

**PROVOST INSTRUCTIONAL TECHNOLOGY GRANTS  
COVER SHEET  
A/Y 2009-2010**

<b>Applicant's Name:</b>	B. Sunday Eiselt
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<b>Project Title:</b>	The Past in High Resolution: A Proposal to Integrate Geophysics and 3D Laser Scanning into Field Training at SMU-in-Taos
<b>Semester you will begin project: (Fall 09, Spring 10, Summer 10)</b>	Summer (June term) 2010
<b>Total Amount Requested:</b>	\$4,992
<b>Brief Abstract:</b>	The goal of this project is to provide enhanced learning and research opportunities for SMU students through the innovative application of geophysical remote sensing and 3D laser scanning on archaeological sites as part of the 2010 SMU-in-Taos archaeology field school. The project is part of a broader initiative to create a nationally-recognized field studies program at SMU that integrates advanced technologies into multidisciplinary educational and research efforts in the applied sciences.

**The Past in High-Resolution**

**A Proposal to Integrate Geophysics and 3D Laser Scanning into Field Training at SMU-in-Taos**

B. Sunday Eiselt

Department of Anthropology

12/13/2009

I have read and endorse this proposal.

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David Meltzer, Chair of Anthropology

Date: \_\_\_\_\_

## **Project Description**

*The purpose of this project is to enhance student training and extend faculty research in the applied sciences at SMU-in-Taos through the innovative application of geospatial technologies in the field.* Specifically I am seeking funds to integrate Geophysical Remote Sensing and 3D Laser Scanning into the curriculum of the 2010 SMU-in-Taos Archaeology Field School. The Field School is a 6 credit field science course that includes three co-directors, six full-time teaching assistants, and 25 to 30 students. The proposed project will investigate the advantages of using geospatial technologies in field training through hands-on student instruction and lectures, the production of a summary report of research and learning activities, and the creation of a web site for communicating our results to the SMU community. Ultimately, we seek to build a nationally recognized program in field studies at SMU that extends beyond the archaeology field school to include geology and the environmental sciences and we need cutting-edge digital technologies to do it. Funding from the Instructional Technology grant would help start this process.

Geophysical remote sensing is a subsurface prospection technique that produces maps of buried features and artifacts through the use of sensors that send electrical or magnetic pulses into the ground. It enables us to plan our excavations, realizing significant savings in time and money, while avoiding dangerous electrical lines and sensitive targets such as human burials before ever putting shovel to soil. Portable 3D laser scanners create high-resolution digital models of landscapes, buildings, and artifacts. Although very similar to conventional survey equipment, the scanner emits over 200,000 beams per second, enabling researchers to capture the morphology and texture of a given object in greater detail than ever before.

Both techniques promote the preservation of delicate resources while enhancing analytical capabilities through non-invasive high-tech alternatives to traditional survey and excavation. As cutting-edge techniques they are rapidly changing the way we approach field work and how we train students in the applied sciences including archaeology, geology, paleontology, civil engineering, architecture, and art history. We currently don't provide this training (or even any significant exposure to it) in any of our

graduate or undergraduate classes at SMU. Although we have the equipment available to us at SMU-in-Taos through our relationship with Mercyhurst College as part of the Taos Collaborative Archaeology Program (TCAP), we currently lack the expertise to use it effectively. Without proper training, we cannot provide adequate instruction for our students. Nor are we able to use this equipment to expand our research, funding, and outreach initiatives.

## **Objectives**

To meet the goals of this project, I intend to hire a consultant to work with us for two weeks during the 2010 field school in June. Christopher Goodmaster is a trained archaeologist and is a remote sensing specialist for Geo-Marine Inc., Plano, Texas (see attached CV). Mr. Goodmaster will,

1. Provide hands-on geospatial instruction to students in field survey, mapping, and scanning.
2. Collect and process "live" data for ongoing projects with student assistance.
3. Present formal lectures on geospatial technologies and laser scanning.
4. Demonstrate data post-processing techniques.
5. Assist faculty with integrating these technologies into research designs and funding proposals.
6. Work with co-directors to produce a summary report and web materials for future planning.

Two research projects are featured in this training. The first includes excavation of the *Morada de Nuestra Senora de Guadalupe* (the Taos Morada). A morada is a sacred chapel and meeting place for the *Hermanos Penitentes*, a lay Catholic Brotherhood originating in the *Hispano* mixed-blood villages of northern New Mexico at the end of the Colonial era. The Taos Morada is the largest in the state and is listed on the National Register of Historic Places. The SMU project will be the first archaeological excavation ever conducted on a morada, and we will initiate this project during the 2010 field school in collaboration with the Our Lady of Guadalupe Parish and members of the Taos area *Hermandad*. Mr. Goodmaster will provide hands-on instruction for students who will learn how a Bartington Three Axis Fluxgate Magnetometer is used to generate subsurface maps of the property and adjoining cemetery prior to excavation. He also will demonstrate the utility of laser scanning for historic preservation on an architectural scale using a portable Konica-Minolta VIVID Scanner and detail of the building as a case study. The morada will be placed in its broader religious context through documentation of the historic rock art produced by *Penitente* practitioners during the historical period. Again working directly with students and

faculty, Mr. Goodmaster will provide instruction in the use of the laser scanner to capture high-resolution data of rock surfaces containing artistic elements made with stone or metal tools. This will enable us to analyze the production technologies of the art, discover new depictions invisible to the naked eye, and evaluate the relationships between overlapping elements from different periods and ethnic groups.

### **Acquired Expertise**

Participants in the SMU-in-Taos Archaeology Field School (students, teaching assistants, and co-directors) will gain comprehensive experience integrating geospatial technologies, specifically geophysical remote sensing and 3D laser scanning, in archaeological field research. Through a carefully developed curriculum incorporating both formal lectures and hands-on experience, course participants will be provided with a basic understanding of the operating principles and use of the equipment and will take part in data collection, processing, and analysis. Participants will gain insight to the potentials and limitations of relevant geospatial techniques and their application to various project-based research questions. Project co-directors will acquire insights for incorporating these technologies in other aspects of instruction, both at the Taos and Dallas campuses, and within their own research designs and funding proposals.

### **Relevance to the Discipline and University**

This project integrates education, research, and outreach in creative ways that are relevant to SMU and the discipline. Specifically, the project supports several key goals and objectives of the University Centennial Strategic Plan. We have worked closely with the Taos Hispanic community for over three years to gain the trust and confidence required to develop culturally-sensitive projects that meet local heritage concerns while providing enriched learning opportunities for students. Geospatial technologies would extend these efforts, enabling us to avoid sensitive burials at the morada (if these exist) and promote the preservation of historic buildings and objects through establishment of permanent 3D archives that can be shared and analyzed for potential sources of deterioration. The project also will result in a web site showcasing the advantages of geospatial analysis for multidisciplinary applied sciences at SMU-in-Taos and on the Dallas Campus. The project therefore enhances the stature of the University through programs that

are organized for community outreach as well as SMU's own constituency (Goal 1, Objective 8). The goals of research are to investigate the emergence and development of the Taos *Hermandad* while demonstrating to students how geospatial technologies can achieve this effectively without offending the religious sensibilities of our consultants. The integration of culturally-sensitive curricula and advanced methodologies therefore improves the teaching and learning environment for students through training and by example (Goal 2, Objective 1). Geospatial analysis is a state-of-the art approach in archaeology and in multidisciplinary applied sciences more generally. Successful application of these techniques in the field will enable us to develop highly competitive grant applications for government and private foundations. The project therefore strengthens scholarly research and creative achievement among faculty, graduate students, and undergraduates through the integration of advanced technologies in the field (Goal 3, Objective 7).

### **Criteria for Evaluation**

We will know that this project is successful over the short term if students leave campus with basic competency in the operation of equipment and how it is integrated into research designs and heritage-based service learning. To evaluate this, we will add a geospatial component to student evaluations and quizzes in the field and we will provide students with a survey to gauge their satisfaction with the learning experience. We will assess the satisfaction of our consultants (with our work, transparency, and ability to communicate effectively) through feedback gained by site visitations and tours, interviews, and follow-up discussions of results. Finally we will evaluate our ability to successfully integrate advanced technologies into the field school curriculum through the production of a report that details the research and learning outcomes of the project. These outcomes will be presented on a web site hosted by SMU and I will work with the Public Affairs office to publicize the project while in the field. Long-term success will be evaluated through efforts to secure outside funding from the National Endowment for Humanities (Save America's Treasures Grant Program), and the National Center for Preservation Technology and Training.

## Proposed Budget

The total cost of this project is \$9,849. I am seeking a total of \$4,992 to pay Geo-Marine, Inc. for Mr. Goodmaster's time while he is in the field with us over a two-week period from June 14 to June 30, 2010. Matching funds will include \$750 through SMU-in-Taos and \$960 from the New Mexico Historical Preservation Fund (currently pending). Geo-Marine Inc., also has agreed to provide in-kind matching funds totaling \$3,147 for travel, per diem, and use of equipment.

Item	Instructional Technology Grant	Matching Funds		
		Geo-Marine, Inc., Cultural Resources Division	New Mexico Historical Preservation Grant (Pending)	SMU-in-Taos
Christopher Goodmaster (80 hrs@\$62.40/hr)	\$4,992.00			
Travel and Per Diem for Mr. Goodmaster		\$847		
Global Positioning System Usage (10 days@\$25/day)		\$250		
3D Laser Scanner Usage (10 days@\$200/day)		\$2,000		
Field Supplies		\$50		
Lodging SMU-in-Taos Campus (10 days@\$50/day)				\$500
Board SMU-in-Taos Campus (10 days@\$25/day)				\$250
SMU Graduate Student Research Assistant (80 hrs@\$12.00/hr)			\$960	
<b>Total</b>	<b>\$4,992</b>	<b>\$3,147</b>	<b>\$960</b>	<b>\$750</b>
<b>Grand Total for Project</b>	<b>\$9,849</b>			

**Schedule:** Work will take place during June of 2010 and will be completed by Fall of the same year.

## Future Planning

The first step in future planning will be to evaluate the success of the project including implementation, research results, and learning outcomes. Based on this evaluation we intend to expand the geospatial component of field research at SMU-in-Taos and make it an integral part of archaeology field school training. To do this we will seek outside funding in 2011 and advertise our results to colleagues in the University, especially the Huffington Department of Earth Sciences and the Meadows School of Arts. The project strengthens our relationship with Mercyhurst College (our partner in the Taos Collaborative Archaeology Program) and is part of our broader efforts to develop a nationally-recognized field studies program at SMU-in-Taos. The development of new opportunities for undergraduate and graduate research and advanced training in geospatial techniques is integral to this effort.

## Curriculum Vitae

Christopher V. Goodmaster  
Project Archeologist  
3D Laser Scanning & Geophysical Remote Sensing Specialist  
Cultural Resources Division  
Geo-Marine Inc.  
2201 K Ave., Suite A2  
Plano, TX 75074  
972.423.5480 (phone)  
972.422.2736 (fax)  
cgoodmaster@geo-marine.com

## Education

### University of Arkansas, Fayetteville

M.A., Anthropology (2007)

High Resolution Multi-sensor Geophysical Investigations at Double Ditch (13OB8): A Non-invasive Study of a Late Prehistoric Plains Village Site in Northwestern Iowa.

### Middle Tennessee State University, Murfreesboro

B.A., Geography (2004)

## Most Recent Positions:

- Project Archeologist, 3D Laser Scanning & Geophysical Remote Sensing Specialist. Geo-Marine Inc. (2008 – present).
- Research Assistant. Center for Advanced Spatial Technologies, University of Arkansas (2004 – 2008).
- Technician. Soil Laboratory, Department of Geosciences, University of Arkansas (2005 – 2006).
- Archeological Technician. Mid-Continental Research Associates (2004 – 2006).
- Interpretive Ranger. Old Stone Fort State Archaeological Park, Tennessee Division of Environment and Conservation (2003 – 2004).

## Research Interests

3D laser scanning and terrestrial LiDAR for documentation and analyses of archaeological sites and artifacts; high-resolution shallow subsurface geophysical survey techniques and analysis of geophysical data; prehistoric archaeology of the Southeast, Midsouth, Midwest, and Plains regions of the US; prehistoric archaeology of the Andes; landscape archaeology; geoarchaeology; archaeoinformatics; and public archaeology.

## Peer-Reviewed Publications

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| Christopher Goodmaster<br>Reinterpretation of an Initial Variant Site through Geophysical Methods.<br><i>Plains Anthropologist</i>   | In prep  |
| Christopher Goodmaster<br>Multi-Sensor Geophysical Investigations at Double Ditch (13OB8): A Non-Invasive Study<br>of a Late Prehistoric Plains Village Site in Northwestern Iowa.<br><i>Journal of the Iowa Archeological Society</i>   | In prep  |
| Angelia Payne, Keenan Cole, Katie Simon, Christopher Goodmaster, and Frederick Limp<br>Designing the Next Generation Virtual Museum: Making 3D Artifacts Available for Viewing and Download<br>In <i>Making History Interactive: Proceedings of the 37th International Conference on Computer<br/>Applications and Quantitative Methods in Archaeology</i> , edited by Bernard Frischer. | In press |

- Katie Simon, Angelia Payne, Keenan Cole, C. Scott Smallwood, Christopher Goodmaster, and Fredrick Limp In press  
 Beyond Cabinets of Curiosity? Analysis Potential in 3D Laser Scanning and Virtual Museums  
 In *Making History Interactive: Proceedings of the 37th International Conference on Computer Applications and Quantitative Methods in Archaeology*, edited by Bernard Frischer.
- C. Scott Smallwood, Angelia Payne, Katie Simon, Christopher Goodmaster, Frederick Limp, and Jackson Cothren In press  
 Lighting Systems in Three-Dimensional Non-Contact Digitizing  
 In *Making History Interactive: Proceedings of the 37th International Conference on Computer Applications and Quantitative Methods in Archaeology*, edited by Bernard Frischer.
- Jackson Cothren, W. F. Limp, David Fredrick, Tim de Noble, Adam Barnes, Christopher Goodmaster, and Caitlin Stevens In press  
 Visualizing the Roman City: Looking at the Past through Multidisciplinary Eyes  
 In *On the Road to Reconstructing the Past: Proceedings of the 35th Annual Conference on Computer Applications and Quantitative Methods in Archaeology*
- Jackson Cothren, Christopher Goodmaster, Adam Barnes, Eileen Ernenwein, Alexei Vranich, W. F. Limp, and Angelia Payne In press  
 Fusion of Three-Dimensional Data at Tiwanaku: An Approach to Spatial Data Integration  
 In *On the Road to Reconstructing the Past: Proceedings of the 35th Annual Conference on Computer Applications and Quantitative Methods in Archaeology*

#### Non-Peer-Reviewed Publications

- Christopher Goodmaster, Lynn M. Alex, and Stephen Lensink 2007  
 What Lies Beneath? Geophysical Survey of a Prehistoric Fortified Village.  
*Newsletter of the Iowa Archaeological Society* 57(2):1-3.

#### Selected Technical Publications

- Christopher Goodmaster In prep  
 Pine Mountain Reprised: A Cultural Resources Survey for the Proposed Pine Mountain Lake Project  
 Report submitted to the United States Army Corps of Engineers, Little Rock Division.  
 Miscellaneous Report of Investigations, Geo-Marine Inc., Plano, TX
- Christopher Goodmaster In prep  
 Cultural Resources Survey for the City of Leakey Wastewater and Water Improvements Project  
 Texas Antiquities Permit Number 5174  
 Report submitted to Naismith Engineering, Inc., Austin, TX  
 Miscellaneous Report of Investigations Number 462, Geo-Marine Inc., Plano, TX
- Christopher Goodmaster 2009  
 Cultural Resources Survey of the New Horizons W4 Pipeline, Panola County, TX  
 Report Submitted to Titanium Environmental Services, LLC, Longview, TX  
 Miscellaneous Report of Investigations Number 473, Geo-Marine Inc., Plano, TX
- Angela Tiné and Christopher Goodmaster 2009  
 Archeological Sensitive Area Avoidance Plan for the Great Expectations 3D Seismic Survey  
 Report submitted to TimeSlice Technologies, Inc., Granbury, TX  
 Miscellaneous Report of Investigations Number 469, Geo-Marine Inc., Plano, TX
- Aaron Naumann, Marsha Prior, Natalie Thomas, and Christopher Goodmaster 2009  
 Cultural Resources Management Survey of the Sam Houston Springs Project Area  
 Texas Antiquities Permit Number 4211  
 Report Submitted to Brown Reynolds Watford Architects, Dallas, TX  
 Miscellaneous Report of Investigations Number 436, Geo-Marine Inc., Plano, TX

### Organized Symposia

- Christopher Goodmaster 2009  
Close-Range 3D Laser Scanning: Recent Developments and Applications  
37th International Conference on Computer Applications and Quantitative Methods in Archaeology,  
Williamsburg, VA

### Conference Presentations

- Christopher Goodmaster 2009  
Mapping at a Scale of One to One:  
The Implications of High Definition Documentation for Archaeological Sites and Artifacts via 3D Laser Scanning  
Society for American Archaeology 74th Annual Meeting, Atlanta, GA
- Angelia Payne, Keenan Cole, Katie Simon, Christopher Goodmaster, and Frederick Limp 2009  
Designing the Next Generation Virtual Museum:  
Making 3D Artifacts Available for Viewing and Download  
37th International Conference on Computer Applications and Quantitative Methods in Archaeology,  
Williamsburg, VA
- Katie Simon, Angelia Payne, Keenan Cole, C. Scott Smallwood, Christopher Goodmaster, and Fredrick Limp 2009  
Beyond Cabinets of Curiosity?  
Analysis Potential in 3D Laser Scanning and Virtual Museums  
37th International Conference on Computer Applications and Quantitative Methods in Archaeology,  
Williamsburg, VA
- C. Scott Smallwood, Angelia Payne, Katie Simon, Christopher Goodmaster, Frederick Limp, and Jackson Cothren 2009  
Lighting Systems in Three-Dimensional Non-Contact Digitizing  
37th International Conference on Computer Applications and Quantitative Methods in Archaeology,  
Williamsburg, VA.
- Adam King and Christopher Goodmaster 2008  
Three-Dimensional Laser Scanning of Copper Plates from Etowah  
Southeastern Archaeological Conference 60th Annual Meeting, Charlotte, NC
- Christopher Goodmaster 2008  
The Potentials of Close-Range, Three-dimensional Laser Scanning for the Documentation,  
Analysis, and Digital Archiving of Southeastern Archaeological Artifacts  
Southeastern Archaeological Conference 60th Annual Meeting, Charlotte, NC
- Christopher Goodmaster, Angelia Payne, W. Fredrick Limp, Keenan Cole, & Marlon Mowdy 2008  
The Virtual Hampson Museum Project:  
Laser Scanning and 3D Visualization for Documentation, Digital Curation, and Public Education  
Southeastern Archaeological Conference 60th Annual Meeting, Charlotte, NC
- Jackson Cothren, W. F. Limp, D. Fredrick, T. de Noble, A. Barnes, C. Goodmaster, and C. Stevens 2008  
Visualizing the Roman City: Looking at the Past through Multidisciplinary Eyes  
35th Computer Applications and Quantitative Methods in Archaeology Conference,  
Budapest, Hungary
- Jackson Cothren, C. Goodmaster, A. Barnes, E. Ernenwein, A. Vranich, W. F. Limp, and A. Payne 2008  
Fusion of Three-Dimensional Data at Tiwanaku: An Approach to Spatial Data Integration  
35th Computer Applications and Quantitative Methods in Archaeology Conference,  
Budapest, Hungary

Christopher Goodmaster and Angelia Payne 3D Laser Scanning at Tiwanaku: Potentials for Documentation, Visualization, and Analysis Technology and Archaeology Workshop, Dumbarton Oaks, Washington, D.C.	2007
Jackson Cothren, Adam Barnes, Christopher Goodmaster, Alexei Vranich, Eileen Ernenwien, and Fredrick Limp Ancient Sites in 21st Century Environments: Fusion of Three-dimensional, Multi-scale Digital Data Technology and Archaeology Workshop, Dumbarton Oaks, Washington, D.C.	2007
Christopher Goodmaster Multi-sensor Geophysical Data Fusion: A Case Study from the American Great Plains 72nd Society for American Archaeology Annual Meeting, Austin, TX	2007
Christopher Goodmaster, Jackson Cothren, Adam Barnes, and Angelia Payne Archaeological Laser Scanning at Tiwanaku: A Multi-year High Density Survey of a UNESCO World Heritage Site 34th Computer Applications and Quantitative Methods in Archaeology Conference, Berlin, Germany	2007
Christopher Goodmaster High Resolution Multi-sensor Geophysical Investigations at Double Ditch (13OB8): A Non-invasive Study of a Late Prehistoric Plains Village Site in Northwestern Iowa 33rd Computer Applications and Quantitative Methods in Archaeology Conference, Fargo, ND	2006
Christopher Goodmaster Image Processing and Data Fusion of Multi-sensor Geophysical Data: A Case Study from a Late-Prehistoric village site on the North American Great Plains 33rd Computer Applications and Quantitative Methods in Archaeology Conference, Fargo, ND	2006
Christopher Goodmaster and Kenneth L. Kvamme Geophysical Investigations at Double Ditch: A Non-invasive Study of a Prehistoric Village in Northwestern Iowa 118th Annual Meeting of the Iowa Academy of Science, Storm Lake, IA	2006
Christopher Goodmaster and Kenneth L. Kvamme Geophysical Investigations at an Initial Variant Village in Northwestern Iowa. 63rd Plains Anthropological Conference, Edmonton, AB, Canada	2005
Christopher Goodmaster and Stephen Yerka Revisiting 40CF1: The Old Stone Fort State Archaeological Park Inventory Project Southeastern Archaeological Conference 60th Annual Meeting, Charlotte, NC	2003
Sommer Landers and Christopher Goodmaster The Old Stone Fort State Archaeological Park GIS: A Tool for Park Management & Archaeological Research Southeastern Archaeological Conference 60th Annual Meeting, Charlotte, NC	2003
S. Sherwood, N. Herrmann, S. Carroll, C. Goodmaster, J. Lindsay, S. Yerka, and D. Brock The Fall Creek Falls Archaeological Project: Our First Year Current Research in Tennessee Archaeology 15th Annual Meeting, Nashville, TN	2003

#### **Professional Organizations**

Society for American Archaeology  
Register of Professional Archaeologists