
2007-2008 Annual Report

Center for Advanced Spatial Technologies

Background and Mission

The Center for Advanced Spatial Technologies (CAST) was founded in 1991. It was designated a formal Research Center by the UA Board of Trustees and the Arkansas Department of Higher Education, that same year. The Center is the administrative equivalent of a Department, and the Director reports to the Dean of the William J. Fulbright College of Arts and Sciences. Close linkages exist between the Center and multiple academic departments across Arts and Sciences and the Colleges of Engineering, Sam M. Walton College of Business, School of Architecture, and Dale Bumpers College of Agriculture, Food and Life Sciences.

In July of 2007, CAST moved to the newly completed J. B. Hunt Transport Services, Inc. Center for Academic Excellence (JBHT) building located at the corner of Dickson Street and Harmon Avenue on the UofA Fayetteville campus. This new building serves as a focal point and enabling infrastructure for information technology, computational sciences, informatics and technology-enabled education, research, and outreach. Center faculty and staff, spanning the disciplines of business, engineering and arts and sciences, prepare students for the diverse, innovative, collaborative, team-oriented environment prevalent in today's workplace.

CAST focuses on three basic areas: education, research, and service to the public. CAST specializes in serving the academic community through its emphasis on high quality university courses in geospatial theory and method. CAST is actively involved in extensive research efforts, through multiple grants totaling \$1-2 million each year.

CAST is active in a wide range of service to the university, community, state, nation, and is also active internationally. For example, Center staff work with over 200 high schools in the EAST program and provide technical geospatial assistance to local and county governments around the State of Arkansas through our USDA-funded RGIS Program.

This year, there were a total of 39 CAST staff members: 3 faculty members, 20 non-classified, 2 classified, 6 hourly, and 8 graduate students. They are: Fred Limp, Jack Cothren, Jason Tullis, Adam Barnes, Heather Chen, Lyndon Colvin, Brian Culpepper, Robyn Dennis, Jeff Easley, Eileen Ernenwein, Ben Gilley, Anne Gisiger, Bruce Gorham, Robin Gregory, Debbie Harmon, Bob Harris, Bill Johnston, Angie Payne, Cristina Scarlat, Tim Sexton, Malcolm Williamson, John Wilson, Snow Winters, Mary Gail Reed, Karen Wagner, Chris Angel, Christopher Goodmaster, Katie Simon, Aaron Jensen, Earl Harrell, Duncan McKinnon, Kennan Cole, Yan Huo, Keshia Koehn, Scott Smallwood, Peter Smith, Caitlin Stevens, Faye Bartlett, and Leon Lee.

University Education

University of Arkansas undergraduate and graduate students have access to a number of offerings in geospatial methods and theory including courses in GIS, GPS, cartography, remote sensing, image interpretation, photogrammetry, surveying, and spatial statistics. These provide the student with a range of career options. Courses are open to students, from any discipline, who plan to use these technologies in their work and research. In addition to classroom instruction, CAST facilities are used by students in both undergraduate and graduate research projects. CAST systems administration staff support various

labs in both Ozark Hall and JBHT. UofA classes taught in CAST-supported, JBHT facilities during FY07-08 follow:

Fall 2007

Introduction to GI Science - Geomatics, Fred Limp (ANTH/GEOS)
Introduction to GPS, Jack Cothren (ANTH/GEOS)
Archeological Method and Theory, Fred Limp (ANTH)
Principles of Remote Sensing, Jason Tullis (GEOS)
Introduction to Raster GIS, Ken Kvamme (ANTH/GEOS)
Archeological Prospecting and Remote Sensing, Ken Kvamme (ANTH)
Archeology Lab, Ken Kvamme (ANTH)
Visualizing the Roman City, Fred Limp (ANTH/GEOS), et al.
Approaches to Archeology Methods Labs (3 sessions), Aaron Fogel (ANTH)

Spring 2008

Quantitative Techniques in Geosciences, Jack Cothren (GEOS)
Advanced Raster GIS, Ken Kvamme (ANTH)
Visualizing the Roman City, Fred Limp (ANTH/GEOS), et al.
Special Problems – Photogrammetry, Jack Cothren (GEOS)
Approaches to Archeological Methods Labs (3 sessions), Aaron Fogel (ANTH)
Vector GIS, Jason Tullis (GEOS)
Settlement Sites, Ken Kvamme (ANTH)

In FY 07-08, there were 158 student research and/or UofA class accounts active at the Center's labs in JBHT, in addition to approximately 60 faculty/staff accounts. Student accounts were active for 16 UAF classes taught in CAST-managed, instructional facilities (JBHT-231 and JBHT-229), and EAST functions held in our new EAST Suite (JBHT-263-265). Hundreds of temporary accounts are also set up each year for a variety of workshops, short-course, EAST classes, demonstrations, etc. Two other labs are available to students doing selective research (JBHT-340 and JBHT-343), and graduate students are offered desk workspace in JBHT-331.

CAST systems administration staff members also support several Department of Geosciences labs in Ozark Hall that also host student researchers and UofA classes. Classes supported this year include:

Fall 2007

Introduction to Cartography (GEOS)
Geophysics (GEOL)

Spring 2008

Computer Mapping (GEOS)
Geomorphology (GEOL)
GPS Geodesy in Geoscience (GEOL)
Honors Colloq in Earth System Science (GEOL)

Publications

CHAPTERS

Schill, S.R., D. Rundquist, A. Filippi, K. Kvamme, J. Cothren and J.A. Tullis
2008 *In Situ Sensors and Field Method*, in Manual of Remote Sensing: Platforms and Sensors (M.W. Jackson, editor), Silver Springs, MD: American Society of Photogrammetry and Remote Sensing, in press.

REFEREED PUBLICATIONS AND PROCEEDINGS

Aquino, L.D., J.A. Tullis and F.M. Stephen

2008, *Modeling Red Oak Borer (Enaphalodes rufulus Haldeman) Damage Using In Situ and Ancillary Landscape Data*, *Forest Ecology and Management* 255:931-939. Publication Available at:

<http://ees.elsevier.com/foreco/>

Conyers, L. B., E. G. Ernenwein, M. Grealy and K. M. Lowe

2008, *Electromagnetic Conductivity Mapping for Site Prediction in Meandering River Floodplains*.

Archaeological Prospection 15(2):81-91, DOI: 10.1002/arp.326. Publication Available at:

<http://dx.doi.org/10.1002/arp.326>

Cothren, Jackson; Christopher Goodmaster; Adam Barnes; Eileen Ernenwein; Alexei Vranich, W. Fredrick Limp; and Angelia Payne

Fusion of Three-Dimensional Data at Tiwanaku: An Approach to Spatial Data Integration. Proceedings of the 35th Computer Applications and Quantitative Methods in Archaeology (CAA) Conference, Budapest, Hungary. Submitted.

Cothren, Jackson; David Fredrick; W. Fredrick Limp; Tim de Noble; Adam Barnes; Christopher Goodmaster; and Caitlin Stevens

2008, *Visualizing the Roman City: Viewing the Past through Multidisciplinary Eyes*. Proceedings of the 36th Computer Applications and Quantitative Methods in Archaeology (CAA) Conference, Budapest, Hungary. Submitted.

Cothren, J, B. Smith, K. Damphousse, P. Roberts

2007, *Geospatial and Temporal Patterns of Preparatory Conduct Among American Terrorist*. *International Journal of Comparative and Applied Criminal Justice*. Volume 31, Issue 2, 2007.

Ernenwein, E. G. and K. L. Kvamme

2008, *Data Processing Issues in Large-Area GPR Surveys: Correcting Trace Misalignments, Edge Discontinuities, and Striping*. *Archaeological Prospection*: 15(2):133-149, DOI: 10.1002/arp.331.

Publication Available at: <http://dx.doi.org/10.1002/arp.331>

Im, J., J.R. Jensen and J.A. Tullis

2008, *Object-based Change Detection Using Correlation Image Analysis and Image Segmentation Techniques*, *International Journal of Remote Sensing* 29(2):399-423. Publication Available at:

<http://www.tandf.co.uk/journals/tf/01431161.html>

Raber, G.T. and J.A. Tullis

2007, *Rapid Assessment of Storm-Surge Inundation after Hurricane Katrina Utilizing a Modified Distance Interpolation Approach*, *GIScience and Remote Sensing* 44(3):220-236. Publication Available at:

<http://bellwether.metapress.com/content/120751/>

Raber, G.T., J.R. Jensen, M.E. Hodgson, J.A. Tullis, B.A. Davis and J. Berglund

2007, *Impact of Lidar Nominal Post-spacing on DEM Accuracy and Flood Zone Delineation*, *Photogrammetric Engineering and Remote Sensing* 73(7):793-804.

Publication Available at: <http://www.asprs.org/publications/pers/index.html>

Reddy, V. J. McFarlane, J. Cothren, C. Thompson

2007, *Extending a Natural Language Interface with Geospatial Queries*. *IEEE Internet Computing*. Vol 1098-7801, Issue 107. Pp. 84-87.

Tullis, J.A., J.D. Cothren, D.E. Irwin, C. Yeager, W.F. Limp, J.M. Wilson, B.E. Gorham and S. Ogle

2007, *Yearly Extraction of Central America's Land Cover for Carbon Flux Monitoring*, *GIScience and Remote Sensing* 44(4):334-355. Available at: <http://bellwether.metapress.com/content/120751/>

UNREFEREED ARTICLES

Barnes, Adam; Jackson Cothren; Alexei Vranich

2007, *Mapping Tiwanaku: Photogrammetric Processing of Historic Aerial Photography*. Research Paper No. 38, Center for Advanced Spatial Technologies, University of Arkansas, Fayetteville, Arkansas.

Culpepper, R. Brian

2008, *GeoBlade Review*, GeoWorld Magazine, June 2008.

Ernenwein, E. G. and M. L. Koons

2007, *Subsurface Imaging in Tiwanaku's Monumental Core*. Paper presented at the Technology and Archaeology Workshop, Dumbarton Oaks. Publication Available at:

http://cast.uark.edu/assets/files/PDF/Tiwanaku/Ernenwein&Koons2007_TiwanakuGeophysics.pdf

Gorham, Bruce

2007, *Mapping the ever-changing landscape: Lessons from the Arkansas land-use / land-cover mapping project*. Innovator: November 2007.

Limp, W.F., J.C. Cothren and J.A. Tullis

2007, *New Analysis Tools: Expanded LIDAR Information Content Drives New Application Opportunities*, Earth Imaging Journal - Jan/Feb.

Williamson, Malcolm D.

2008, *DeLorme XMap 5.0 GIS Enterprise*, GeoWorld. March. Publication Available at:

<http://www.geoplace.com/> (subscriber access only)

INVITED LECTURES

Tullis, Jason A.

2007, *The Fourth R: Remote Sensing*, presentation to Arkansas and Oklahoma High School students in the 8th-10th grade Gifted and Talented Program, Fayetteville, Arkansas, July 2007.

OTHER LECTURES, PAPERS, AND ORAL PRESENTATIONS

Asante, K., J. Cothren

2007, *Using the TerraHawk Imaging System as a Photogrammetric Mapping Tool*. University of Arkansas GIS Day, November 19, 2007.

Barnes, A., J. Cothren, C. Goodmaster, E. Ernenwein, A. Vranich, W.F. Limp, A. Payne.

2008, *Fusion of Three-Dimensional Data at Tiwanaku: An Approach to Spatial Data Integration*. 36th Annual Conference on Computer Applications and Quantitative Methods in Archaeology, On the Road to Reconstructing the Past. Budapest, 2-6 April 2008.

Barnes, A., J. Cothren

2007, *Using Modern Photogrammetric Methods to Analyze an Ancient Landscape*. Technology and Archaeology Symposium, Dec 7, 2007. Dumbarton Oaks, Washington D.C. (invited)

Barnes, A., J. Cothren, D. Fredrick, F.W. Limp, T. de Noble, C. Goodmaster, C. Stevens

2008, *Visualizing the Roman City: Viewing the Past Through Multidisciplinary Eyes*. 36th Annual Conference on Computer Applications and Quantitative Methods in Archaeology, On the Road to Reconstructing the Past. Budapest, 2-6 April 2008.

Cothren, J., J. Nipper, R. Dzur, D. Sandin

Automated Matching and Orientation of Aerial Images using Affine Covariant Region Descriptors. ASPRS 2008, Annual Conference. Bridging the Horizons: New Frontiers in Geospatial Collaboration. May 1, 2008. Portland, OR.

Cothren, J., A. Barnes, C. Goodmaster, A.Vranich, E. Ernenwien, F. Limp
2007, *Ancient Sites in 21st Century Environments: Fusion of Three-dimensional, Multi-scale Data*. Technology and Archaeology Symposium, Dec 7, 2007. Dumbarton Oaks, Washington D.C.

Cothren, J., W. Johnson, E. Ernenwien, F. Limp, M. Hargrave
2007, *Integrated Multi-sensor Characterization of Archaeological Sites using ArchaeoMapper*. Poster presented at SERDP-ESTCP National Conference. Washington DC. Dec 2007.

Gregory, Robin
2008, Presentation at the 2008 EAST Partnership Conference in Hot Springs, Arkansas. EAST, Arkansas Public Schools.

Leh M.D, Bajwa S.G, Chaubey I. and Cothren J.
2008, *Remote sensing based methodology of delineating stream channel morphology*. ASABE Paper No. 08-3734. 2008 Annual International Conference of the ASABE. Providence, Rhode Island.

Leh M.D, Bajwa S.G, Chaubey I. and Cothren J.
2008, *A remote sensing based methodology of delineating stream channel morphology*. ASABE Paper No. 08-3734. 2008 Annual International Conference of the ASABE. Providence, Rhode Island.

Lovick, A., J. Cothren
2007, *Multi-source Data Fusion in support of GPS Campaigns on the Island of Dominica*. University of Arkansas GIS Day, November 19, 2007.

Research and Externally Funded Projects awarded in FY07-08

Each year, CAST staff members are involved in major research projects, training programs, and other cooperative efforts with a variety of governmental and business organizations. Recent research projects focused on areas such as interoperability, image object analysis, decision support, geospatial data warehousing and distribution, web-mapping, natural resources analyses, K-12 GIS education, remote sensing education, multi-instrument data fusion, water quality analysis, and expanding geospatial capabilities of local governments in rural areas.

- The total amount of externally-funded research grants awarded to CAST during Fiscal Year 07-08 was \$749,687.
- The total amount of externally-funded research grants awarded in previous years, but still active in Fiscal Year 07-08, was \$1,468,114.
- The total amount of proposals that were submitted during Fiscal Year 07-08, but were not funded or not funded yet was \$427,584.

The list of grants and proposals below is followed by detailed descriptions of each project.

2007-2008 Grants and Proposals List		Awarded	Awarded	Proposals
	Title	This Year	Previously	This Year
1	EAST Initiative Geospatial and Visualization Support Training....	312,721.00		
2	Digital Antiquity: Planning a Digital Information Infrastructure....	155,656.86		
3	Life Cycle Analysis for Fluid Milk w/experimental Verification....	3,623.62		
4	Vitual Hampson Museum	90,000.00		
5	Travel Demand Model Development	13,302.00		
6	Arkansas View: Expanding the Use and Value of Remote Sensing....	51,000.00		
7	Arkansas Wetlands Resources Information Management System....	120,661.00		
8	The Amarna Virtual Museum Pilot Project	2,723.00		
9	Gis-Based Mapping of Hydrogeomorphic (HGM) Wetland Classes....		55,667.00	
10	CORONA Atlas of the Middle East		193,733.00	
11	Streamlined Archaeo-Geophysical Data Processing and Integration....		229,616.00	
12	Routing Models for Rural Transportation Networks with Time....		7,499.00	
13	Stream Team Information System Design & Development - Phase I		38,778.00	
14	Computing & Retrieving 3D Archeological Structures....		173,223.00	
15	RGIS - Geographic Information Systems Project		185,000.00	
16	Applied Silvicultural Assessment (II) of Upland Oak-Hickory Forests....		220,000.00	
17	Red River Nutrient Criteria Development Phase I		5,770.00	
18	National Archeological Database - Modification #5		12,000.00	
19	Integration of GIS & Logistics Planning Methods for AR Rural Transportation		5,904.00	
20	Terrorism in Time & Space: Inclusion of Spatio-Temporal Data from Federal -- NIJ- Terrorist Activities II		92,333.00	
21	Tracking Data Analysis and Decision Support System - Phase I		29,950.00	
22	Analysis of NW Arkansas Residential & Commercial Property....		20,242.00	
23	An Analysis of the NW Arkansas Residential and Commercial Property Market		16,582.00	
24	Probabilistic Risk Based Decision Support for Oil & Gas Exploration		73,963.00	
25	GeoSpatial Analysis of Terrorist Activities: The Identification....		107,854.00	
26	An Examination of Hurricane Katrina Mitigation Efforts Utilizing....			155,899.00
27	RGIS Mid-South 2008			140,000.00
28	SOW for MARs			24,685.00
29	Preserving & Visualizing Arkansas Heritage			97,000.00
30	Terrestrial Habitat Mapping Update for the Boston Mountain & AR....			10,000.00
		749,687.48	1,468,114.00	427,584.00
			TOTAL	2,645,385.48

PROJECTS AWARDED DURING FISCAL YEAR 07-08.

1) EAST Initiative Geospatial and Visualization Support Training for the EAST Initiative Funding

EAST Initiative

\$312,721.00

PI: Fred Limp CO PI: Malcolm Williamson

U of A Project # PT06 356

01-JUL-07 to 31-OCT-08

The EAST Initiative is an educational initiative built around student-centered project-based learning, in which students use cutting-edge technology while developing community service projects. CAST is pleased to have been the very first education partner of EAST. As of the '07-'08 school year, EAST was found in 200 schools in eight states, with some 12,000 student participants, ranging from second grade to

community college. CAST's involvement with the EAST Initiative is primarily focused around geospatial and visualization technologies, which are applicable to a broad spectrum of student community service projects. CAST research staff collaborate with EAST's administration to provide a wide variety of training and support services to EAST students and teachers. These include:

- 2- and 3-day technology workshops for students.
- Full-day visits to EAST schools.
- Student and teacher support through the EAST web forum, e-mail, and telephone.
- Extensive web resources.
- Technology introductions for EAST teachers.
- Break-out sessions, presentations, demos, and support at the annual EAST Partnership Conference.

In addition CAST supports and manages the North West Arkansas EAST Training Center in the JB Hunt Center at the University of Arkansas as well as the UA EAST Alumni Center, also in the JB Hunt Center.

2) Digital Antiquity: Planning a Digital Information Infrastructure for Archaeology

The Andrew W. Mellon Foundation

\$155,656.86

PI: Fred Limp

UA Project # PT07-000196

01-JUL-07 to 30-JUN-08

Cultural heritage is central to a people's identity. Nearly all countries mandate its protection, often through archaeological documentation and interpretation. The curation in perpetuity of irreplaceable archaeological artifacts, field notes, photographs, reports, and analytical data underlies the public's faith that their heritage is safeguarded for the future. Archaeoinformatics.org was established as a collaborative organization to design, seek funding for, and direct a set of cyberinfrastructure initiatives for archaeology. Archaeoinformatics.org seeks to coordinate with and develop interoperability of its own projects with other relevant data-sharing initiatives.

In its planning year, Archaeoinformatics.org pursued four initiatives: *Digital Heritage Gateway* to define the core metadata that describe digital repositories' holdings, *Archaeological Digital Preservation Archive* to create a permanent, accessible repository for digital archaeological data, development of *Best Practices Guides*, and development of data archiving protocols and best practices for *Non-standard Data* formats.

3) Life Cycle Analysis for Fluid Milk w/experimental Verification of DNA/CA Dairy Carbon Footprint

University of Arkansas

\$3,623.62

PI: Greg Thoma CO PI: Darin Nutter & Marty Matlock

UA Project Code: PT08-70

28-JAN-08 - 31-AUG-08

The CAST portion of this project is to provide routing data to project cooperators in the Chemical and Civil Engineering Departments for their analysis of the impact of transportation costs on the life cycle of dairy products. The project focuses on taking dairy producers and dairy processing locations in X Y coordinate form and making use of the Google Maps API to return the *most likely* route between stops, along with the associated distance and approximate time of travel for each route. The derived distance and time measures will be used to estimate the impact of transportation-related costs on the carbon footprint of dairy products.

4) Virtual Hampson Museum

Arkansas Natural and Cultural Resources Council

Total Budget: \$90,000.00

PI: Fred Limp

UA Project # PT-7-000095

01-JUL-07 to 30-JUN-08

The Virtual Hampson Project began in July 2007. In the first year, the team scanned 470 artifacts, developed an online, Flash-based interface for the Hampson Virtual Museum, and created a realistic, 3D

visualization of the Upper Nodena archaeological site, where many of the artifacts were found. The online virtual museum contains photos, short movie clips, descriptions, and an interactive 3D viewer for each of the *virtual* artifacts as well as links to download each individual model in varying formats and resolutions. In future work, the team proposes to scan an additional 500 artifacts and place them in the current online system. They will also improve the visualizations of the Nodena Village making them more accurate with historic/archaeological records and adding additional animations and viewpoints. All information will be published and updated on the Virtual Hampson Museum website: <http://hampsonmuseum.cast.uark.edu/>.

5) Travel Demand Model Development

Arkansas Highway and Transportation Department
\$13,302.00

PI: Fred Limp CO PI: Cristina Scarlat
UA Project # PT07 920
25-JAN-08 - 30-JUN-08

This project focuses on developing a travel demand model for Northwest Arkansas for 2010, 2015 and 2030. The project involves working with transportation planners at the Northwest Arkansas Regional Planning Commission and Arkansas Highway and Transportation Department.

6) Arkansas View: Expanding the Use and Value of Remote Sensing through Education, Research, and Outreach

AmericaView, Inc.
\$51,000.00

PI: Jason Tullis CO PI: Bruce Gorham and Fred Limp
UA Project # PT07-000346
01-JUL-07 to 30-JUN-08

ArkansasView is a consortium of colleges, universities, K12 schools, other non-profit organizations, as well as state and federal agencies working within Arkansas. The consortium is dedicated to bringing about the wide application of remotely-sensed data, and other earth science data products within the remote sensing and GIS communities of Arkansas. ArkansasView is part of a larger non-profit organization known as AmericaView, Inc. AmericaView is a locally controlled and nationally coordinated program with a mission to advance the availability, timely distribution, and widespread use of remote sensing data and technology through education, research, outreach, and sustainable technology transfer to the public and private sectors. The Consortium is actively working to expand participation in the AV Program to all 50 states.

Satellite imagery offers a wealth of information about our planet, but is not being used to its full potential. The three main reasons for its underutilization are: (1) Citizens have very little knowledge about the technology and how it can be used, (2) The data can be costly and are not always readily accessible, and (3) Using the data requires considerable investments in software, hardware, and training. These challenges are being addressed through the power of partnerships made possible by ArkansasView and the AmericaView consortium. ArkansasView is: (1) Delivering informative workshops, seminars, and lectures in schools, businesses, government agencies and other private and public institutions, (2) providing personnel, materials, and facilities for educational training, (3) conducting research to improve remote sensing technology transfer, (4) creating real-time, sustainable data delivery options for emergency response, and (5) working to establish closer relationships with software and data vendors in order to obtain group discounts.

7) Arkansas Wetlands Resources Information Management System (AWRIMS) - Phase II

Arkansas Natural Resource Commission
\$120,661.00

PI: Fred Limp CO PI: Brian Culpepper and Jack Cothren
UA Project # PT07595
01-OCT-07 to 30-OCT-08

The Arkansas Wetlands Resources Information Management System (AWRIMS), at its current development level, allows querying, viewing, mapping, printing, and preliminary analysis of wetland related datasets. The goal of the AWRIMS project is to produce an automated system that analyzes

hydrogeomorphic characteristics, landscape assessments, wetland impacts and restoration data, as well as other available digital data within Arkansas and provide effective summarization of cumulative landscape changes and trends. The analytical capacity currently under development on the AWRIMS project provides quantitative summation of acres (gains and losses) and simple comparative analyses. The resulting AWRIMS tools will analyze all available existing and historic data; quantify the wetland types, quality, and abundance; summarize impact and restoration activities; assess landscape position; and provide acceptable, accurate results at the watershed level. The resulting decision support logic will provide the *blue-print* for development of future enhancements for the Arkansas wetlands decision support system.

8) The Amarna Virtual Museum Pilot Project

Amarnatrust - University of Cambridge

\$2,723.00

PI: Fred Limp

UA Project # PT08-258

21-MAY-08 to 31-AUG-08

The Amarna Virtual Museum Pilot Project proposes to design a web-based interface for the organization, interpretation, browsing, downloading, and digital archiving of three-dimensional digital models of at least 30 ancient Egyptian artifacts dating to the Amarna period (c. mid-1300s BC). The Amarna Virtual Museum website will employ a MySQL database to link three-dimensional digital data and digital images of the artifacts to contextual and interpretive information. A Flash applet will allow website users to retrieve artifact data from the MySQL database through an AMFPHP service (an open-source implementation that allows Adobe Flash to connect with MySQL). This will provide a graphical interface enabling users to select artifacts based on various criteria. This pilot project will serve to demonstrate the feasibility of such an interface in allowing the dissemination and remote access of highly specialized digital data to members of the research community, as well as the public, promoting and supporting the use of said data to those who may lack the technical resources to utilize such data otherwise, providing archaeological interpretation of Amarna period archaeology to the public, and to serve as a showcase of the technology involved and a vehicle to pursue additional funding for a more comprehensive effort.

PROJECTS AWARDED PREVIOUSLY, BUT STILL ACTIVE IN FISCAL YEAR 07-08.

9) GIS-Based Mapping of Hydrogeomorphic (HGM) Wetland Classes for the St. Francis Wetland Planning Area

NCRC Natural/Cultural Resource Commission

\$55,667.00

PI: Fred Limp CO_PI: Malcolm Williamson

UA Project Code # PT07 209

01-APR-07 to 30-JUN-08

CAST collaborates with the Arkansas Multi-Agency Wetland Planning Team (MAWPT) in a continued effort to map wetland classes and subclasses around the state using the Hydrogeomorphic (HGM) approach. The HGM approach to assessment of wetland functions relies upon site-specific evaluation of geomorphic setting, water source, and hydrodynamics. In this project, CAST is working with biologists and geomorphologists of the MAWPT to model and map the classes and subclasses of wetlands, as defined by the HGM approach, of the St. Francis River wetland planning area. CAST uses geospatial technology and improved spatial and quantidata to determine the location and extent of these wetland classes and subclasses.

10) CORONA Atlas of the Middle East

National Endowment for the Humanities

\$193,733.00

PI: Jesse Casana CO PI: Jack Cothren

UA Project # PT06-000346

01-AUG-06 to 31-JUL-08

Archaeologists have long appreciated the extraordinary power of aerial photography and satellite imagery to aid in the discovery and interpretation of archaeological sites, the recognition of larger cultural landscape features such as roads, canals, and field systems, and the mapping and management of cultural resources. However, in the Middle East, no imagery of adequate spatial resolution was available to archaeologists until 1995, when a large archive of US intelligence satellite images from the 1960s and 1970s, known as CORONA, were declassified and made publicly available. These images provide stunning, high resolution views of the landscape, and have been employed recently in a handful of innovative projects in the Middle East. In these cases, use of CORONA imagery has revolutionized our understanding of the quantity and distribution of archaeological remains, fundamentally transformed field methodologies, and vastly improved our understanding of settlement histories. Moreover, because CORONA images are over 30 years old, they preserve a picture of archaeological sites prior to their widespread destruction by recent industrialization, urban expansion, and agricultural intensification. Even as modern high-resolution satellite imagery has become increasingly accessible to non-specialists through GoogleEarth and other similar online resources, CORONA remains an absolutely unique resource that can never be replaced by newer technologies.

This project will develop a digital CORONA satellite imagery-based archaeological atlas of the Middle East and surrounding regions including the modern nations of Iran, Iraq, Turkey, Syria, Jordan, Lebanon, Israel/Palestine and Egypt and adjoining parts of the Arabian Peninsula, Central Asia and North Africa. This project applies newly developed orthorectification techniques to process the CORONA imagery and sustainable data distribution strategies that will provide the archaeological community with very accurate, high-resolution digital CORONA imagery of the Middle East. The project will also produce digital topographic data from the imagery and will provide images that can be viewed in three dimensions.

11) Streamlined Archaeo-Geophysical Data Processing and Integration for DoD Field Use

US Army Corps of Engineers

\$229,616.00

PI: Fred Limp CO PI: Jack Cothren & William Johnston & Eileen Ernenwein

UA Project # 05-08 7054

1-APR-06 to 30-MAR-08

Evaluating the eligibility of archaeological sites for the National Register of Historic Places (NRHP) in compliance with federal law (NHPA) is an ongoing activity at DoD installations. Traditional approaches based on hand excavation are expensive, highly invasive, and potentially unreliable. This project demonstrated that use of remote sensing techniques can reduce the invasiveness and dramatically improve the reliability of NRHP evaluations. The project also developed new methods for integrating data collected by multiple sensors that dramatically enhance their information content and resource management value. The benefits of this approach are not currently accessible to DoD Cultural Resource Management (CRM) personnel because data processing is very labor intensive and demands a high level of technical expertise with seven or more commercially available software systems.

This project has two objectives: (1) Assemble a single, user-friendly software that will serve as an effective medium for infusing the integrated, multi-sensor geophysical approach into wide use, and (2) Demonstrate and validate the cost and performance benefits of the approach and technology infusion tool to DoD geophysical users, representatives of federal, state, and tribal historic preservation offices, and other CRM practitioners, federal and state resource managers.

12) Routing Models for Rural Transportation Networks with Time-Varying Const.

Mack Blackwell (John)

US Department of Transportation

\$7,499.00

PI: Fred Limp

UA Project # PT06-378

01-FEB-07 to 30-JUN-08

The purpose of this project is to develop network routing data in support of poultry truck routing analyses by students and faculty in the Industrial Engineering Department. The routing data is derived from publicly available data and is culled and reformatted to meet processing demands. The overall goal of

the project is to explore alternative feed delivery and poultry delivery routing strategies in the event of a disease outbreak.

13) Stream Team Information System Design & Development - Phase I

Arkansas Game and Fish Commission

\$38,778.00

PI: Dr. Jack Cothren CO PI: Brian Culpepper

UA Project # 000419

28-MAY-07 to 30-JUN-08

The tasks associated with this research effort were to design and develop a database architecture that provides the AGFC Stream Team managers and partners with streamlined access to a spatial data warehouse of Arkansas water quality, stream survey, and habitat remediation information. The spatial warehouse provides project volunteers and partners with a secure update and edit capability for water quality, stream survey, and habitat remediation reporting and data collection. Data visualization and cartographic representation of these spatial data measurements and datasets are distributed within the Arkansas Stream Team website. Stream Team volunteer activities and events scheduling from their centralized database will be accessible to the Stream Team Volunteers and monitored by AGFC project managers via current web browsers. This collaborative research provides AGFC access to recently released standards for geospatial data processing solutions and enables CAST faculty, staff and students to evaluate the usefulness of these open geospatial data standards (i.e. Open GIS Consortium Simple Features Specifications) for spatial data management, distributed data collection and decision support use by an Arkansas state agency. This project serves as a local OGC test-bed to determine if the OGC standards are applicable to the spatial data storage needs of AGFC, and if the implementation of the spatial data standard is acceptable by the project partners. Project impacts such as user access speed, database schema compatibility, agency data storage capacity/requirements will be documented in a final white paper style report to be distributed via our CAST website.

14) Computing & Retrieving 3D Archeological Structures from Subsurface Survey

University of Pennsylvania

\$173,223.00

PI: Fred Limp

UA Project # 04-556 5289

12-OCT-04 to 30-SEP-07

In collaboration with Kostas Daniilidis, George Biros, Jianbo Shi and Alexei Vranich of the University of Pennsylvania, CAST staff collaborated on the NSF-funded (total award \$1.5M) project *Computing & Retrieving 3D Archeological Structures from Subsurface Survey*. The project's objectives were to develop advanced processing techniques for geophysical data collection, inversion, integration, and visualization. The location is the world heritage site of Tiwanaku located in Bolivia. CAST activities have focused on the field investigations and analysis of data from geophysical survey, aerial photography and terrestrial laser scanning. CAST staff member Eileen Ernenwein has surveyed 6.24 hectares of land at Tiwanaku, in many areas with multiple methods. Photogrammetric progressing of a dozen aerial photos from 1972 and 1992 and integration of SRTM (Shuttle Radar Topographic Mapping) data has produced 12 orthophotos, a digital surface model (DSM) covering all areas of photo overlap, and any potential stereo object extractions, as well as a regional DEM. The orthophotos and regional DEM provide a means to address questions on the solar and astronomical alignment of the site and other questions. Laser scanning was conducted for several structures and excavation areas within the monumental core of the archaeological site of Tiwanaku, in addition to several unique artifacts recently excavated from the site.

15) RGIS - Geographic Information Systems Project

US Department of Agriculture, CSREES; USDA Office Extramural Program

\$185,000.00

PI: Fred Limp

UA Project # 30830

01-SEP-06 to 31-AUG-07

Over the past 15 years, RGIS Mid-South has established itself as Arkansas' premier resource for vendor-neutral, free geospatial technical support for both the public and private sector. We average over 175 unique constituent support events annually while our website supports well over 33,000 hits monthly.

Most recently, our technical support of an ad-hoc imagery partnership composed of city and local government has saved local tax payers over \$700,000 by facilitating technical discussions between the imagery partnership and vendors. Recently, RGIS Mid-South updated the local RGIS Mid-South website (www.rgis.cast.uark.edu) that highlights our specific accomplishments here at the University of Arkansas. This website also includes a free imagery viewer for Northwest Arkansas (2004 true-color imagery acquired by the Imagery Task Force) which enables free access to the full resolution imagery for anyone with internet connectivity. Users can print maps, geocode addresses within Benton or Washington Counties, and even download the photography from the University of Arkansas' Spatial Library (UASL). Approximately 1,700 users have registered to use this application since February 2005. The NWA Regional Planning Commission, and CAST staff members Jack Cothren and Brian Culpepper have assisted our local government representatives with the identification and specification of imagery needs for the task force, plus the identification of suitable photogrammetric/engineering contractors.

16) Applied Silvicultural Assessment (II) of Upland Oak-Hickory Forests and the Red Oak Borer in the Ozark and Ouachita Mountains of Arkansas

USDA Forest Service

\$220,000.00

PI: Fred Stephen CO PI: Jason Tullis

UA Project # 30871

01-OCTOBER-06 to 30-SEPTEMBER-11

The goal of this applied silvicultural assessment (ASA) is to continue development and implementation of a GIS-based oak hazard model as it relates to future red oak borer outbreaks. Highlights from the 2006-2007 effort are the collection of high density LIDAR over a 32 km² study area in the Boston Mountains. Approximately 80 million LIDAR points were captured and are being processed to extract vertical forest structure. This resulting data is being combined with a robust field data collection and warehousing effort. In addition to an oak hazard model (which is useful to forest managers), the project is helping to uncover patterns in red oak borer infestation that can assist in determining underlying scientific basis for the recent spike in red oak borer population.

17) Red River Nutrient Criteria Development Phase I

USDA-ARS

\$5,770.00

PI: Bruce Gorham

UA Project Code # 31892

01-MAR-07 to 28-FEB-09

This project's goal is to improve overall understanding of stream nutrient retention in the Red River watershed. The study area includes the entire Red River basin and extends from eastern New Mexico to central Louisiana. The following tasks are being performed: (1) Stream sampling data, provided by various state and federal agencies, is being spatially processed for inclusion in a consistent geospatial database, (2) A seamless digital elevation model (DEM) is being produced, based on the National Elevation Dataset, for the entire study area, (3) Using the points and the DEM mentioned in steps 1 and 2 above, watershed maps are being generated for each sampling point. These maps will show the aerial extent of all land flowing to that point, 4) The type and amounts of all landcover types, based on the National Landcover Dataset, will be calculated for each watershed, and (5) maps and reports for each of the sampling-point watersheds will be done.

18) National Archeological Database - Modification #5

National Archeological Database and National NAGPRA Databases

National Archeological Database Program

\$12,000.00

PI: Fred Limp CO_PI: Robert Harris

UA Project # H0001020007

14-SEP-06 - 31-JUL-07

CAST has an agreement with the National Park Service, Archeology Division, to create, maintain and update the National Archeological Database (NADB) On-line System. The NADB-Reports module contains over 350,000 archeological bibliographic references. The National Archeological Database provides considerable national exposure for CAST and the University of Arkansas. The web interfaces

receive over 1,000 hits per month. Last year, we had additional funding over the maintenance base level to upgrade the NADB system by adding *Sent From/To* queries and reports to the system.

19) Integration of GIS & Logistics Planning Methods for AR Rural Transportation

Mack Blackwell

\$5,904.00

UA Project # PT06-238

PI: Manuel Rossetti CO PI: Ed Pohl & Fred Limp

01-AUG-06 - 31-JUL-07

The Center partnered with faculty from Industrial Engineering (Profs. Manuel Rosetti and Ed Pohl) in a pilot project *Integration of Geographical Information Systems (GIS) and Logistics Planning Methods for Arkansas Rural Transportation Emergency Planning*. Researchers in the area of emergency management planning have recognized the need for integrating data with analysis tools and have advocated taking a systems perspective of emergency planning that couples the use of advanced computer and communication technologies (wireless networks, automatic vehicle location, global positioning systems, geographic information systems, etc.) with advanced optimization and simulation techniques. The management of resources in this way is a fundamental issue in the area of operations research, and a wide-variety of modeling techniques can be utilized if the right data is available to the analyst. The State of Arkansas has developed an extensive on-line database of statewide infrastructure, hospital locations, transportation networks, schools, demographic data, etc. The objective of this research was to assess the feasibility of linking the existing geographic information systems that contain relevant locations (shelters, schools, command posts, etc.), spatial features (roads, rail lines, etc.), organizations, etc. with logistics planning and analysis tools and techniques.

20) Terrorism in Time & Space: Inclusion of Spatio-Temporal Data from Federal -- NIJ- Terrorist Activities II

US Department of Justice

\$92,333.00

PI: Jack Cothren CO PI: Brent Smith

UA Project # PT06-256

01-OCT-06 to 30-SEP-08

Defining terrorism has been the most serious problem confronting those who study this phenomenon. Whatever definition the scholar or analyst selects subsequently affects the population of incidents or events from which the samples for research are drawn, the methods used to collect data, and ultimately, the findings of the completed study. As the study of terrorism matures, different databases using different definitions of terrorism have emerged. In some cases, these databases reflect the whims of the individual scholar's political or ideological biases. In other cases, some existing databases have been taken as authoritative simply because of the large number of incidents included; basically taking the position that including everything somehow will solve the conceptual difficulties. The American Terrorism Study (ATS) has taken a different approach. This study, begun in 1988 with the cooperation of what was then called the FBI's Terrorism Research and Analytical Center, when they began compiling the court case records and creating a statistical database on all federal criminal cases since 1980, resulting from indictment under an official FBI terrorism investigation. Although this provides a rather conservative estimate of the total volume of terroristic activity in America, it has provided a consistent and reliable method of measuring the extent of terrorism in America over time. While the development of alternative terrorism databases has utility for specific types of research endeavors, using the official record of FBI cases as the foundation for the development and expansion of existing terrorism databases is a logical step in the maturation of terrorism scholarship.

The primary purpose of this project is to: (1) Expand geospatial and temporal data collection and analysis to include the remaining FBI terrorism cases from 1980-2004, and (2) Create a more comprehensive *American Terrorism Study* database that merges all prior data from previous research efforts by the Terrorism Research Center, so that scholars can conduct more robust analyses of terrorism behaviors.

21) Tracking Data Analysis and Decision Support System - Phase I

Arkansas Game and Fish Commission

\$29,950.00

PI: Jack Cothren CO PI: Brian Culpepper
UA Project # PT07-000368
15-JUN-07 to 30-MAY-08

CAST has worked with Luke Naylor, Waterfowl Program Coordinator of the Arkansas Game & Fish Commission (AGFC), on the expansion of the data processing and analysis capability of their existing Satellite Mallard Tracking System. This effort required the completion of an information needs assessment, followed by the appropriate software development, including customized programming and system prototyping of a Decision Support and Analysis System. This waterfowl decision support system will be utilized by AGFC to automate the statistical and geospatial analysis of daily wildlife tracking data into concise reporting products.

22) Analysis of NW Arkansas Residential & Commercial Property Markets CBER – Skyline Reporting System FY2007

Arvest Bank Group
\$20,242.00

PI: Katherine Deck
U of A Project #PT-7-327
01-JUN-07 to 31-MAY-08

CAST partnered with the Walton College of Business' Center for Business and Economic Research (CBER) to develop the Northwest Arkansas Skyline Reporting System. The skyline project has resulted in the development of an online data building permit collection system and a data visualization system that streamlines the development of quarterly Skyline Reports for Northwest Arkansas, specifically Benton and Washington Counties. This economic information system provides quarterly status reports and historical analysis of residential, commercial, and multi-family development within the two-county area.

23) An Analysis of the NW Arkansas Residential and Commercial Property Markets

Arvest Bank Group
\$16,582.00

PI: Fred Limp
UA Project # PT08-236
01-JUN-08 to 31-MAY-09

(A continuation of Project #22 above.) The Center for Advanced Spatial Technologies (CAST) partnered with the Walton College of Business' Center for Business and Economic Research (CBER) to develop the Northwest Arkansas Skyline Reporting System. The skyline project has resulted in the development of an online data building permit collection system and a data visualization system that streamlines the development of quarterly Skyline Reports for Northwest Arkansas, specifically Benton and Washington Counties. This economic information system provides quarterly status reports and historical analysis of residential, commercial, and multi-family development within the two-county area.

24) Probabilistic Risk-Based Decision Support for Oil & Gas Exploration

Department of Energy, Low Impact Natural Gas and Oil Program
\$73,963.00

PI: Greg Thoma CO PI: Khursheed Karim, Fred Limp, and Jack Cothren
UA Project # TP06-126
01-OCT-06 to 30-SEP-08

The Fayetteville Shale play is an unconventional natural gas play across central Arkansas. At approximately two million acres, it may rival the Barnett Shale play in Texas. It is anticipated that thousands of wells will be drilled during the next several years, requiring installation of massive infrastructure of roads and pipelines and well-drilling fluid disposal and infrastructure to handle millions of gallons of fracturing fluids. It is a formation that requires fracturing to produce economic quantities of gas. The project goal is development of modules for a web-based decision support tool that will be used by mid-and small-sized oil and gas exploration and production companies as well as environmental regulators and other stakeholders to proactively minimize adverse ecosystem impacts associated with the recovery of oil and gas reserves in sensitive areas in the Arkansas region. This decision support tool will rely on creation of a database of existing E&P technologies that are known to have low ecosystem impact as the primary objective of Phase 1 of the project. The technology database will be coupled with a web-based geographic information system interface that will provide site specific ecosystem risk analysis for

E&P facility layouts as the primary deliverable of Phase 2 of the project. The decision support tool will include evaluation of risks to the ecosystem, including wildlife; risk posed beginning with road layout, including decisions regarding temporary vs. permanent roads; hazards associated with erosion and sediment runoff to surface waters; drill pad construction and placement, spudding, as well as probabilistic reliability estimations of ecosystem damage and costs associated with accidental releases of produced fluids during the course of the active extraction, and finally abandonment and closure of the production site. Work performed for Phase 1 will support the creation of a database of equipment and operational technology that has been demonstrated to have lower impact on sensitive ecosystems than do conventional technologies. Risk analysis tools such as preliminary hazard analysis (PHA), hazard and operability analysis (HAZOP), and failure mode and effects analysis will be used during this phase of the project. Site visits and discussions with stakeholders will also be scheduled and used to guide the development of the database; this phase will consider the environmental impacts through the life cycle of a lease from the initial seismic survey, drilling, production, and closure. Phase 2 work will focus on extension of our existing probabilistic reliability model that is focused on risk management of actively producing leases to include risk management for the life cycle of the lease. The approach used here will be to adapt existing models (e.g. revised universal soil loss equations for sediment generated from road construction) to predict effects of disturbances identified in Phase 1 in a GIS-based environment so that stakeholders can evaluate different alternative lease layouts in a manner that will result in streamlined permitting, improved environmental protection, and enhanced oil and gas extraction.

25) GeoSpatial Analysis of Terrorist Activities: The Identification of Spatial and Temporal Patterns of Preparatory Behavior of International and Environmental Terrorists

U.S. Department of Justice

\$107,854.00

PI: Brent Smith CO PI: Jackson Cothren and Fred Limp

U of A Project # 05-563 6475

01-OCT-05 to 30-SEP-07

Terrorists engage in a variety of non-terrorist criminal conduct prior to the commission of any terrorist act. These non-terrorist acts include crimes related to the creation of false identities for group members, thefts to procure funding for the group, thefts of weapons or explosive materials and, frequently, crimes related to the maintenance of internal security. These behaviors ultimately culminate in acts of terrorism. By examining these preparatory behaviors, routinized patterns of activity can be identified. The goal of this project is to further delineate patterns of preparatory behavior among international and environmental terrorists. The research involves an examination of selected terrorist incidents (and preventions) in the United States during the past 25 years with a particular focus on the planning processes and behaviors in which the terrorists engaged while preparing for the terrorist incidents. The study includes both criminal and non-criminal conduct. A close examination of this *antecedent conduct* places the subsequent terrorist incident in context, providing the potential to identify patterns of conduct that might lead to intervention prior to the commission of actual terrorist incidents. One crucial aspect of this antecedent conduct is the spatial and temporal relationship between terrorist residences, meeting sites, preparatory crimes and eventual terrorist incident.

PROPOSALS SUBMITTED IN FY 07-08, THAT WERE NOT FUNDED OR HAVE NOT YET BEEN FUNDED.

26) Geospatial Decision Support for Low Environmental Impact Unconventional Gas Infrastructure Development

Department of Energy

\$155,899.00

PI: Jack Cothren CO PI: Greg Thoma and Fred Limp

01-JAN-08 to 31-DEC-10

Status: Rejected

27) RGIS Mid-South 2008

US Department of Agriculture Cooperative State Research, Education, and Extension Service

National Consortium for Rural Geospatial Innovations Funding
\$140,000.00
PI: Fred Limp CO PI: Brian Culpepper
01-AUG-08 to 31-JUL-09
Status: Funded, awaiting award

28) Pilot Assessment of Remote Sensing for Cacao Production

Mars, Inc.
Total Budget: \$24,685.00
PI: Fred Limp
Status: Pending

29) Preserving & Visualizing Arkansas Heritage

ANCRC
\$97,000.00
PI: Fred Limp
01-JUL-08 to 30-JUN-09
Status: Awarded for July 2008

30) Terrestrial Habitat Mapping Update for the Boston Mountain & AR Valley Eco-Regions

Arkansas Natural Heritage Commission
\$10,000.00
PI: Fred Limp CO PI: Bruce Gorham
01-FEB-08 to 15-JUN-08
Status: Under review

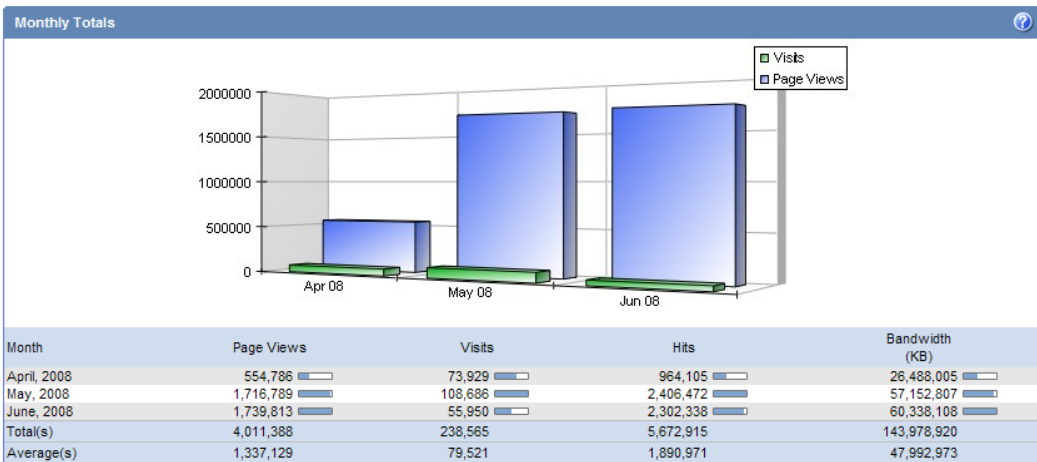
Public Service

CAST staff members are regularly involved in a variety of activities that directly and indirectly benefit Arkansans, from its work with Arkansas' high school students who participate in the EAST Initiative to making geographic information data easily available to the general public through the CAST website and the data warehouse.

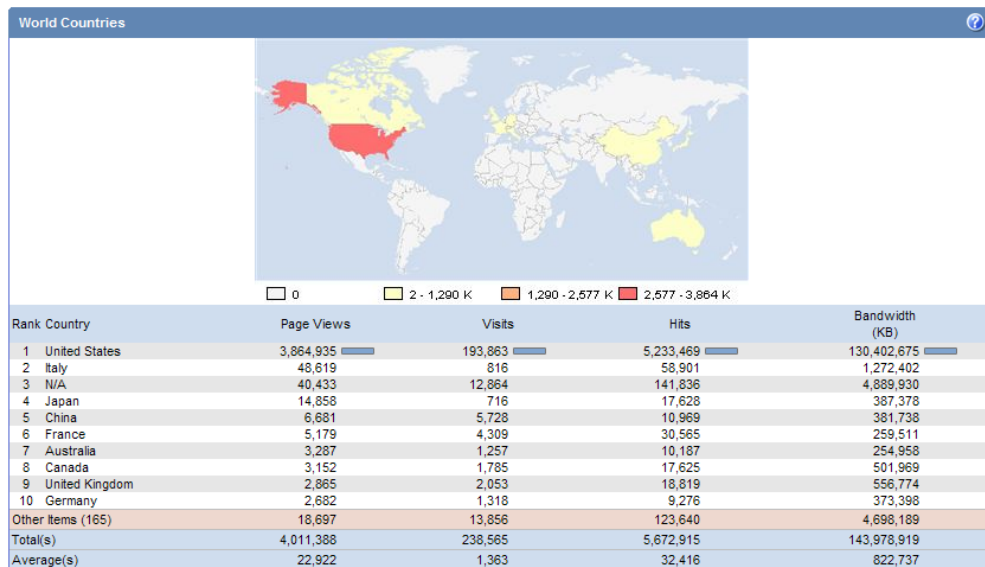
CAST staff members respond to hundreds of requests for assistance or demonstrations each year from sources ranging from University of Arkansas students to rural Girl Scout groups. CAST's public service mission includes talks, demonstrations, workshops, meetings, presentations, and responses to requests for a variety of types of information.

CAST's Website

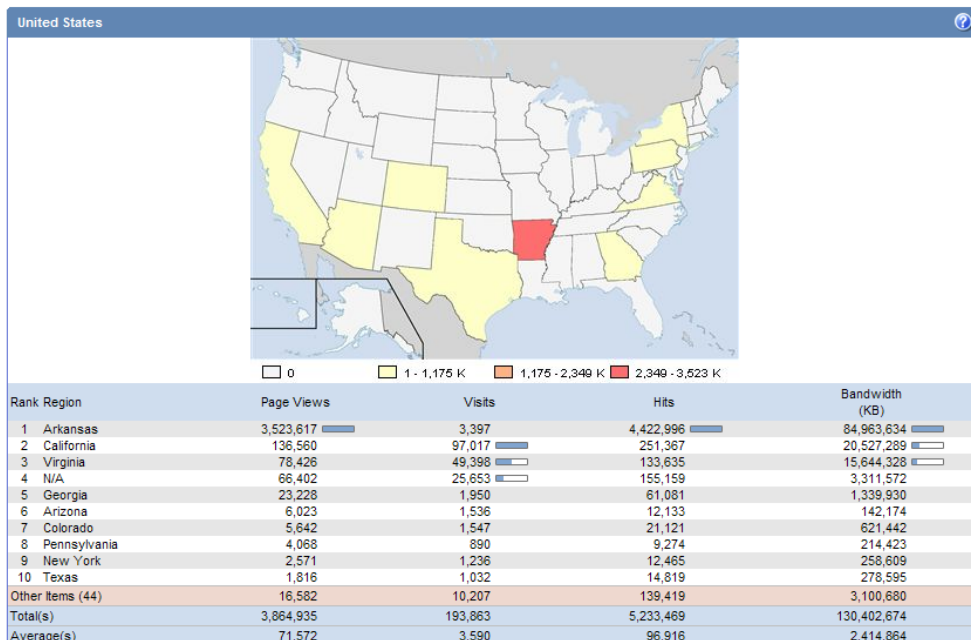
The Center for Advanced Spatial Technologies' website has been recently updated and has a new *look* as of March 2008. Since the new website update, the site received an average of about 1.3 million monthly page views. The new reorganization of the website allows for better navigation and visualization of CAST's projects and activities and presents a vast array of information on geospatial technologies in general. Visitors to the CAST site are from around the world, but the largest numbers of worldwide web visitors are from the North America, Asia, Australia and Europe. In the United States, most of the visitors are from Arkansas, California and Virginia. Cast's website can be found at: www.cast.uark.edu



CAST's website views, visits and hits, April-June, 2008.



Top visitors of the CAST website by country, April-June, 2008.



Top visitors of the CAST website from the United States, April-June, 2008

GPS Base Station

CAST, in collaboration with Development Consultants Inc. (DCI), provides GPS differential correction services to the public. The base station differential correction files are freely available for GPS users in Arkansas and the surrounding region. Base station correction files can be obtained via FTP at the direct address: <ftp://130.184.75.105/recent> , or can be accessed through our GPS page on the CAST website at: <http://web.cast.uark.edu/local/gps/base.html> The base station is a TrimbleR NetRSR receiver/automated reference station, collecting L1, L2 carrier and C/A code for differential GPS (DGPS) information. The antenna, a Zephyr Geodetic with Radome SNO, is located atop the Science and Engineering building on the University of Arkansas campus. By agreement with DCI Fayetteville, free public access is provided to the correction files. DGPS data is collected 24 hours per day, 7 days per week, and 365 days per year. Use of this base station is recommended for GPS end users within 190 miles/300km of Fayetteville, Arkansas.

Outreach Activities

CAST staff members are contacted regularly by faculty, students, governmental employees and others with a broad range of research and technical assistance requests. Responding to these requests is an important part of the Center's public service activities. A structured database has been developed to aid in the tracking of these activities. In Fiscal 07-08, CAST staff responded to 215 requests from outside the UA community and 167 from UA faculty, staff and students.

In Fiscal 07-08, research assistance was provided to 12 Federal governmental agencies. These included: USGS Mid-Continent Geographic Science Center, USDA-APHIS, National Weather Service, US Geological Survey, US Forest Service, US Department of Agriculture, Smithsonian Institution, and the US Army Corps of Engineers.

Assistance was provided to 11 state governmental agencies, including: Arkansas Cooperative Extension, Arkansas Cooperative Fish and Wildlife, Kansas GIS Office, Arkansas Department of Environmental Quality, Arkansas Geographic Information Office, Arkansas Dept. of Education, Arkansas Dept. of Education, and the Arkansas Land Information Board.

Technical assistance and other research support were provided to 13 universities. These included: University of Texas Pan American in Bolivia, John Hopkins University, Kennesaw State University, University of Central Arkansas, University of Oklahoma, Birzeit University, and the University of Arkansas at Little Rock.

Through the EAST program, CAST assisted more than 100 Arkansas K-12 schools and 8 out-of-state K-12 schools. CAST staff visited 35 Arkansas and 4 out-of-state K-12 schools directly. CAST presented 26 workshops for EAST students and teachers. CAST staff supported EAST students and teachers through more than 350 replies to posts on the EAST Forums and more than 400 direct e-mail replies.

CAST responded to requests for assistance from 29 local governments. These included: City of Fayetteville, City of Fort Smith, NW Arkansas Regional Planning Office, City of Farmington, Benton County, Fayetteville Public Schools, Fulton County, City of Siloam Springs, City of Morrilton, Mississippi County, White County, Baxter County, Washington County, Ventura County California, and Sebastian County.

CAST responded to 28 requests for research assistance from non-profits and NGOs. These included: The Nature Conservancy, Audubon Arkansas, NW Arkansas Red Cross, NW Arkansas GIS Users Group, Siloam Springs Electric, Institute for Bird Populations, Central Arkansas Water, Botanical Garden of the Ozarks, and the Fayetteville Chamber of Commerce.

There were 47 requests from the private sector. Firms that were aided included: McGoodwin Williams and Yates, ESPN, Watershed Concepts Inc., Arkansas Oklahoma Gas, American Electric Power in Texas, Conway Corp, Build Smart, Tetra Tech Inc., GeoSyntec Consultants, World Oil Properties Inc., EDR Inc., a.c.t. Geospatial Inc., and Development Consultants Inc.

Assistance to the UA community involved 167 separate research/instructional support activities for UofA Fayetteville students, faculty and staff (not including formal instruction situations.) A few of the UofA Fayetteville Departments that were assisted included: Anthropology, Geosciences, ENDY, Civil Engineering, Mullins Library, School of Landscape Architecture, UA Tree Ring Lab, Research Accounting, Bio-Ag Engineering, Biological Science, FAMA, Crop Soils and Environmental Sciences, Architecture, UofA Farm, Drama, Humanities, UAEDI, Environmental Health and Safety, Plant Pathology, Education Reform, Entomology, and Institutional Research.

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