Facilities

 CAST is dedicated to research and applications in geospatial analysis and modeling, enterprise spatial databases, remote sensing, digital photogrammetry and geospatial interoperability and has been selected as a Center of Excellence by Leica Geosystems, Intergraph Corporation, Oracle Corporation, Trimble Navigation Ltd., Sun Microsystems, Skyline Software, Definiens Imaging Software, Safe Software, PCI Geomatics, eSpatial Systems and is involved in a multi-year CRADA with ESRI.

 CAST specializes in serving the academic community through its emphasis on high quality university courses in Geographic Information Systems (GIS), Global Positioning Systems (GPS), and related technologies. CAST is actively involved in extensive research efforts through multiple grants totaling more than $1.5 million awarded each year. The research efforts compliment and greatly benefit the educational and public service focus by allowing staff and students to stay on the leading edge of emerging technologies as well as providing opportunity for economic development through the Center's business incubator efforts.

As a multi-college organization, CAST unites personnel from the several colleges in the common goal of introducing and making geospatial technologies available to a wide variety of researchers and professionals and to furthering the field through basic and applied research. CAST focuses on research, technology transfer, undergraduate and graduate education, service to communities and local governments, and professional training in a variety of geospatial and related technologies.

 CAST has an extensive IT infrastructure with a broad range of software solutions, more and 110 high-performance workstations – including many stereo-photogrammetric systems, multi-terabytes of disk and three systems administration staff to support these facilities. CAST/AIL has extensive experience deploying these capabilities in archaeological research. The project will also have important impacts locally on the research and education environment at the University of Arkansas and at institutions across the state. Diverse UA students from departments in several colleges benefit from the opportunity to use state-of-the-art analytical instruments in geology, environmental dynamics, civil engineering, chemical engineering, and archaeology, and in research projects that join one or more of these fields.

 Additionally, with support from NSF ESP 0918970, the Center has developed the website http://gmv.cast.uark.edu. Completed in late 2012 this site hosts comprehensive workflows for the field operation and lab processing of resulting data from a range of systems under discussion in this proposal. The GMV material provides detailed information of the field methods, processing techniques that will be used and that have been developed by the Center staff from over a decade of experience.

Equipment

 With funding from a number of sources – including NSF MRI#0321286 and EPS# 0918070 – CAST/AIL has assembled a complementary and integrated suite of instruments and software that can be used to study the human past.

Surface reconstruction and morphometric analysis

- Breuckman smartSCAN HE - an extremely high-resolution structured-light scanner for small objects;
- Z+F 5600i - a short-range, phase-based near-infrared laser scanner for enclosed spaces and modestly sized sites;
- Leica C10 - a long-range time-of-flight 532nm laser for large interiors and extended sites; a very long-range near-infrared time-of-flight scanner for large sites;
- Optech ILRIS -long range (e.g. 800 m+) TLS for large sites.
- Konica-Minolta Vivid 9i – high-resolution triangulation-based laser scanner for small to moderate (e.g. 1-2 m) objects;
- Rapidworks' Rapidform software for point cloud processing, meshing, feature extraction and morphometric analysis;
- Point Cloud Library – an open-source and extensible library for complete automated point cloud alignment, point cloud processing, morphometric analysis, and feature extraction;
- Meshlab – an open source, multi-platform for point cloud processing;
- LP360 – an Airborne LiDAR processing package integrated with ArcGIS;
- TIFFs – an Airborne LiDAR classification package optimized for vegetation and forest classification.
- Canon 5D MkII (2 units) – 21.1 megapixel full-frame sensor digital single-lens reflex (DSLR) camera bodies and lenses, capable of live remote viewing and 1080p video recording;
- Agisoft PhotoScan Standard Ed. – industry-leading software for automatically building accurate, high-quality textured 3D models from still images;
- Agisoft PhotoScan Professional Ed. – adds georeferencing, DEM production, and orthophoto production to the capabilities of the Standard Edition;
- Genie TZ-50 aerial work platform – a self-trailering (5000 lb.) gasoline/electric-powered manlift with 50' vertical and 30' horizontal reach, suitable for mounting of laser scanners and other research instruments.

Archaeo-Geophysics
- GSSI SIR-3000 ground-penetrating radar (GPR) unit with 400 MHz and 270 MHz antennas - a high-resolution instrument that can map buried archaeological features up to 5 meters below the surface;
- Bartington Grad601-2 Dual-Sensor Magnetic Gradiometer – a dual sensor fluxgate magnetometer capable of mapping subtle changes in magnetic fields, which indicate buried archaeological features up to 2 meters beneath the surface;
- AGI Sting R1 Earth Resistivity Meter – an electrical resistivity array designed for landscape-scale subsurface mapping, capable of detecting geological and cultural layers of large earthen mounds and similar features;
- Geonics EM38-MK2 Electromagnetic Induction meter – an instrument that simultaneously maps both the magnetic susceptibility and conductivity of the earth at two distinct depths, characterizing archaeological features within 2 meters of the ground surface;

- ArchaeoFusion - software developed at CAST for processing and integrated multi-sensor geophysical datasets from a variety of platforms.
- GPR slice - Industry standard software for the processing and topographic correction of GPR data

Aerial Survey
- Terrahawk four-band MSS aerial imager with Redlake 4100 sensor - an aircraft or boom mounted MSS scanner
- Tuffwing UAV Mapper and ground control – fixed wing unmanned aerial system equipped for photographic or multispectral aerial surveys
- 3DR Solo sUAS (3 units) and ground control – quadcopter unmanned aerial system equipped for photography, videography, or thermal IR sensing
- Freefly Cinestar 8 sUAS and ground control – 8-rotor unmanned aerial system equipped for photography, videography, or thermal IR sensing
- FLIR Tau 2 640 thermal imaging camera w/ TeAx ThermalCapture data logger – a high-performance, compact, lightweight LWIR uncooled thermal imaging camera suitable for use with the 3DR Solo aerial platform
- Palm IR thermal imager - single band thermal imaging system. This device has proved effective in various archeological mapping efforts

Geodetic positioning and topographic survey
- Trimble 5600 Robotic total station - for traditional, rapid surveys and micro-topography development.
- A suite of 6 geodetic-grade GPS receivers and antennae (2 Trimble 5700, 1 Trimble 5800, 3 Leica GS-15)
- GPS baseline and absolute positioning software including Trimble Geomatics Office, Leica Geomatics Office, and GYPSY-OASIS from NASA's Jet Propulsion Laboratory.
- A suite of thirteen mapping grade GPS receivers with decimeter post-processing accuracy using Trimble Pathfinder Officer and integrated through data-dictionaries with ArcGIS and other GIS software.
- ERDAS Imagine/LPS and ENVI/IDL for geometric and radiometric processing of satellite and aerial optical image and synthetic aperture radar and terrestrial optical imagery

Visualization
- RazorVue Multi-Touch Collaborative Interface – a custom-built large format (10 ft. by 4 ft.), high-resolution, multi-touch visualization system, well-suited to exploration of large data sets and collaborative investigation;
- Stereo Display classroom – a large-format High Definition 3D projector is linked to an NVIDIA 3D Vision Pro system, allowing ten users to view projected 3D data;
- Mitsubishi WD-65C9 stereo DLP system – a 65"1080p 3D-capable display, driven by an NVIDIA 3D Vision system;

- Unity Pro – a powerful 3D game development system with multiplatform publishing capability, well-suited for visualization, exploration, and presentation of archaeological data.