1.   Names and contact information for PI and Co-PI's

Tim Murtha, PhD (PI)
Landscape Architecture
Katsuhiko Muramoto and Loukas Kalisperis, PhD (co-PIs)
Architecture
John I. Messner, PhD (co-PI)
Architectural Engineering

2.   Title of Project:

<u>**WEST END, STATE COLLEGE: INTEGRATING INFORMATION**</u>
BRIDGING THE GAP BETWEEN GEOGRAPHIC INFORMATION SYSTEMS AND
BUILDING INFORMATION MODELING FOR PUBLIC, ADAPTIVE, AND INFORMED
COMMUNITY PLANNING

3.   Abstract (not to exceed 150 words)

Increasingly, scholars, practitioners, and community organizations are relying on Internet based
public planning and *decision support systems*. While these technologies have been successfully
deployed, they largely rely on targeted issues and provide limited visualization of 'scenarios'.
Linking BIM and GIS we are designing a 3-D visual relational database that will provide public
participation through geo-referenced annotation. This dynamic model should not only increase
democratic participation in the planning process, but also provide a database driven 'living
community system' that can more effectively communicate environmental and building
information to the entire community. In order to accomplish this, we are collaborating with the
State College Borough Planning Department to construct an experimental living community
system for the West End/West Campus region of State College. This project is the first step in
what we envision as a broader regional living system that can be deployed elsewhere.

4.   Keywords (three to six keywords)

Landscape planning, visualization, participation, interactive planning,

5.   Project Description

INTRODUCTION:
        Increasingly, Landscape Architects, Architectural Engineers, and Architects are
challenged by the promise and demands of sustainable or 'green design'. And while guidelines
are provided by the Green Building Council, LEED, and others, we recognize that thoughtful and
successful sustainable design requires collaborative efforts that link the systems of buildings and
built form to the living social and natural systems within which they are embedded. Moreover,

we believe that for effective democratic design and planning we must produce collaborative systems that are publically accessible and data driven.

For decades, each of our disciplines have addressed this need; however, each have utilized independent computing platforms and/or programs to manage, analyze, model, and communicate quantitative information about embedded systems. Landscape architects, for example, first designed Geographic Information Systems so that their planning and site designs were embedded within layers of information about soil, vegetation, demographics, and transportation networks. Architects and architectural engineers rely increasingly on Building Information Modeling software for analogous tasks, but focused on rapid prototyping, analysis, and construction modeling. We are certain that the information within each of these 'systems' is compatible; however, it is not traditionally linked within a single relational database so that all of us can effectively integrate our ideas in a common platform. Attempts by CAD have been useful for collaborative drafting, however to truly integrate systems information, we must bridge the gap between BIM and GIS, thereby constructing a 3-D visual relational database. Recently, Autodesk has referred to this as the digital cities initiative. Such systems can and should be effectively employed as *Decision Support Systems* to promote democratic planning and public participation in *Landscape Ecological Planning* and Community Design (Von Haaren and Kretschmar 2006). Unfortunately, such democratically deployed systems are not common in the US, despite their success throughout Europe.

This proposal therefore is an experimental proposal focused on the development of a public accessible visual relational database linking building information with geospatial data for the Centre Region, specifically West Campus and West End Region of State College Borough. Collaborating with the State College Borough, we chose this area for this project because:

1. Local planning office identified this as the highest priority region of State College due to the intersecting issues of *Historic Preservation*, *Proposed Commercial Development and Campus Planning*, and complex transportation systems;
2. High quality geospatial data is readily available; and,
3. The location allows us field visits to enhance our data through field collection if necessary.

This is an experimental research proposal but we are certain that it offers critical assistance to the local community. We are presently working with the Borough Planning Department and will continue to collaborate through this funding. More importantly, this project will provide a model that can be applied to other communities throughout Pennsylvania and beyond. It is also an early stage of research that will be expanded and enhanced through external funding beyond 2009. We received Bower's funding to initiate work on a portion of this project (database development) during the fall of 2008. We are now seeking funds here to complete a public access online West End model during the spring and summer of 2009.

SPECIFIC PROJECT TASKS:
The specific objectives for this project are:

1. Develop a Core Geospatial Database within a online public-GIS.
   a. Develop a core topographic database of the State College Borough/West Campus Region. Using local LIDAR (Light Detection and Ranging) data as a base we will construct a detailed topographic database for the State College borough. LIDAR data provides highly accurate and well categorized topographic and reflectance information, allowing researchers to develop a detailed 3-D model of the earth's surface as well as the natural and cultural features above the surface. Figure 1. illustrates a categorized perspective image of a residential development with tree-lined streets in the State College Region.
   b. Develop a core set of ecological data for the State College Borough/West Campus Region. This database will include core variables such as soil type (and DCNR soil analyses), Land Cover, Vegetative Cover, etc.
   c. Develop a core set of local cultural systems data for State College Borough/West Campus. This database will include transportation networks, parcels, zoning information, and building footprints.
   d. Develop a core set of high-resolution aerial photos within the database. This simply involves mosaic‒ing several recently acquired digital images from PASDA.
2. Integrate these data with 3‒D detailed building information (proposed and existing).
   a. Develop individual models of the Borough/West Campus Buildings. Primarily our efforts will target the borough area between Beaver Avenue and College Avenue from University to Corl Street and West Campus, including the newly sold OW Houts site. It is possible that we will expand this focus, time permitting.
3. Publish these data as part of a partially public access database via the web. Using KLM in Google Earth, ArcINFO server, and either FLASH or Carto-PDF, we will publish the data with the guidance of the Borough.
4. While the funding we are requesting here is not included in the scope of this fourth task, we will use this model to test the three public *DSS* for best providing public participation in the planning process. Appleton and Lovett (2003) clearly demonstrate the applicability of such an approach for visualizing rural landscapes and decision making, but we aim to move beyond static visualizations so that the public participants can leave geospatial 'tags' (notation) for dynamic participation in the process. For example, the borough is currently considering several zoning changes and development plans for the parcels adjacent to the former OW Houts site. The proposed building models will be provided as layers so that public participants can visualize the changes and attach comments to the proposed changes.

If we, as architects, planners, engineers, and scientists are to face the challenges of effective sustainable design with democratic participation, we must bridge the gap between the systems of buildings with the natural and cultural systems within which they are embedded. While the majority of this challenge will be overcome by interdisciplinary collaboration, part of the

challenge is to bridge the information divide between BIM and GIS. Our proposed research will link the systems of built form, with the cultural a natural systems by constructing a universal platform 3‑D visual relational database of West Campus and portions of State College Borough. Using our experience here, we will expand our research to the broader watershed and region, with external support.
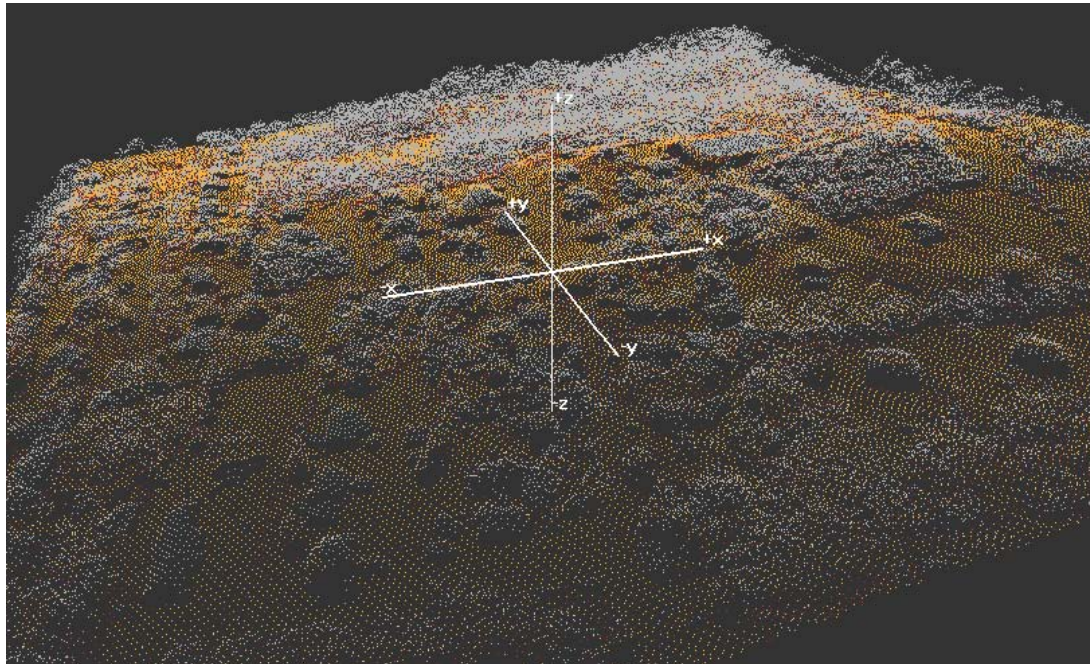

Figure 1. Digital Model using LIDAR of State College (Vegetation = White; Built = Orange)

References:

Appleton, K. and Lovett, A. (2003) GIS based visualization of rural landscapes: defining sufficient results for environmental decision making, *Landscape and Urban Planning*, 65, pp. 117-131.

Von Haaren, C and Kretzscmar, B (2006) The Interactive Landscape Plan: Use and Benefits of New Technologies in Landscape Planning and Discussion of the Interactive Landscape Plan in Koenigslutter am Elm, Germany, *Landscape Research* 31:1, pp. 83-105.

6.   Statement of the Problem (see description for clarification)

Develop a public accessible interactive DSS for West End/West Campus region of State College.

7.   Method(s) (see description for clarification)

IT-supported landscape planning system (Von Haaren and Kretzscmar 2006)

8.   Goal(s) (see description for clarification)

Bridge the gap between BIM and GIS, while providing public participation through georeferenced annotation.

9.   Anticipated Deliverable(s)

The primary deliverable for this effort is a publically accessible 3‑D visual relational database of a portion of State College Borough and West Campus that links geospatial (environmental and cultural) data with building information models for minimally the area defined by University Drive, Beaver Avenue, College Avenue and Corl Street in addition to West Campus. This database will be accessible via the web and offered in at least two universal computing platforms, including Google Earth/KLM and ArcINFO server.

In addition to this primary deliverable, there are a series of added deliverables directly linked to the construction of the database, including:
1. A website housing the database and describing the process to construct it;
2. A white paper/monograph will be authored to document our process; and,
3. At least one Peer‑reviewed journal publication (likely more) and conference papers submitted during the 2009 calendar year.

10.   Statement of Relevance to the Hamer Center's Mission

By developing a public planning tool that bridges the State College Borough Planning Department and the broader community, this project will strengthen the Hamer Center's commitment to *citizenship, community, public, and democracy*. Moreover, we believe this tool can be effectively deployed throughout Pennsylvania and beyond.

11.   Project Schedule

Activities for the proposed research/education proposal will primarily occur during the Spring Semester of 2009, with production of the website during the summer of 2009.
Spring 2009: Murtha, Muramoto, and Messner organize and assess current database for Borough
        and West Campus;
        ArcINFO server home designed;
        Project team digitizes proposed West End changes; and,
        Environmental Analysis Tools finalized.
Summer 2009: By August 1, complete model exported to universal platforms; and,
         Database deployed on interactive website by August 15, 2009.
        While we will have completed an external funding request to the *CNH division of NSF* by the end of this year, we will develop another proposal for the *Science Technology and Society Division of NSF* for submission in the early summer 2009.