an office in GISSAL</li> <li>▪ Work priorities managed by campus GIS Steering Committee</li> <li>▪ K-State representative to State of Kansas GIS Technical Advisory Committee</li> </ul>
Purchase GIS Server	<ul style="list-style-type: none"> <li>▪ Server specifications determined in January 2005</li> <li>▪ A three server system to support application development and deployment</li> </ul>
Purchase Software	<ul style="list-style-type: none"> <li>▪ Some of the \$10,000 allocation for software will be used to acquire Oracle Spatial Database software and/or help offset the cost of the university ESRI GIS site license in FY 06.</li> </ul>

Table 1. Completed research objectives during Year 1 of the Geospatial Technology Infrastructure Enhancement Program.

### 2.1.2 Phase II Objectives and Implementation Timeline

Research enhancements begin with the recruitment and hiring of several new personnel. First, the ability to add a new GIScience faculty member will increase the ability of K-State **to compete more frequently and more successfully for outside funding** through individual or multidisciplinary collaborative projects. In terms of the number of faculty trained in various aspects of GIScience, K-State still lags far behind its peer universities and other prominent land grant institutions. For example, Pennsylvania State University identifies approximately 100 faculty with geospatial expertise. At K-State, that number is closer to 15 tenure-track faculty members.

As measured by an informal survey of extramural funding received by academic departments and research units in 2000, researchers examining natural resource and environmental topics are clearly leading the GIS movement at K-State. To complement this existing relative research and teaching

strength, it is recommended that a **tenure-track GIScience expert in the social sciences** be hired. A new social science faculty member can take advantage of many grant requests for proposal opportunities that seek or expect application of geospatial techniques in the hazards, medical, human-environment interactions, economic, or transportation fields.

It would be unreasonable to expect one faculty member to assume the responsibility for day-to-day management of the Center of Excellence in addition to maintaining a normal teaching, research, and service/outreach profile. However, one summer month of salary can be provided to compensate the Center director for the necessary administration and leadership required for success. A new **post-doctoral research associate** should be hired to work closely with the Center director regarding laboratory management and build a complementary extramurally-funded research program. The research associate would also be the Center's primary contact for grant writing assistance and technical assistance.

An opportunity also exists to fundamentally alter the way K-State faculty and students interact with basic and "value-added" digital geospatial data. Progression of a typical GIS project begins with the acquisition of basic data from one or more archives maintained at the state or federal level. In many cases, it is necessary to create new data (e.g., determination of landcover types based upon a time-series of satellite imagery). While the end result of this process is often scholarly publication, the data are frequently relegated to storage. A new **University Spatial Data and Application Server** can be used to archive this data that can then be expanded or improved upon in future research. Such a system can be implemented using *Phase I* resources such as the Application Developer/Geodatabase Specialist and GIS server infrastructure. To ensure reliable operation, it should be emphasized that such a system should be comprised of redundant database and spatial database engine (SDE) servers with an additional one Terabyte of space on the SAN. Given normal replacement schedules and future space requirements, the server will need to be replaced, and an additional Terabyte of SAN space added, 3-4 years after the system goes online. Funds to provide this equipment replacement ARE NOT requested in this proposal but reliable and robust performance is necessary to serve GIS-based applications such as Internet mapping services (IMS), thematic packages of data via web services, and real-time data reporting systems (e.g., for the Great Plains Diagnostic Network and the Kansas Weather Data Library).

The Targeted Excellence program is also being asked to provide funding for two **graduate research assistants** to be housed in GISSAL or the future Geospatial Technology Commons to initiate agricultural biosecurity, bioscience, and environmental research projects that will provide the foundation for or prototypes of future grant work and peer-reviewed manuscripts. One GRA is requested for Year 1 with a second position added in Year 2. Both GRA's would be funded through Year 5 of the project. In addition to the necessary staff support, new computer workstations will be needed as the current computing infrastructure in GISSAL is currently devoted to existing grant work

Since 1996, Kansas State University has maintained an ESRI GIS software site license. This license, managed by CNS, permits use of most ESRI GIS products, such as ArcView 3.x and ArcGIS. Currently, funding for the ESRI site license is accomplished on a fragmented basis, with individual departments, research centers, and colleges "chipping in" amounts perceived to be in concert with their individual usage. Such a funding strategy results in instability and potentially dangerous implications for meeting the demand of a recurring annual cost. A current concern is accurate estimation of demand across units and possible perceptions of inequitable cost sharing. Another is the lack of support by entire colleges that should be active in interdisciplinary geospatial research. A major difference in how the ESRI site license is funded at K-State versus other universities is the relatively low contribution received from the central administration and/or computer and information services. **Centralized ESRI site license funding** should be implemented and more funding is requested in to provide that service for the first year, with decreasing amounts through Year 4 to allow for researchers the opportunity to offset this essential cost through grants.

Finally **professional development** funds are requested to assist K-State researchers to meet with funding agencies, participate in research planning meetings, and attend select training events and professional conferences. Combined with the minimal staffing requirements described above, the

availability of “discretionary” travel dollars is the foundation of the proposed Center’s ability to successfully build a GIScience research program.

The research component of this *Geospatial Technology Infrastructure Enhancement - Phase II* proposal will establish a multidisciplinary Center of Excellence for Geospatial Technology and Applications at Kansas State University. The Center will benefit by having a director who has salary dollars linked to that administrative responsibility, a post-doctoral research associate to conduct research and manage day-to-day activities, and a “starter” staff of graduate research assistants to immediately address urgent GIScience issues related to agricultural biosecurity, biosciences, and environmental quality. Specific objectives for the research component to this proposal are listed below in Table 2.

OBJECTIVES	DESCRIPTION
Recruit/Hire New GIS Faculty Member	<ul style="list-style-type: none"> <li>▪ Fully fund a new tenure-track faculty member specializing in GIS applications in the social sciences, hazards, and/or medical geography</li> <li>▪ Faculty line continued by College of Arts and Sciences after project conclusion</li> </ul>
Recruit/Hire GISSAL Post-Doctoral Research Associate	<ul style="list-style-type: none"> <li>▪ Supervise day-to-day operations in GISSAL</li> <li>▪ Develop/Maintain a GIS research program</li> <li>▪ Provide GIS subject matter and technical support for research projects.</li> <li>▪ Assist faculty in the preparation of grant proposals with a GIS component.</li> </ul>
Recruit/Hire Graduate Research Assistants (2)	<ul style="list-style-type: none"> <li>▪ Provide immediate assistance in grant preparation, field work, research projects, and prototype GIS models and tools.</li> </ul>
Summer Salary for Center Director	<ul style="list-style-type: none"> <li>▪ Compensate the Center of Excellence Director for administrative and service responsibilities associated with overseeing a university laboratory.</li> </ul>
Pay for ESRI GIS Software Site License	<ul style="list-style-type: none"> <li>▪ Central funding for the annual \$25,000 commitment required to pay for necessary GIS software</li> <li>▪ No funds requested after Year Four</li> </ul>
Purchase GISSAL Computer Workstations	<ul style="list-style-type: none"> <li>▪ Expand Center computer infrastructure to immediately accommodate increased workload.</li> </ul>
Provide Professional Development Funds	<ul style="list-style-type: none"> <li>▪ Funding to pay for travel in support of grant opportunities (e.g., UCGIS, NSF) and research meetings (e.g., NEON, CUAHSI)</li> </ul>
Develop University Spatial Data Server	<ul style="list-style-type: none"> <li>▪ Use Application Developer/Geodatabase Specialist hired under the <i>Phase I</i> program to design new GIS data server</li> </ul>

Table 2. Proposed research infrastructure enhancements.

Table 3 presents a timetable for implementing research-related objectives to staff the Center of Excellence for Geospatial Technology and Applications, improve grant writing capabilities, and stimulate innovative research and applications. The amount of requested funds start high to help “jump-start” activities but, with the exception of the new faculty member and summary salary for the Center director, decline by Year 5 to reflect the increasing self-sufficiency gained by anticipated extramural projects.

## 2.2 Teaching – Programmatic and Curricular Enhancements

Availability of faculty who specialize in the applications, methods, and theory of spatial data and associated tools are an essential prerequisite for adequately preparing students to meet the increasing geospatial demands of private and public sector employers. Kansas State University must affirm its commitment to the teaching component of geospatial technology by **hiring capable faculty** and related support personnel.

K-State faculty currently offer geospatial technology or applications courses in the curricula of only four departments – agronomy, civil engineering, geography, and landscape architecture/regional community planning. A diverse curriculum, assembled by trained experts, is essential to effectively teach more students about geospatial technology, its underlying theory, and how to properly apply this technology. The new social science faculty member would be responsible for developing an introductory GIS course focusing on socio-economic applications, one (or more) courses that take advantage of his/her research interests, and alternate with existing GIS faculty in the Department of Geography to develop and offer a **new advanced GIS course** (e.g., GEOG 808 GIS III).

ACTION/DELIVERABLE	YR 1	YR 2	YR 3	YR 4	YR 5
Recruit/Hire New GIS Faculty Member					
Recruit/Hire GISSAL Post-Doctoral Research Associate					
Recruit/Hire Graduate Research Assistants					
Purchase GISSAL Computer Workstations					
Pay for ESRI GIS Software Site License					
Provide Supplement Research Travel Funds					
Provide Summary Salary for GISSAL Director					
University Spatial Data Server Online					

Table 3. Timeline of proposed research activities.

A promising and efficient method to expose a large population of K-State undergraduates to GIScience and GIS technology is through the development of **learning modules** for large enrollment classes in all colleges at Kansas State (e.g., AGRON 305 Soils, CE 015 Engineering Assembly, GENAG 101 Ag Orientation, GEOG 100 World Regional Geography). Such modules, delivered through K-State Online and designed by teams of subject matter experts working with personnel from the Department of Geography, GISSAL, or the future Geospatial Technology Commons, are an innovative and effective means to develop cognitive strategies among the general student body whereby spatial reasoning can increasingly be applied to relevant issues outside (and also inside) the geography classroom (Macaulay 1994; West 2004). The promise of integrating geospatial technologies into the engineering, social science, and biophysical science classroom is the opportunity to present “contextually rich” learning environments where instructors can develop critical thinking skills, methods of scientific inquiry, and highlight the geographies inherent in pressing societal issues (Wilder et al., 2004; Tinker 1992). The ability of faculty to successfully use the “teaching with GIS” approach is not hampered by technological diffusion, but rather the effectiveness at which the curricular value is made clear, both to students and faculty (Bednarz and Ludwig 1997). GIS learning modules for classes across campus will be a major step towards increasing student spatial reasoning skills at K-State.

In addition to the module approach, increasing the general literacy of K-State students in geospatial technologies can be substantively improved by incorporating critical foundation courses in the University General Education (UGE) curriculum. As part of this research-oriented program, **UGE proposals** will be submitted to include GEOG 302 (Cartography and Thematic Mapping) and GEOG 508 (Geographic Information Systems I) as UGE courses.

### 2.2.1 Phase I Accomplishments

Two major teaching objectives were met during the first year of the GIScience Infrastructure Enhancement Program. The **Graduate Certificate in GIScience**, first available to K-State students in 2003, remains a popular option for graduate students in several disciplines. To date, seven have successfully completed the rigorous requirements of the certificate program, including students from the Department of Geography, Department of Geology, Division of Biology, and Department of Computer and Information Sciences. In 2004, the Faculty Senate approved an **Undergraduate GIS Certificate**. A summary of teaching accomplishments during Year 1 of the *Geospatial Technology Infrastructure Enhancement Program* are summarized in Table 4.

COMPLETED OBJECTIVE	DESCRIPTION
Undergraduate GIS Certificate	<ul style="list-style-type: none"> <li>▪ Approved by the KSU Faculty Senate in 2004 with a start date of Spring 2005.</li> <li>▪ Created due to high student demand for undergraduate equivalent to Graduate Certificate in GIScience Program</li> </ul>
Graduate Certificate in GIScience	<ul style="list-style-type: none"> <li>▪ Implemented in 2003, and administered by the Department of Geography</li> <li>▪ 7 students, from 4 departments, have completed the requirements</li> <li>▪ Approximately 12 students currently enrolled</li> </ul>

Table 4. Completed teaching-related objectives during Year 1 of the GIScience Infrastructure Enhancement Program.

### 2.2.2 Phase II Objectives and Implementation Timeline

The hiring of a new tenure-track GIS faculty member with social science research interests in hazards, medical geography, or economics would provide the university with the subject matter expert needed to not only realize gains in extramural grant awards, but also expand the GIScience curriculum (e.g., add new course GEOG 808 Advanced GIS) and begin development K-State Online GIS modules. With an additional faculty line filled, the opportunity will also exist for completing proposals to nominate two basic geospatial technology courses, GEOG 302 (Cartography and Thematic Mapping) and GEOG 508 (Geographic Information Systems I), for the University General Education curriculum. Table 5 presents a timetable for teaching milestones in support of proposed programmatic and curricular enhancements.

ACTION/DELIVERABLE	YR 1	YR 2	YR 3	YR 4	YR 5
Recruit/Hire New GIS Faculty Member					
GEOG 302/508 UGE Proposals Submitted					
GEOG 302/508 Offered as UGE Courses					
Develop K-State Online GIS Module(s)					
Offer New Advanced GIS Course					

Table 5. Timeline of proposed teaching-related activities.

### 2.3 Outreach – Professional Development and Continuing Education

GISSAL and the Department of Geography have already initiated efforts to serve off-campus students and professionals by developing and offering **introductory GIS workshops** in conjunction with the K-State Division of Continuing Education and the Environmental Systems Research Institute (ESRI) Authorized Instructor Training Program. Currently, K-State offers two ESRI-authorized workshops: *Introduction to ArcView* and *Introduction to ArcGIS*. The need exists, especially at a research institution, and in a state like Kansas with a comparatively sophisticated GIS population, to offer additional advanced educational opportunities.

In addition to continuing education, **professional development seminars** are important to illustrate the value of geospatial technologies across the spectrum of academic disciplines and application areas. The VPAST-sponsored Geospatial Technology Lecture Series will be continued for the next 2-3 years. Already, K-State has hosted visiting scholar David Maidment from the University of Texas to discuss his research in GIS and water resources. A campus GIS seminar series, with our own faculty presenters, may also be an effective way of communicating geographic ideas and geospatial capabilities to the K-State community.

### 2.3.1 Phase I Accomplishments

A brief summary of professional development and continuing education objectives realized during the first year of *Phase I* are listed in Table 6.

PHASE I OBJECTIVE	NOTES
Offer “Introduction to ArcView” Workshop	<ul style="list-style-type: none"> <li>▪ Funded instructor certification and program fees</li> <li>▪ Began workshops in 2003 in coordination with the Division of Continuing Education</li> </ul>
Offer “Introduction to ArcGIS” Workshop	<ul style="list-style-type: none"> <li>▪ Funded instructor certification and program fees</li> <li>▪ Began workshops in 2003 in coordination with the Division of Continuing Education</li> </ul>
VPAST Geospatial Technology Lecture Series	<ul style="list-style-type: none"> <li>▪ David Maidment (University of Texas) presented first VPAST lecture in September 2004</li> </ul>

Table 6. Completed professional development/distance education objectives during Year 1 of the Geospatial Technology Infrastructure Enhancement Program.

### 2.3.2 Phase II Objectives and Implementation Timeline

ESRI develops and markets the most widely used suite of GIS software in the United States. Future plans include establishment of a “for profit” **ESRI Authorized Learning Center (ALC)** at Kansas State University. Currently, no ESRI ALC exists in the states of Nebraska, Kansas, or Oklahoma.

As suggested by many of the collaborators involved with this, and the previous Phase I, proposals, resources are also requested to fund, via competitive award, a **travel and professional training grant** for faculty and staff seeking to improve upon their geospatial skills or participate in national or international conferences (e.g., ESRI Annual Meeting). In addition, the GIS Steering Committee will organize periodic **GIS Seminars** that highlight KSU projects and faculty to supplement the **VPAST Geospatial Technology Lecture Series**. Specific objectives for the professional development/continuing education component to this proposal are listed in Table 7.

OBJECTIVES	DESCRIPTION
Establish ESRI Authorized Learning Center	<ul style="list-style-type: none"> <li>▪ Establish ESRI Authorized Learning Center and become the premier state/regional GIS learning center.</li> </ul>
Expand Division of Continuing Education GIS Workshops	<ul style="list-style-type: none"> <li>▪ Increase number of ESRI Authorized Instructors on campus.</li> <li>▪ Offer advanced GIS courses such as ArcGIS II, Spatial Analyst, and ArcIMS.</li> <li>▪ Explore additional opportunities with other technology and software manufacturers such as Trimble, AutoDesk, and Intergraph.</li> </ul>
Expand VPAST Geospatial Technology Lecture Series	<ul style="list-style-type: none"> <li>▪ Host two visitors per year who are leaders in the field of geospatial technologies (VPAST-funded through 2007)</li> </ul>
Offer Faculty Travel and Training Grants	<ul style="list-style-type: none"> <li>▪ Competitive awards to K-State faculty to promote professional development.</li> <li>▪ Faculty recipients conduct seminars discussing experiences.</li> </ul>
GIS Seminar Series	<ul style="list-style-type: none"> <li>▪ Seminars by KSU faculty highlighting campus research</li> </ul>

Table 7. Proposed professional development/distance education objectives.

## 2.4 Other – Administrative and Professional

Two additional objectives are included in this “Other” category, which include some of most critical elements of the proposal. K-State faculty and staff realize that given the resources available at the department (and college) level today, and the interdisciplinary nature of GIScience, GIS, and geospatial technologies, that **leadership, teamwork, and central services** are needed to facilitate the realization of our individual and collaborative goals. Continued meetings of the campus **GIS Steering Committee** will provide a multidisciplinary administrative structure and “voice” for the continuation and improvement of geospatial activities at K-State. Built from the existing ad hoc council in operation since 2000, the GIS

Steering Committee was formed by Provost Nellis during Fall 2004 and includes members from every K-State college.

The University Consortium for Geographic Information Science (UCGIS) is a non-profit organization of universities and other research institutions dedicated to advancing our understanding of geographic processes and spatial relationships through improved theory, methods, technology, and data. The UCGIS attempts to serve as an effective, unified voice for the geographic information science research community; foster multidisciplinary research and education, and promote the informed and responsible use of GIScience and geographic analysis for the benefit of society. **Continued membership, and active participation, in UCGIS** should be a goal of K-State. Advantages to member universities (Table 9) include instant national visibility, increased competitiveness for extramural funding, better communication with political leadership, closer ties with private affiliate members (e.g., Intergraph Corporation provides members with university site licenses for GeoMedia GIS software), and recruiting advantages for promising GIScientists through a student grants program.

Arizona State University	<b>Kansas State University</b>	Pennsylvania State Univ
University of Arizona	<b>University of Kansas</b>	University of Pennsylvania
Boston University	University of Kentucky	University of Pittsburgh
Brigham Young University	Louisiana State University	University of Redlands
California State Univ Systems	University of Maine	Rutgers University
Univ of California, Berkeley	Univ of MD, College Park	Sand Diego State Univ
Univ of Calif, Santa Barbara	Mass Inst of Technology	Univ of South Carolina
Clark University	Univ of Mass – Amherst	Univ of Southern California
<b>University of Colorado</b>	Michigan State University	Southwest Texas State Univ
University of Connecticut	University of Michigan	SUNY– Buffalo
University of Delaware	University of Minnesota	Syracuse University
Florida International Univ	University of Mississippi	Univ of Tennessee – Knoxville
Florida State University	<b>University of Nebraska</b>	Texas A&M – Corpus Christi
George Mason University	New Mexico State Univ	University of Texas at Dallas
Georgia Inst of Technology	University of New Mexico	University of Utah
University of Georgia	Univ of NC, Chapel Hill	Virginia Commonwealth Univ
Hunter College	Univ of NC - Charlotte	Univ of Washington
Idaho State University	University of New Mexico	West Virginia University
University of Idaho	Ohio GIS Net	Univ of Wisconsin, Madison
Univ of Illinois, Chicago	Ohio State University	Univ of Wisconsin, Milwaukee
Univ of IL, Urbana-Champaign	<b>University of Oklahoma</b>	University of Wyoming
Indiana University	Oregon State University	
University of Iowa	University of Oregon	

Table 9. UCGIS university members with K-State and other Big 12 schools highlighted.

#### 2.4.1 Phase I Accomplishments

Kansas State University was formally accepted as a member of the UCGIS during Fall 2004 after a formal review of the university’s membership portfolio created by the Department of Geography. The initial membership fee of \$3,500 was paid by both the Office of the Provost and *Phase I of Geospatial Technology Infrastructure Enhancement*.

The campus GIS Steering Committee met for the first time during the Fall 2004 semester and has scheduled discussions once per month through Spring 2005. Steering Committee meetings have served as a forum to update campus representatives about current and future GIS activities. Importantly, committee members also include respected academics from outside of Kansas State University and at least one private sector representative from partners such as ESRI.

PHASE I OBJECTIVE	NOTES
UCGIS Membership	<ul style="list-style-type: none"> <li>▪ Developed online application portfolio incorporated into the K-State GIS Commons website (www.ksu.edu/giscommons)</li> <li>▪ Paid \$3,500 initial member fee – part from Phase I project funds</li> </ul>
GIS Steering Committee	<ul style="list-style-type: none"> <li>▪ Formed during Fall 2004 semester</li> <li>▪ Includes representatives from each K-State college, other universities, and private sector</li> </ul>

Table 10. Completed administrative/professional objectives during Year 1 of the Geospatial Technology Infrastructure Enhancement Program.

#### 2.4.2 Phase II Objectives and Implementation Timeline

As a continuation of activities related to *Geospatial Technology Infrastructure Enhancement (Phase I)*, the campus GIS Steering Committee will continue monthly discussions and provide feedback as requested by the Provost and VPAST. Representatives of the Steering Committee will also informally brief deans and other key administrators about ongoing activities and future initiatives. Continued membership in the UCGIS will require an annual payment of \$1,000. Limited funds from *Phase I* have been earmarked to offset this expense.

### 3 INVOLVING PARTNERS TO FACILITATE PROGRESS

#### 3.1 Campus Collaborations

Widespread support for this effort is evident in the **academic diversity of team members** listed on the cover page of this proposal, as well as the appended letters of support. Much of this proposal's content is a logical extension of findings discussed by the *ad hoc* GIS Advisory Committee formed by the campus GIS Coordinator (2000-01) funded by Dean Law (College of Architecture, Planning, and Design), Dean White (College of Arts and Sciences), and Dean King (College of Engineering). The **Geographic Information Systems Spatial Analysis Laboratory (GISSAL)** will serve as the initial home to the Center of Excellence until appropriate space has been found for the future Geospatial Technology Commons envisioned by the Provost. The students and faculty of the Department of Geography's Remote Sensing Research Laboratory (RSRL) will provide both technical expertise and its extensive library of non-commercial satellite images to the University Spatial Data and Application Server.

#### 3.2 State Coordination and Participation

The Project director will continue close working relationships with the State of Kansas Information Architect and GIS Coordinator through participation in the **Kansas GIS Policy Board** and **GIS Technical Advisory Committee**. This important connection is invaluable in communicating the university's commitment to geospatial technology, its capabilities, and ability to serve state needs in GIS education, research, and outreach.

This proposal also contains funding to enable cooperation with the **Kansas Data Access and Support Center (DASC)** has also agreed to provide informal consulting services for the design and operation of the University Spatial Data and Application Server. Since its creation in 1991, DASC has served as the central archival and distribution center for the Kansas GIS Core Database and as an outreach arm for the Kansas GIS Policy Board. Currently, the DASC GIS Core Database server contains 41 databases that can be ordered using their Core Database Catalog (published annually), or are accessible via FTP from their website (<http://gisdasc.kgs.ukans.edu>).

## 4 MANAGING SUCCESS

The structure of the proposed project, with substantive research infrastructure enhancements, and attention to teaching and outreach, calls for centralized operational control with a distributed leadership framework to ensure maximum benefits to the entire university community. The GISSAL or Geospatial Technology Commons will serve as the “headquarters” for new non-faculty staff and equipment with the post-doctoral research associate providing the necessary day-to-day management of ongoing activities. GISSAL will work closely with networking and database specialists in CNS and the Office of Mediated Education on aspects of the University Spatial Data and Application Server, with CNS responsible for control and maintenance of related computing hardware and software (including GIS and database software). In addition, GISSAL will support iTAC technical support activities (e.g., software access and installation) by providing training assistance to iTAC staff over the course of the project.

### 4.1 GIS Steering Committee

Administrative oversight and assessment of program success will be provided by the multidisciplinary GIS Steering Committee formed during 2004. Meeting once per month, the committee will provide to the VPAST and Provost, as well as college deans and central administrators, through informal reports by the committee chair. The mission of the K-State GIS Steering Committee is to:

- Facilitate GIS-related activities,
- Increase the awareness of GIS on campus,
- Assist in the preparation of major research proposals with geospatial emphases,
- Identify where geospatial expertise exists on campus, and
- Define GIS-related issues on campus and provide recommendations for achieving/solving them.

The GIS Steering Committee will provide recommendations and strategies for ensuring the continuation of faculty and graduate student lines, education and outreach programs, and hardware/software requirements after the Targeted Excellence funding period expires. The committee will also be responsible for evaluating and awarding faculty travel and professional development grants and sponsoring a new GIS Seminar Series to showcase faculty geospatial research.

### 4.2 Program Continuation and Growth

The GIS Steering Committee will also address the challenge of ensuring the long-term success of proposed and future geospatial technology enhancements. In conjunction with members of the committee, the chair will collect data to help quantify overall project success (e.g., publications, course enrollments, extramural funding, teaching evaluations, graduate interviews, employer comments, etc). Informal reports prepared by the GIS Steering Committee will update key administrative leaders on the status of campus geospatial activities and related measures of success. Those leaders will then be in an informed position to continue support for proposed budget expenditures and programmatic enhancements that are not guaranteed to continue beyond the lifespan of Targeted Excellence.

The opportunity to improve on K-State’s historical success in extramural funding for GIS research, or projects with a significant GIS component, is excellent. During the period of 1995-2004, over **70 projects** in at least 7 departments were funded, averaging in excess of **\$2 million annually** (Table 11). Though significant, the \$18 million total is an underestimate of the impact of GIS on research funding, as survey results from the Departments of Computing and Information Science, Civil Engineering, and Geology are not included. Also not included in these numbers are geospatial enhancements included in recent university proposals directed towards funding earmarked for Homeland Security and Agricultural Biosecurity.

Department/Unit	No. of Projects	Amount
Biology	6	\$4,248,010
Geography	27	\$5,394,702
NILMAT	4	\$3,959,293
Agronomy	24	\$2,250,194
KS Coop Fish & Wildlife	3	\$1,308,000
Biological & Agricultural Engg	6	\$ 934,500
Sociology and Anthropology	1	\$ 245,702
<b>Total</b>	<b>71</b>	<b>\$18,340,401</b>

Table 11. Researcher reported data for extramural funding for GIS-related research projects from 1995-2004.

An important activity of the GIS Steering Committee will be to document the influence that GIS users, methods, and software have in shaping the university's total research budget. This will serve to better inform administrators, faculty, staff, and students on GIS activities on campus, and is a basic requirement for continued membership into the University Consortium for Geographic Information Science (UCGIS). Other projected or potential revenue streams to continue the proposed project are shown in Table 12.

REVENUE SOURCE	DESCRIPTION
Workshops	<ul style="list-style-type: none"> <li>▪ \$45,000 per year (all proposed classes @ 25 student per year each).</li> </ul>
GIS Standard Budget Items	<ul style="list-style-type: none"> <li>▪ GIS Advisory Council recommends budget line items, and amounts, to be included by researchers in GIS and related research projects.</li> </ul>
Research Overhead	<ul style="list-style-type: none"> <li>▪ Total extramural funding for GIS and related projects &gt; \$18 million from 1995-2004.</li> <li>▪ Annual average for GIS and related extramural funding &gt; \$2 million.</li> </ul>
GIS Technology Fee	<ul style="list-style-type: none"> <li>▪ If established, could generate \$270,000 per year (\$15 per student x 18,000 students).</li> <li>▪ Sufficient to pay for all salaries (including fringes), equipment, travel, and other direct costs requested in this proposal.</li> </ul>

Table 12. Possible sources of revenue for project continuation.

#### 4.3 Assessment

Basic metrics for tracking and evaluating the success of the proposal will be of four types: (1) increases in the number, amount, and types of extramural research projects, (2) publication of teaching and research scholarship, (3) improved communication and greater multidisciplinary collaborations through the campus GIS Steering Committee, and (4) GIS course enrollments and number of students and professionals exposed to or trained in GIS and geospatial technologies. Examples of possible benchmarks that may be adopted by the GIS Steering Committee are listed in Table 13.

BENCHMARKS	DESCRIPTION
Teaching	<ul style="list-style-type: none"> <li>▪ Enrollment increases in GIS and GIS applications courses</li> <li>▪ Select K-State Online modules completed by Year 5</li> <li>▪ Social science GIS faculty hired</li> </ul>
Research	<ul style="list-style-type: none"> <li>▪ University Spatial Data and Application Server online by Year 2</li> <li>▪ \$5 million in new grant research by Year 5</li> <li>▪ One or more seminars per year by faculty receiving travel grants</li> </ul>
Outreach	<ul style="list-style-type: none"> <li>▪ Instruct 50 students per year in ESRI workshops.</li> </ul>
Other	<ul style="list-style-type: none"> <li>▪ K-State named an ESRI Authorized Learning Center</li> <li>▪ Continued membership and increased participation in UCGIS activities</li> <li>▪ New method of funding the annual ESRI site license implemented</li> </ul>

Table 13. Specific proposed objectives for outreach activities.

## 5 K-STATE LEADERSHIP IN GISCIENCE AND BIOSECURITY

The goal of this Targeted Excellence proposal, *GIScience Infrastructure Enhancement Program – Phase II*, is to **establish a research Center of Excellence for Geospatial Technology and Applications and continue the diffusion of GIScience and geospatial technologies into the general university community**. Approval of this “*Phase II*” program will elevate Kansas State University to a leadership position in geospatial research for agricultural biosecurity, biosciences, and environmental quality and serve as a necessary step toward international recognition for cross-disciplinary application of geospatial technologies. Though K-State may be considered to be “late adopter” in terms of geospatial technology, we now have the opportunity to leap forward and be an active participant and leader in what Dobson (1993, p. 437) has called “an intellectual revolution comparable to earlier intellectual revolutions prompted by the printing press and the computer.” This is especially true for the emerging research area of agricultural biosecurity and food safety.

The field of GIScience and supporting geospatial technologies fully compliments the university’s core missions, is an integral component of several other Targeted Excellence proposals, and will provide a springboard for the development of unique disciplinary and multidisciplinary programs (e.g., agricultural biosecurity, plant and animal disease modeling, spatial economics, water resources, and GIS-related certificate programs). The impacts resulting from approval of this proposal fit hand-in-glove with the published evaluation criteria for the Targeted Excellence initiative. By improving our geospatial research infrastructure, K-State can expand its unique contribution to national security through innovative research and practical applications through stronger cross-campus collaboration and more competitive grantsmanship. Strengthening the requisite human and equipment infrastructure will also enhance the status of K-State in the areas of GIScience while helping students and faculty/staff to maximize the effectiveness of geospatial technologies in the curriculum, basic research, applied studies, and continuing education services.

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## 7 PROJECT DIRECTORS - CURRICULUM VITAE

### JAMES MICHAEL SHAWN HUTCHINSON

Assistant Professor, Department of Geography, Kansas State University  
118 Seaton Hall, Manhattan, Kansas 66506  
Phone: 785.532.6727 ▪ Fax: 785.532.7310 ▪ Email: shutch@ksu.edu  
Web: [www-personal.ksu.edu/~shutch](http://www-personal.ksu.edu/~shutch)

#### Professional Preparation

- Ph.D., Geography, 2000; Kansas State University, Manhattan, Kansas
- M.A., Geography, 1997; Kansas State University, Manhattan, Kansas
- B.S., Wildlife Biology, 1990; Colorado State University, Fort Collins, Colorado

#### Appointments

- Asst. Professor, Department of Geography, Kansas State University; August 2001 – Present.
- Director, Geographic Information Systems Spatial Analysis Laboratory (GISSAL), Department of Geography, Kansas State University; February 2002 – Present.
- Visiting Asst. Professor, Department of Biological & Agricultural Engineering, Kansas State University; August 2000 – July 2001.

#### Research Interests

Agricultural biosecurity, applications of remote sensing and GIS for land cover assessment and natural resource management, water resources and watershed environmental modeling, biogeography and human impacts on the environment, boundary layer climatology and vegetation-climate relations - North America and Great Plains emphasis.

#### Publications Related to this Proposal

*(Selected publications from more than 11 refereed publications)*

- Goodin, D.G., J. Gao, J.M.S. Hutchinson. 2004. Seasonal, topographic, and burn frequency effects on biophysical/spectral reflectance relationships in tallgrass prairie. *International Journal of Remote Sensing* 25(23):5429-5445.
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- Bhuyan, S.J., K.R. Mankin, J.M.S. Hutchinson, D.G. Goodin, J.K. Koelliker. 2002. Deriving land cover of a large agricultural watershed from multiple Landsat scenes. *Journal of Environmental Hydrology*, Paper 6, Volume 10 ([www.hydroweb.com/jeh.html](http://www.hydroweb.com/jeh.html)).

#### Synergistic Activities

- Consultant, Great Plains Diagnostic Network (<http://www.gpdn.org/>)
- Director, Graduate Certificate in GIScience Program, Kansas State University; 2002-Present.
- Member, State of Kansas GIS Policy Board, 2001-Present.

- ESRI Authorized Introduction to ArcView Instructor; 2003.
- Lead Investigator, Kansas State University GIScience Infrastructure Enhancement Program.

## Collaborators

*(Project collaborators and co-authors during the past two years)*

Dr. Jim Aber (Emporia State University)	Dr. James Koelliker (Kansas State University)
Dr. Donald Althoff (Kansas State University)	Dr. Nancy Leathers (Kansas State University)
Dr. Dan Andresen (Kansas State University)	Dr. Kyle Mankin (Kansas State University)
Dr. Phillip Barnes (Kansas State University)	Dr. Luke Marzen (Auburn University)
Eric Bernard (Kansas State University)	Dr. Mitchell Neilsen (KSU)
Dr. Samar Bhuyan (City of Phoenix, AZ)	Dr. Charles Oviatt (Kansas State University)
Dr. John Briggs (Arizona State University)	Dr. Robert Owen (Texas Tech University)
Leslie Campbell (Kansas State University)	Dr. Firooza Pavri (Emporia State University)
Dr. David Downing (University of Kansas)	Dr. Kevin Price (University of Kansas)
Dr. Douglas Goodin (Kansas State University)	Dr. John Reese (Kansas State University)
Dr. John Harrington, Jr. (Kansas State University)	Dr. James Steichen (Kansas State University)
Dr. Stacy Hutchinson (Kansas State University)	Dr. David Steward (Kansas State University)
Jincheng Gao (Kansas State University)	Dr. Naiqian Zhang (Kansas State University)
Dr. Colleen Jonsson (Southern Research Institute)	Dr. Gerald Zuercher (Dubuque University)

## Graduate Advisors

- PhD: Dr. John A. Harrington, Jr., Department of Geography, Kansas State University, Manhattan, Kansas.
- M.A.: Dr. John A. Harrington, Jr., Department of Geography, Kansas State University, Manhattan, Kansas.

## Thesis Advisor and Postgraduate-Scholar Sponsor

*(Students and postgraduates advised during last five years; Total Advisees to date: 5 M.A., 1 PhD, and 1 postdoctoral research associate)*

- Dr. Nancy Leathers, Postdoctoral Research Associate, 2003-Present
- Tracy Brown, M.A., 2004
- In Progress: Troy Livingston (PhD), Tony Davis (M.A.), Brooke Stansberry (M.A.), Thomas Vought (M.A.)

## Research Summary

*(Geospatial environmental research program totaling more than \$3.6 million in awards during the past five years from sponsors including: NASA, NIH, USDA APHIS, USDA NRCS, and National Park Service)*

- Hutchinson, J.M.S., J.A. Harrington, Jr. 2004. Geospatial Technology Infrastructure Enhancement Program. Kansas State University Targeted Excellence Program, \$330,000.
- Jonsson, C.B., L. Allen, Y. Chu, R. Owens, D.G. Goodin, J.M.S. Hutchinson, E. Pontelli, D. Ranjan, S. Tran, M. Almiron. 2003. The Impact of Rapid Anthropogenic Land Cover Change in the Chaco and Interior Atlantic Forest in Paraguay on Hantavirus Ecology. National Institutes of Health, \$1,857,996.
- Hutchinson, J.M.S. 2003. Vegetation Mapping of National Parks in the Southwestern United States. U.S. Dept. of Interior National Park Service, \$117,000.
- Steichen, J., S.L. Hutchinson, P. Barnes, J.M.S. Hutchinson, D. Althoff, J. Oviatt, N. Zhang. 2003. Assessing the Impact of Maneuver Training on NPS Pollution and Water Quality. Strategic Environmental Research and Development Program (SERDP), \$1,217,512.
- Reese, J., J.M.S. Hutchinson, and J. Campbell. 2003. Post Hoc Exercise on the Spread of a Potential Bioterrorism Agent. USDA Animal and Plant Health Inspection Service (APHIS) and the KSU National Agricultural Biosecurity Center. \$70,395.

## **Educational Activities**

- Developed ESRI-authorized GIS outreach workshops through Kansas State University Division of Continuing Education (2003-04).
- Created Graduate (2002) and Undergraduate (2004) GIS Certificate Programs at Kansas State University.
- Teach graduate and undergraduate geospatial techniques courses at Kansas State University including: Cartography & Thematic Mapping, GIS I, Computer Mapping & Geographic Visualization, and GIS II.

## **Current Projects**

- Geospatial Technology Infrastructure Enhancement Program  
*Kansas State University; \$333,000*  
Strengthen the human and equipment GIScience infrastructure at Kansas State University to enhance the university status in the areas of GIScience and geospatial technologies and help students and faculty/staff to maximize the effectiveness of geospatial technologies in the curriculum, basic research, applied studies, and outreach services.
- The Impact of Rapid Anthropogenic Landcover Change in the Chaco and Interior Atlantic Forest in Paraguay on Hantavirus Ecology  
*National Institutes of Health; \$1,857,996*  
Conduct landscape change analysis and disease vector modeling using geospatial techniques to assist in generating spatial predictions of hantavirus outbreaks in Paraguay.
- Vegetation Mapping of National Parks in the Southwestern United States  
*U.S. Dept. of Interior National Park Service; \$63,533*  
Manage project and supervise one GRA who is assisting Park Service ecologists in classifying vegetation using high-resolution infrared aerial photography and converting that information into GIS format.
- Assessing the Impact of Maneuver Training on NPS Pollution and Water Quality  
*Strategic Environmental Research and Development Program (SERDP); \$1,217,512*  
Co-PI of major research effort at Fort Riley studying the impact of military training on surface water quality, with a special emphasis on sediment transport. Supervising one GRA and one undergraduate student in creating a regional climate atlas, developing GIS data layers to serve as landscape water quality model inputs, and using satellite sensors to quantitatively estimate near surface soil moisture conditions.

**JOHN A. HARRINGTON, JR.**

Department of Geography, Kansas State University, Manhattan, KS 66506

Phone: (785) 532-6727 | E-mail: [jharrin@ksu.edu](mailto:jharrin@ksu.edu)

Professional Preparation

Michigan State University	Geography	Bachelor of Science, 1972
University of Minnesota	Geography	Master of Arts, 1974
Michigan State University	Geography	Doctor of Philosophy, 1980

Appointments

1999-	Kansas State University: Geography Department Head
1996-	Kansas State University: Professor
1994-1996	Kansas State University: Associate Professor
1993-1994	Indiana State University: Professor
1989-1993	Indiana State University: Associate Professor
1988-1994	USDA Agriculture Research Service: Remote Sensing Specialist
1986-1989	New Mexico State University: Associate Professor
1985-1986	University of Nebraska-Lincoln: Assistant Professor
1980-1985	University of Oklahoma: Assistant Professor
1978-1980	University of Oklahoma: Visiting Assistant Professor

Selected Publications

- 2003 "An Integrated Approach for Water Quality Assessment of a Kansas Watershed" S.J. Bhuyan, J.K. Koelliker, L.J. Marzen, and J.A. Harrington, Jr., Journal of Environmental Modelling and Software Vol. 18(5), 473-484.  
"Southwest Kansas: Local Emissions and Non-Local Determinants" J. Harrington, Jr., D. Goodin, L. Harrington, D. Kromm, and S. White, p. 57-78, in Global Change in Local Places: Estimating, Understanding, and Reducing Greenhouse Gases, R. Abler editor., Cambridge University Press
- 2002 "Land Cover Change and Associated Trends in Surface Reflectivity and Vegetation Index in Southwest Kansas: 1972-1992," D.G. Goodin, J.A. Harrington, Jr., and B.C. Rundquist, Geocarto International Vol. 17(1), 43-50.  
"Assessment of runoff and sediment yield using remote sensing, GIS and AGNPS," S.J. Bhuyan, L.J. Marzen, J.K. Koelliker, J.A. Harrington, Jr., and P.L. Barnes Journal of Soil and Water Conservation Vol. 57(6), 351-364.
- 2001 "Teaching Site-Specific Agriculture: Three Semesters' Experience with a Multi-Disciplinary Approach," J.P. Schmidt, M.D. Ransom, G.J. Kluitenberg, M.D. Schrock, J.A. Harrington, Jr., R.K. Taylor, and J.L. Havlin, Journal of Natural Resources and Life Sciences Education Vol. 30, 77-83.  
"KATS: A GIS-based Spatial Decision Support Tool for Water Resource Management in Kansas," Max Lu and J. Harrington, Jr., Papers and Proceedings of Applied Geography Conferences, Vol. 24, 106-112.  
"Using AGNPS 98 and GIS to Model Sediment Yield from a Newly Constructed Golf Course," S.K. Starrett, Y. Su, L. Chen, and J. Harrington, in Urban Drainage Modeling Symposium 2001, R.W. Brashear and C. Maksimovic (eds.), American Society of Civil Engineers.
- 2000 "The Effects of Climatic Factors on Vegetation Dynamics of Tallgrass and Shortgrass Vegetation Cover," B.C. Rundquist and J.A. Harrington, Jr., Geocarto International Vol. 15(3), 31-36.  
"Water Quality Modeling in the Red Rock Creek Watershed, Kansas," L.J. Marzen, J. Harrington, Jr., S.J. Bhuyan, J.K. Koelliker, L.D. Frees, and C.G. Volkman, Papers and Proceedings of Applied Geography Conferences, Vol. 23, 175-182.  
"GIS Development for the Colbert Hills Golf Course," J. Harrington, Jr. and N. Leathers, Papers and Proceedings of Applied Geography Conferences, Vol. 23, 183-189.

- 1998 "Balancing Scientific and Ethical Values in Environmental Science" J.R. Harman, J.A. Harrington, Jr., and R.S. Cerveny, Annals, Association of American Geographers, Vol. 88, 277-286.
- "Local Greenhouse Gas Emissions: A Case Study in Southwest Kansas," D.G. Goodin, J.A. Harrington, Jr., G.I. Holden, Jr., and B.D. Witcher, Great Plains Research Vol. 8, 231-253.
- "Vegetation Change in the Mount St. Helens Blast Zone, 1979-1992," L.M.B. Harrington, J.A. Harrington, Jr., and P.M. Frenzen, Geocarto International Vol. 13, 75-82.
- "Remote Sensing of Temporal and Spatial Variations in Pool Size, Suspended Sediment, Turbidity, and Secchi Depth in Tuttle Creek Reservoir, Kansas: 1993," M.D. Nellis, J.A. Harrington, Jr., and J. Wu, Geomorphology Vol. 21, 281-293.
- 1997 "Monitoring Conservation Reserves: A Geographic Approach," N. Leathers and J.A. Harrington, Jr. Papers and Proceedings of Applied Geography Conferences, Vol. 20, 25-34.
- "Satellite-Based Herbaceous Biomass Estimates in the Pastoral Zone of Niger," B. Wylie, I. Denda, R. Pieper, J. Harrington, Jr., B. Reed, and M. Southward Journal of Range Management Vol. 48, 159-164.
- "Remote Sensing of Suspended Sediments: The Lake Chicot, Arkansas Project, F.R. Schiebe, J.A. Harrington, Jr., and J.C. Ritchie International Journal of Remote Sensing, Vol. 13, p. 1487-1509.
- "A Satellite-based Range Assessment System for the Sahel of Africa," B. Wylie, J. Harrington, Jr., R. Pieper, and I. Denda Geocarto International, Vol. 7(1), 79-85.

#### Synergistic Activities

For the period 1988-1990, I served, with range scientists, veterinarians, and rural social scientists, as the geospatial technology (remote sensing and geographic information systems (GIS)) resource person on a USAID funded project with the African country of Niger. We developed a capability for government scientists to use near real-time satellite imagery to estimate rangeland forage production from the annual grasslands. The project brought two Nigerian government scientists to the US for MS degrees and also established the first working GIS in the country. This work on remote sensing of rangelands led to my selection as a member of the Society for Range Management's, Remote Sensing and GIS Committee. Another committee member and I co-edited a 1996 special issue of *Geocarto International* dealing with the theme, "Remote Sensing of Rangelands".

During the period 1988-1994, I was a consultant for the USDA ARS National Ag. Water Quality Laboratory. I provided remote sensing and GIS expertise for scientists at the lab. Our collaborative work appeared in numerous publications and our collective efforts help guide policy formation related to on-going ARS efforts in developing new geospatial technology applications.

At Kansas State University, I have been elected and have served on the Board of Directors for the interdisciplinary Natural Resources and Environmental Sciences (NRES) Secondary Major since 1996. I have frequently been one of the interdisciplinary team of instructors for the capstone class and served a three year term as NRES Director from 1998-2000.

Since 1996, I have been involved in two major multi-university research projects involving teams of geographers. The three year Global Change in Local Places (GCLP) project was funded by NASA and involved teams from K-State, Toledo, and Appalachian State, and leadership from three past-President of the Association of American Geographers. We looked at sources, drivers, and mitigation opportunities for greenhouse gas emissions in southwest Kansas and compared results with the other regional study teams. The current project, Infrastructure to Develop Human-Environment Regional Observatories (HEROs), involves teams from K-State, Clark, Penn State, and Arizona. Our research is looking at local and regional vulnerability to climate variations that are related to land use/cover changes. For both the GCLP and HERO projects, I have coordinated the K-State effort and managed budgetary aspects.

I worked with John Havlin and a team of interdisciplinary faculty in Agriculture and Engineering on a proposal to establish a precision agriculture/GIS class and fund computers for the laboratory in Throckmorton Hall. AGRON 655 (Site Specific Ag) is now team-taught each year. A co-authored article about our experience was published in 2001.

Current and Previously Completed Projects

- Infrastructure to Develop Human-Environment Regional Observatories NSF \$290,000  
2000-2005 I spend about 10% of my time in project management and research.  
I am supervising GRAs who are using satellite imagery to assess land cover change.
- HERO Research Experience for Undergraduates NSF \$ 80,000  
2002-2005 I spend less than 5% of my time managing this effort.  
Others have supervised the student summer research in the past; I do it this summer.  
With a student assistant, I will supervise three students for six weeks this summer.
- Kanapolis Watershed Water Quality Assessment EPA/KDHE \$385,995  
2000-2004 I spend less than 5% of my time on this effort. I help supervise a GRA  
who is using remote sensing of land cover and GIS to assist in hydrologic modeling.
- Evaluating Models Predicting Livestock Output Due to Climate Change DOE/NIGEC \$180,000  
2001-2004 I am the K-State PI for this effort that involves an animal scientist  
from Nebraska. I spend about 10% of my time on this project supervising a GRA  
and writing scholarly manuscripts based on our effort.
- Soil Survey Geographic Digitization USDA/NRCS \$ 25,000  
2001-2002 I am a co-PI on this project and spent less than 5% of my time helping  
Shawn Hutchinson supervise the work, that was done in GISSAL.
- Hyper-spectral Remote Sensing of Kansas Rural Environments NASA \$292,709  
2001-2004 Doug Goodin is the PI and I spend less than 5% of my time on this  
project discussing project strategy and helping coordinate GRA activities.

8 BUDGET (PAS BUDGET WORKSHEET REV. 1/15/04)

Kansas State University Budget Summary											
PRINCIPAL INVESTIGATOR: Hutchinson, Harrington				For PAS Office Use Only				Date:			
TITLE: GI Science Targeted Excellence Phase II								PP#			
A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates (Lists each separately with title, L10 Shows number in brackets)			Person-Months			Funds Requested					
			CAL	ACA	SUMR	YR 1	YR 2	YR 3	YR 4	YR 5	TOTAL
1	New Faculty Member	Asst/Assoc Prof		40.50		24,998	50,995	52,015	53,055	54,116	235,178
2	Center Director	Asst/Assoc Prof			5.00	5,750	5,865	5,982	6,102	6,224	29,923
3											
4											
5											
6											
7											
8											
9											
10	Additional Personnel:										
	<b>2 Total Senior Personnel (1-10)</b>			40.50	5.00	30,748	56,860	57,997	59,157	60,340	265,102
B. Other Personnel											
1	1 Post Doctoral Associates			60.00		45,000	45,900	46,818	47,754	48,709	234,182
2	Other Professionals, Classified										
3	Other Professionals, Unclassified										
4	2 Graduate Students					18,000	36,720	37,454	19,102	19,484	130,760
5	Undergraduate (>=6 hours)										
6	Undergraduate (<=6 hours)										
7	Secretarial - Clerical, Classified										
8	Secretarial - Clerical, Unclassified										
9	Other, Classified										
10	Other, Unclassified										
	<b>Total Other Personnel</b>					63,000	82,620	84,272	66,856	68,193	364,942
C. Fringe Benefits (if charged as direct costs)						25,518	35,233	35,938	35,701	36,415	168,805
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>						119,265	174,713	178,207	161,714	164,949	798,849
D. Equipment (list item and dollar amount for each exceeding \$5,000 on budget justification page).						25,000	20,000	10,000	5,000		60,000
E. Travel											
1	Domestic (incl. Canada, Mexico and U.S. Possessions)					8,000	11,000	10,000	8,500	5,500	43,000
2	Foreign					1,000	1,000	1,000	1,000	1,000	5,000
F. Participant Costs											
1	Stipends										
2	Travel										
3	Subsistence										
4	Other										
G. Other Direct Costs											
1	Materials and Supplies					20,000	2,500	1,250		1,000	24,750
2	Publication Costs/Documentation/Dissemination										
3	Consultant Services										
4	Computer Services										
5	Tuition										
6	SubAwards (Note: Each SubAward will require a separate budget)										
7	Other										
	<b>TOTAL OTHER DIRECT COSTS</b>					20,000	2,500	1,250		1,000	24,750
<b>H. TOTAL DIRECT COSTS (A through G)</b>						173,265	209,213	200,457	176,214	172,449	931,599
I. Indirect Costs (F&A)											
<b>J. TOTAL PROJECT COSTS (H + I)</b>						173,265	209,213	200,457	176,214	172,449	931,599
K. Cost Sharing											

**Kansas State University  
YEAR 1 Budget Summary**

PRINCIPAL INVESTIGATOR:		Hutchinson, Harrington			PAS Use Only	
TITLE:	GI Science Targeted Excellence Phase II				Date:	
					PP#	
A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates (Lists each separately with title, L10 Shows number in brackets)		Person-Months			Funds Requested	
		CAL	ACA	SUMR	YEAR 1	
1	New Faculty Member		4.50		24,998	
2	Center Director			1.00	5,750	
3						
4						
5						
6						
7						
8						
9						
10	Additional Personnel:					
	<b>2 Total Senior Personnel (1-10)</b>		4.50	1.00	30,748	
<b>B. Other Personnel</b>						
1	1 Post Doctoral Associates		12.00		45,000	
2	Other Professionals, Classified					
3	Other Professionals, Unclassified					
4	2 Graduate Students				18,000	
5	Undergraduate (>=6 hours)					
6	Undergraduate (<6 hours)					
7	Secretarial - Clerical, Classified					
8	Secretarial - Clerical, Unclassified					
9	Other, Classified					
10	Other, Unclassified					
<b>Total Other Personnel</b>					63,000	
<b>C. Fringe Benefits (if charged as direct costs)</b>					25,518	
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>					119,265	
<b>D. Equipment</b> (list item and dollar amount for each exceeding \$5,000 on budget justification page).					25,000	
<b>E. Travel</b>						
1	Domestic (incl. Canada, Mexico and U.S. Possessions)				8,000	
2	Foreign				1,000	
<b>F. Participant Costs</b>						
1	Stipends					
2	Travel					
3	Subsistence					
4	Other					
<b>G. Other Direct Costs</b>						
1	Materials and Supplies				20,000	
2	Publication Costs/Documentation/Dissemination					
3	Consultant Services					
4	Computer Services					
5	Tuition					
6	SubAwards (Note: Each SubAward will require a separate budget)					
7	Other					
<b>TOTAL OTHER DIRECT COSTS</b>					20,000	
<b>H. TOTAL DIRECT COSTS (A through G)</b>					173,265	
<b>I. Indirect Costs (F&amp;A)</b>						
<b>J. TOTAL YEAR COST (H + I)</b>					173,265	
<b>K. Cost Sharing</b>						

**Kansas State University  
YEAR 2 Budget Summary**

<b>PRINCIPAL INVESTIGATOR:</b> Hutchinson, Harrington		<b>PAS Use Only</b>	
<b>TITLE:</b>	GIScience Targeted Excellence Phase II		<b>Date:</b>
			<b>PP#</b>
<b>A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates</b> (Lists each separately with title, L10 Shows number in brackets)		<b>Person-Months</b>	
		<b>CAL</b>	<b>ACA</b>
			<b>SUMR</b>
			<b>Funds Requested</b>
			<b>YEAR 2</b>
1	New Faculty Member Asst/Assoc Prof		9.00
2	Center Director Asst/Assoc Prof		1.00
3			
4			
5			
6			
7			
8			
9			
10	Additional Personnel:		
	2 Total Senior Personnel (1-10)		9.00 1.00
			56,860
<b>B. Other Personnel</b>			
1	1 Post Doctoral Associates		12.00
2	Other Professionals, Classified		
3	Other Professionals, Unclassified		
4	2 Graduate Students		
			36,720
5	Undergraduate (>=6 hours)		
6	Undergraduate (<6 hours)		
7	Secretarial - Clerical, Classified		
8	Secretarial - Clerical, Unclassified		
9	Other, Classified		
10	Other, Unclassified		
	<b>Total Other Personnel</b>		82,620
<b>C. Fringe Benefits (if charged as direct costs)</b>			35,233
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>			174,713
<b>D. Equipment</b> (list item and dollar amount for each exceeding \$5,000 on budget justification page).			20,000
<b>E. Travel</b>			
1	Domestic (incl. Canada, Mexico and U.S. Possessions)		11,000
2	Foreign		1,000
<b>F. Participant Costs</b>			
1	Stipends		
2	Travel		
3	Subsistence		
4	Other		
<b>G. Other Direct Costs</b>			
1	Materials and Supplies		2,500
2	Publication Costs/Documentation/Dissemination		
3	Consultant Services		
4	Computer Services		
5	Tuition		
6	SubAwards (Note: Each SubAward will require a separate budget)		
7	Other		
	<b>TOTAL OTHER DIRECT COSTS</b>		2,500
<b>H. TOTAL DIRECT COSTS (A through G)</b>			209,213
<b>I. Indirect Costs (F&amp;A)</b>			
<b>J. TOTAL YEAR COST (H + I)</b>			209,213
<b>K. Cost Sharing</b>			

**Kansas State University  
YEAR 3 Budget Summary**

<b>PRINCIPAL INVESTIGATOR:</b> Hutchinson, Harrington		<b>PAS Use Only</b>	
<b>TITLE:</b>	GIScience Targeted Excellence Phase II		<b>Date:</b>
			<b>PP#</b>
<b>A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates</b> (Lists each separately with title, L10 Shows number in brackets)		<b>Person-Months</b>	
		<b>CAL</b>	<b>ACA</b>
			<b>SUMR</b>
			<b>Funds Requested</b>
			<b>YEAR 3</b>
1	New Faculty Member Asst/Assoc Prof		9.00
2	Center Director Asst/Assoc Prof		1.00
3			
4			
5			
6			
7			
8			
9			
10	Additional Personnel:		
	<b>2 Total Senior Personnel (1-10)</b>		9.00 1.00
			57,997
<b>B. Other Personnel</b>			
1	1 Post Doctoral Associates		12.00
2	Other Professionals, Classified		
3	Other Professionals, Unclassified		
4	2 Graduate Students		
			37,454
5	Undergraduate (>=6 hours)		
6	Undergraduate (<6 hours)		
7	Secretarial - Clerical, Classified		
8	Secretarial - Clerical, Unclassified		
9	Other, Classified		
10	Other, Unclassified		
	<b>Total Other Personnel</b>		84,272
<b>C. Fringe Benefits (if charged as direct costs)</b>			35,938
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>			178,207
<b>D. Equipment</b> (list item and dollar amount for each exceeding \$5,000 on budget justification page).			10,000
<b>E. Travel</b>			
1	Domestic (incl. Canada, Mexico and U.S. Possessions)		10,000
2	Foreign		1,000
<b>F. Participant Costs</b>			
1	Stipends		
2	Travel		
3	Subsistence		
4	Other		
<b>G. Other Direct Costs</b>			
1	Materials and Supplies		1,250
2	Publication Costs/Documentation/Dissemination		
3	Consultant Services		
4	Computer Services		
5	Tuition		
6	SubAwards (Note: Each SubAward will require a separate budget)		
7	Other		
	<b>TOTAL OTHER DIRECT COSTS</b>		1,250
<b>H. TOTAL DIRECT COSTS (A through G)</b>			200,457
<b>I. Indirect Costs (F&amp;A)</b>			
<b>J. TOTAL YEAR COST (H + I)</b>			200,457
<b>K. Cost Sharing</b>			

**Kansas State University  
YEAR 4 Budget Summary**

<b>PRINCIPAL INVESTIGATOR:</b> Hutchinson, Harrington		<b>PAS Use Only</b>	
<b>TITLE:</b>	GIScience Targeted Excellence Phase II		<b>Date:</b>
			<b>PP#</b>
<b>A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates</b> (Lists each separately with title, L10 Shows number in brackets)		<b>Person-Months</b>	
		<b>CAL</b>	<b>ACA</b>
			<b>SUMR</b>
			<b>Funds Requested</b>
			<b>YEAR 4</b>
1	New Faculty Member Asst/Assoc Prof		9.00
2	Center Director Asst/Assoc Prof		1.00
3			
4			
5			
6			
7			
8			
9			
10	Additional Personnel:		
	<b>2 Total Senior Personnel (1-10)</b>		9.00 1.00
			59,157
<b>B. Other Personnel</b>			
1	1 Post Doctoral Associates		12.00
2	Other Professionals, Classified		
3	Other Professionals, Unclassified		
4	1 Graduate Students		
			19,102
5	Undergraduate (>=6 hours)		
6	Undergraduate (<6 hours)		
7	Secretarial - Clerical, Classified		
8	Secretarial - Clerical, Unclassified		
9	Other, Classified		
10	Other, Unclassified		
	<b>Total Other Personnel</b>		66,856
<b>C. Fringe Benefits (if charged as direct costs)</b>			35,701
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>			161,714
<b>D. Equipment</b> (list item and dollar amount for each exceeding \$5,000 on budget justification page).			5,000
<b>E. Travel</b>			
1	Domestic (incl. Canada, Mexico and U.S. Possessions)		8,500
2	Foreign		1,000
<b>F. Participant Costs</b>			
1	Stipends		
2	Travel		
3	Subsistence		
4	Other		
<b>G. Other Direct Costs</b>			
1	Materials and Supplies		
2	Publication Costs/Documentation/Dissemination		
3	Consultant Services		
4	Computer Services		
5	Tuition		
6	SubAwards (Note: Each SubAward will require a separate budget)		
7	Other		
	<b>TOTAL OTHER DIRECT COSTS</b>		
<b>H. TOTAL DIRECT COSTS (A through G)</b>			176,214
<b>I. Indirect Costs (F&amp;A)</b>			
<b>J. TOTAL YEAR COST (H + I)</b>			176,214
<b>K. Cost Sharing</b>			

**Kansas State University  
YEAR 5 Budget Summary**

<b>PRINCIPAL INVESTIGATOR:</b> Hutchinson, Harrington		<b>PAS Use Only</b>	
<b>TITLE:</b>	GIScience Targeted Excellence Phase II		<b>Date:</b>
			<b>PP#</b>
<b>A. Senior Personnel: PI/PD, Co-Pis, Faculty and Other Senior Associates</b> (Lists each separately with title, L10 Shows number in brackets)		<b>Person-Months</b>	
		<b>CAL</b>	<b>ACA</b>
			<b>SUMR</b>
			<b>Funds Requested</b>
			<b>YEAR 5</b>
1	New Faculty Member Asst/Assoc Prof		9.00
2	Center Director Asst/Assoc Prof		1.00
3			
4			
5			
6			
7			
8			
9			
10	Additional Personnel:		
	<b>2 Total Senior Personnel (1-10)</b>		9.00 1.00
<b>B. Other Personnel</b>			
1	1 Post Doctoral Associates		12.00
2	Other Professionals, Classified		
3	Other Professionals, Unclassified		
4	1 Graduate Students		19,484
5	Undergraduate (>=6 hours)		
6	Undergraduate (<6 hours)		
7	Secretarial - Clerical, Classified		
8	Secretarial - Clerical, Unclassified		
9	Other, Classified		
10	Other, Unclassified		
	<b>Total Other Personnel</b>		68,193
<b>C. Fringe Benefits (if charged as direct costs)</b>			36,415
<b>TOTAL SALARIES, WAGES, AND FRINGE BENEFITS (A+B+C)</b>			164,949
<b>D. Equipment</b> (list item and dollar amount for each exceeding \$5,000 on budget justification page).			
<b>E. Travel</b>			
1	Domestic (incl. Canada, Mexico and U.S. Possessions)		5,500
2	Foreign		1,000
<b>F. Participant Costs</b>			
1	Stipends		
2	Travel		
3	Subsistence		
4	Other		
<b>G. Other Direct Costs</b>			
1	Materials and Supplies		1,000
2	Publication Costs/Documentation/Dissemination		
3	Consultant Services		
4	Computer Services		
5	Tuition		
6	SubAwards (Note: Each SubAward will require a separate budget)		
7	Other		
	<b>TOTAL OTHER DIRECT COSTS</b>		1,000
<b>H. TOTAL DIRECT COSTS (A through G)</b>			172,449
<b>I. Indirect Costs (F&amp;A)</b>			
<b>J. TOTAL YEAR COST (H + I)</b>			172,449
<b>K. Cost Sharing</b>			

## 9 BUDGET JUSTIFICATION

### Salaries and Wages – Total Requested = \$364,942 (excluding fringe benefits)

1. Senior Personnel
  - a. Salaries for senior project personnel include only the nine-month salary for a new Social Science GIS faculty member beginning at \$50,000 per year. Budget includes funding for 4.5 years. Salary for years 2-5 assumes an annual 2.0% increase.
  - b. One summer month of salary for 5 years is included to compensate the GISSAL director for administration and service time. Base rate is \$5,750 per month in year one and includes an annual 2.0% increase.
2. Other Personnel
  - a. One post-doctoral research associate is proposed to conduct research and server as GISSAL manager. Salary begins in year 1 at \$45,000. Salary for years 2-5 assumes an annual 2.0% increase.
  - b. Support for two graduate student research assistants (GRAs) in GISSAL is requested. Graduate students will provide research support for preliminary projects and development of various prototype tools. One GRA will be hired in year 1 and another in year 2. Full funding through year 5 is included. Salary for each GRA will be \$18,000 per year beginning in year one and increase annually by a rate of 2.0%.

### Fringe Benefits – Total Required = \$168,805

1. Fringe benefits are calculated at the normal rates for the university (see <http://www.ksu.edu/research/preaward/fringe.htm>).

### Equipment – Total Requested = \$60,000

1. Computer Services – Total Request = \$60,000
  - a. A total of \$60,000 over five years is request to pay for the annual \$25,000 ESRI GIS software university site license.
  - b. Requested amount decreases over the life of the project as site license expenses will be paid through research grants and overhead.

### Travel – Total Requested = \$48,000

1. Domestic and foreign travel support (total of \$19,000) is requested to researchers in defraying travel expenses for research planning, meeting with funding agencies, and attending national-level professional conferences in the fields of geography, computer science, and GIScience.
2. The remaining domestic travel request (\$29,000) is included to award as Travel and Training Grants for professional development of KSU faculty members.

### Other Direct Costs – Total Requested = \$24,750

1. Materials and Supplies – Total \$24,750
  - a. GIS Computer Workstations – Total Request = \$15,000
    - i. Five to six computers are needed to provide immediate work environments in the Center of Excellence.

- b. A total of \$9,750 over the life of the project is requested for the purchase of expendable geospatial laboratory materials (e.g., color laserjet toner, wide-format plotter ink and paper) for the center.
- c. Requested amount decreases over the five year period.

**Total Direct Costs – Total Requested = \$931,599**

- 1. Budget Breakdown by Category (Years 1-5)
  - a. Senior Personnel = \$256,102 or 28% of project total
  - b. Other Personnel = \$364,942 or 40% of project total
  - c. Fringe Benefits = \$168,805 or 18% of project total
  - d. Equipment = \$60,000 or 6% of project total
  - e. Travel = \$48,000 or 5% of project total
  - f. Other Direct Costs = \$24,750 or 3% of project total

**10 APPENDIX A – LETTERS OF SUPPORT**