

THE VIRTUAL LEARNING LAB
Facilitated Teaching and Learning in the Wireless Environment

By

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A Grant Proposal Submitted To:

Wireless Research and Demonstration Grants Program
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Abstract

The proposed project for the Wireless Technologies for Teaching & Learning grants program is intended as the first step in a broader effort to introduce wireless and online technologies into that arena of teaching and learning specific to lab and field archaeology and museum studies (Mendoza, 2001c). The proposed effort entails both applied research and demonstration project objectives and goals centered on the deployment of wireless technologies for teaching and learning applications specific to ongoing research and community outreach within the early historic Hispanicized Mission Indian communities of the California Central Coast (Mendoza, 2002e, 2002h; Mendoza and Halla, 1999b).

The proposed project will permit the integration of new and innovative technologies in a first ever lab and field-based historical archaeology research deployment and demonstration project of wireless PDA devices equipped for wireless data entry and field project communications (Barber, 1994; McPherron and Dibble, 2002). Project funding will equip participants with wireless PDA (802.11b compatible) devices equipped with GPS and digital scanning capabilities, Seiko Instruments InkLink Handwriting Systems, and SmartPad devices for the preparation of handwritten electronic field notes and SmartPad-based maps and illustrations, project journals, specimens forms, and basic data entry over the wireless medium. Said devices will be linked in the field via a laptop-based field server equipped with a wireless access point and two-way satellite broadband transmission and reception capabilities. The field base station or laptop-based server will in turn facilitate connectivity to off-site project participants via *QuickCam Pro* field cameras, online journals, and "Wireless Field Reports" postings mediated by way of the CSU Monterey Bay Institute for Archaeology data server located at <http://archaeology.csumb.edu>.

Students and other project participants will be prompted to engage the use of wireless PDA-based electronic field manuals or eBooks prepared specifically for specimens' analysis and identification in historical archaeology contexts (e.g., Mendoza, 2002i). Such applications of both multimedia and wireless telecommunications will provide students with the tools and technologies necessary for making use of electronic field manuals used in the identification of such specimens as ceramics, animal bone, and *Munsell* soils color chart readings. Where museum anthropology studies are concerned, students will make use of portable hand-held electronic scanning devices such as digital imaging and barcode scanners, now being used by this investigator to create an online visual database for the archaeology and museum anthropology collections specific to Old Mission San Juan Bautista. Concomitantly, the aforementioned webcam will be deployed in both lab and field contexts for provisioning visual communications access via video and audio for off-site participants and collaborating institutions of the Central Coast Consortium for Archaeological Technologies of Cabrillo College.

Funding of the proposed project will facilitate the deployment of a first ever lab and field-based virtual learning lab in archaeology and museum anthropology akin to the classroom-based facilitated learning version documented in recent publications (Mendoza, 2001c, 2001d). Moreover, while we seek to deploy PDA devices in teaching and learning -- for the enhancement of student learning outcomes, we also envision the publication of a scholarly or technical paper or report that details the potentials of such technology for the archaeology and museum anthropology communities on the California Central Coast and beyond. Given that recent publications concerned with technology integration in archaeology have yet to identify wireless, broadband, or wireless PDA devices or media in their assessments of future orientations in the field (e.g., McPherron and Dibble, 2002), we believe that one dimension of the inherent significance of this project lies in the paucity of such technology approaches in the fields of archaeology and museum anthropology.

As per the feasibility of the proposed deployment of wireless technologies, we would like to reiterate that much of the applied thrust of the Institute for Archaeological Science, Technology, and Visualization has in fact been to see through that research and development, and technical instrumentation and innovation in teaching and learning that will serve to enhance the totality of the educational enterprise here at CSU Monterey Bay. Finally, given that the proposed project demonstration sites are already scheduled for startup by the spring of 2003, it should be emphasized that grant support will serve to enhance both student learning outcomes and community interactions within the technology-enhanced medium of wireless communications.

Project Description

The Institute for Archaeological Science, Technology, and Visualization has maintained a long-term commitment to its original mandate and mission to see through the development and deployment of innovative and cutting-edge technologies and applications such as GIS (Geographic Information Systems), GPS (Global Positioning Systems), EDM (Electronic Distance Measurement), and GPR (Ground Penetrating Radar) in archaeological and museum anthropology contexts. Much of what the Institute and its students have accomplished to date centers on the research and development of instructional technologies and multimedia for archaeology and the social sciences more broadly. To that end, the proposed project seeks to build upon existing assets within the Institute so as to see through the deployment of a wireless and broadband demonstration project -- that incorporates digital instrumentation for data capture and processing -- within the context of an authentic field research setting specific to ongoing archaeological research in an early California mission dated to the late 18th century.

The deployment of appropriate technologies in this instance will encompass both on-campus learning labs (replete with applied research aspects) and archaeological field investigations centered on the excavation and mapping of the architectural traces of an early California mission. Where the on-campus learning lab applications are concerned, it should be noted that the CSU Monterey Bay campus has already transitioned into the domain of going fully wireless as per its status as a demonstration project site for wireless technologies in teaching and learning. In this rarified atmosphere, students will undertake wireless data capture, data processing and transmission, and the upload of primary document files to the Internet via wireless PDA hand-held computers equipped with SmartPad and Seiko Instruments InkLink Handwriting Systems, and C-Pen devices for the scanning of historic documents pertaining to museum anthropology and archaeological research specific to the undertakings in question.

Where remote field settings necessitate a differing approach, the deployment of a virtual learning lab consisting of wireless (802.11b compatible) PDAs, and a laptop-based field server replete with access point and a two-way broadband satellite connection will provide the basis for wireless transmissions of data, and the posting of weekly Online Journal entries and "Wireless Field Reports" to the campus server of the Institute for Archaeological Science, Technology, and Visualization. The deployment of the virtual learning lab replete with remote base stations will ensure that project participants are afforded every opportunity to post field notes and reports, electronic maps and illustrations, Online Journal entries, and raw data directly from the field setting of an ongoing archaeological investigation. Because this latter effort will be coordinated with the results of a GPR (Ground Penetrating Radar) survey, students will have the opportunity to communicate their respective experiences with both wireless and broadband, and remote sensing technology applications in archaeology and the social sciences more broadly.

Project objectives and deliverables will center on those teaching and learning outcomes specific to the production of primary source documents -- such as field notes, journals, photographs, maps, illustrations, and observations -- in archaeology and museum anthropology. In order to assure that the research and learning enterprise remains central to the undertaking in question, ongoing assessment and evaluation of the student learning experience will be monitored and mediated by way of regularly scheduled student evaluations and assessments facilitated by way of mandated Online Journal entries, lab and field surveys, and student self-assessments currently used by the Institute to monitor student progress in other campus-based learning labs. Ultimately, it is anticipated that both the research and demonstration project dimensions of the proposed undertaking will benefit both the campus community and the fields of archaeology and museum anthropology more generally. Of course, this latter source of benefits will accrue only by virtue of the publication and dissemination of the results of the wireless initiatives in question.

Need for the Research

Given what has been said so far, we believe that the wireless initiative in question, and its deployment in an authentic field research setting specific to archaeology and museum anthropology will

inevitably benefit both the academy and the community. As such, we believe that the need for this research holds considerable promise as a demonstration project for other potential wireless initiatives in both academic and community settings on the California Central Coast and beyond. The specific application of wireless and broadband technology for lab and field applications in archaeology and museum anthropology remains a largely untested promise, and as such, this project holds the potential to serve as a charter model for the deployment of appropriate technologies within these academic venues. Other points of information that make clear the need for the research and demonstration initiative in question include:

- The need for furthering the research and development of wireless and broadband applications in archaeology and other social sciences lab and field settings.
- Enhanced opportunities for the innovative deployment and testing of wireless instructional technologies targeted at enhancing mandated learning outcomes in lab and field settings.
- Providing undergraduate students with enhanced opportunities for engaging in authentic lab and field research within which data collection and analysis -- and primary source documents -- are generated via cutting-edge wireless technologies.

Population Served

The specific populations served by the proposed grant include matriculated CSU Monterey Bay students, and non-matriculated project volunteers and museum docents from the communities of San Juan Bautista and Carmel, California, who are actively engaged in the service learning programs of the Institute for Archaeological Science, Technology, and Visualization. The specific CSU Monterey Bay student cohorts for whom the project has been proposed are those identified with two project-based or applied learning experiences scheduled for the 2003 spring term, including SBS 224s/324s (Archaeology: From Map to Museum), and SBS 260s/360s (Archaeology of a California Mission).

Where SBS 224s/324s is concerned, said learning lab provisions both upper and lower division students with authentic research opportunities centered on the fundamentals of archaeology and museum anthropology. Two such examples of the modularized and authentic research learning experience to be had within this venue include: (a) the Modern Materials Cultures Project in which students sample, study, analyze and quantify household waste or rubbish and what it has to tell us about our subject's specific dietary practices (e.g., Rathje and Murphy, 1992; CNN/Mendoza, 1994; Mendoza, 2001c; 2001d); and (b) the Ancient Technologies and Cultures Project in which students participate in a faculty-facilitated flintknapping and stone tool reduction demonstration followed by the controlled sampling, collection, quantification, analysis, and classification of lithic or stone tool debris and diagnostic types produced by their instructor (Whittaker, 1994; Mendoza, 2001c, 2001d).

The SBS 260s/360s field course in archaeological field methods centers on provisioning an authentic archaeological field experience in an early California mission community dating from the period of A.D. 1797 to 1833. Basic lab and field techniques provided within this authentic research experience with primary materials include research design, sampling strategies, archaeological reconnaissance, cultural resources management, electronic mapping, excavation methods, artifact collections management and documentation, database entry and analysis, interpretive methods, archaeological illustration, and field notes preparation. The field setting in this instance will center on Old Mission San Juan Bautista, California, and will include student access to a recently funded California Missions Foundation initiative to conduct a GPR (Ground Penetrating Radar) survey of both Old Mission San Juan Bautista and Mission San Carlos Borromeo del Rio Carmelo (Carmel), California (Menn and Mendoza, 2002).

Both SBS 224s/324s and SBS 260s/360s will in turn include field excursions to the Carl Luck Museum which continues to serve as one of the Institute's community partners. The Carl Luck Library and Museum was recently awarded a significant (\$150,000) digital imaging grant for the generation of an

electronic archive of historic collections – including early documents and an extensive collection of historic photographs – specific to the Carl Luck Museum. In this instance, the museum will serve as a point of departure for each course's field studies in museum anthropology. As such, the populations to be served by this grant include:

- Students enrolled in applied lab and field contexts and courses specific to SBS 224s/324s (Archaeology: From Map to Museum) and SBS 260s/360s (Archaeology of an Early California Mission).
- Both lower and upper division undergraduate, and graduate, students of CSU Monterey Bay.
- First generation, low income, and underrepresented college student cohorts matriculated at CSU Monterey Bay in its capacity as an HSI (Hispanic Serving Institution).
- Museum staff, docents, and project volunteers of the communities of San Juan Bautista and Carmel, California, will be recruited and encouraged to participate.
- Fellow faculty seeking demonstration project designs for similar technology applications at CSU Monterey Bay and other institutional partners participating in the Central Coast Consortium for Archaeological Technologies of Cabrillo College will be sought out via workshop sponsorships.

Off-site project participants who will benefit from our "Wireless Field Reports" will include members of the Boy Scouts of America who are currently participating in the Institute's collaborative effort to support the Boy Scouts of America's Archaeology Merit Badge Program. Members of the Girl Scouts of the USA will also be recruited as per this effort to connect the project to the community. Extant collaborations with the archaeology programs at Hartnell, Cabrillo, and Monterey Peninsula Community Colleges will in turn be enhanced via the establishment of renewed collaborations with academic archaeologists at those institutions currently participating in the technology initiatives of the Central Coast Consortium for Archaeological Technologies based at Cabrillo College in Aptos, California.

Project goals

The goals and objectives of the proposed Wireless Technologies in Teaching and Learning grant application remain specific to the academic mission and mandates of the CSU Monterey Institute for Archaeological Science, Technology, and Visualization. In point of fact, the primary initiative of the Institute for Archaeological Science, Technology, and Visualization is to develop a fully integrated curriculum centered on archaeological science, technology, and visualization via the deployment of innovative technology applications and instructional technology initiatives. As such, the Institute's curriculum encompasses the social, geo-spatial, virtual, environmental, and archaeological sciences. Project-based and both lab and field oriented, the Institute maintains a program to explore and directly engage the development of a variety of instructional technology and innovative social scientific applications, including:

- Online and multimedia instructional courseware
- Archaeology and museum collections software development and database applications
- Virtual museum development and virtual reality (VR) or other digital modeling of archaeological sites and materials
- An ongoing program of archaeological research and material culture studies
- Museum design, development, and public programming for the Old Mission and community of San Juan Bautista and other project sites on the California Central Coast
- Archaeology and museum anthropology applications in Service Learning
- Experimental applications in Global Positioning Systems, Ground Penetrating Radar, Electronic Distance Measurement, and related cutting-edge technologies

Given the Institute's mission and mandates, we seek to enhance the undergraduate social science learning experience with an applied approach to lab and field applications that make use of appropriate technologies for archaeology, museum anthropology, and the social sciences more generally. Facilitating an undergraduate learning experience that provisions access to cutting-edge technologies in GIS, GPS, and many other related applications has to date proven itself an impetus to student learning and interests in the sciences more broadly at CSU Monterey Bay (Mendoza, 2001c, 2001d); and has in turn served as but one additional basis for provisioning training, access, and employment for students matriculating in the program (Mendoza, 1999c). To that end, the proposed project in wireless applications will seek to see through the following goals with an eye toward the correspondence of said goals with the mission and mandates of the Institute for Archaeological Science, Technology, and Visualization. As such, project goals include:

- A project-based effort to educate and train undergraduate students in the use of wireless science, technology, and visualization methods in archaeology and museum anthropology
- Establishing and provisioning lab and field venues within which to test the potentials of broadband satellite and wireless PDA technologies and applications in lab and field studies
- Facilitating the development and deployment of a technology-rich wireless learning environment within which to model the applications and potentials of broadband and wireless for students engaging such media for the first time
- Demonstrate and model wireless technologies and hand-held computing devices for students from all walks of life with a specific consideration to mentoring students from non-academic and underrepresented communities
- Refining the potentials of data collection and management over wireless Internet and broadband applications from remote field locations as per the research and development goals of the Institute
- Facilitating a demonstration project in lab and field archaeology and museum anthropology with demonstrable research outcomes, thereby provisioning undergraduate students with an authentic research experience based on primary resources and materials in the social sciences specific to archaeology, museum anthropology and GIS and GPS applications
- Dissemination and publication of research results in both peer and non-peer reviewed venues with an eye to documenting the results of both field research in archaeology and the wireless demonstration project initiative in question

Anticipated Outcomes

Because the Institute for Archaeological Science, Technology, and Visualization has long sought to deploy new and innovative multimedia and telecommunications technologies in authentic lab and field research settings (Mendoza, 1999c, 2001d; Menn and Mendoza, 2002), we anticipate that both the research and demonstration dimensions of the proposed project will be met by virtue of the extant research and development orientation and experience of the Institute's faculty and student cohorts. Given the specific parameters of the project and the lack of instructional technology models for wireless deployment in archaeological and museum studies field contexts, we anticipate that challenges to the deployment will arise and to that end we have structured our team and its resources to meet the potential contingencies in question. Specifically, we anticipate the project outcomes and deliverables will center on the following concrete outcomes:

- Participating students and other project participants will benefit from training and mentoring for wireless PDA applications in teaching and learning
- Project participants, specifically matriculated students, will demonstrate proficiency in the use of wireless PDA devices for the purposes of provisioning basic data entry and telecommunications from within lab and field settings

- Existing community partnerships and new collaborations will benefit from direct involvement in campus technology initiatives by way of the technology-enhanced teaching and learning -- research and demonstration – pedagogical and community outreach framework of the proposed project effort
- Both students and community partners will benefit from that enhanced teaching and learning experience made possible by way of the deployment of a remote or mobile project-based multimedia learning lab
- The Institute for Archaeological Science, Technology, and Visualization (ASTV) – and colleagues at collaborating and peer institutions -- will benefit from the opportunity to expand ongoing research and development of Internet-based data entry and analysis in lab and field archaeology and museum anthropology
- The ASTV and its students will in turn benefit from the acquisition and long-term availability of new technologies for teaching and learning in remote lab and field contexts
- Enhancement and or development of basic PDA-based multimedia learning modules resulting from increased access to a project consultant proficient in Visual Studio PDA-platform programming

Dissemination Plan

The dissemination plan for the proposed project will work to feature both the demonstration and research dimensions and resulting deliverables of the overall archaeological undertaking and wireless demonstration project effort. Because wireless and broadband technology uses in archaeology and museum anthropology are in their infancy, the peer and non-peer reviewed publication of relevant findings from that research undertaken will serve as a prime objective for dissemination of how such technologies and applications may be deployed in lab and field settings specific to teaching, learning, and research. Because I have previously taken to publishing findings from prior teaching and learning demonstration projects specific to the so-called virtual learning lab in archaeology and museum studies (Mendoza, 2001d), I look forward to the opportunity to publish the results of the proposed technology-enhanced wireless learning lab research and demonstration project. In addition, so that undergraduate students may remain at the center of any and all project developments, the Institute's ASTV website located at <http://archaeology.csumb.edu> will serve as an electronic portal for documenting the project via a new section of the site devoted to "Field Reports" specific to the Wireless Research and Demonstration Project and its Virtual Learning Lab component. In addition, so that other faculty and staff at CSU Monterey Bay may benefit from the findings of the demonstration project in question, a campus workshop on wireless technologies will be hosted via the Institute for Archaeology. As such, specific aspects of the dissemination plan include:

- Publication of findings specific to actual lab and field deployments of wireless and broadband applications in archaeology and museum anthropology in both scholarly or peer-reviewed and community or non-peer reviewed venues
- The weekly posting of "Wireless Field Reports" -- pertaining to both student and faculty experiences with wireless technology applications in archaeology and museum anthropology -- to the Institute for Archaeological Science, Technology, and Visualization (ASTV) website located at <http://archaeology.csumb.edu>
- Distribution of working prototypes for evaluation of selected PDA-based multimedia learning modules to selected archaeology and museum anthropology colleagues participating in the Central Coast Consortium for Archaeological Technologies of Cabrillo College
- A campus community workshop for CSU Monterey Bay faculty and staff on wireless technology applications in teaching and learning

Formative Evaluation Plan

As noted in other contexts within this proposal, because this project is being undertaken with both research and demonstration project dimensions in mind, the principal investigator – in concert with project consultants and student assistants – will seek to collect evaluation and assessment data specific to both student learning outcomes and instructional technology deployment on an ongoing basis throughout the course of the project as proposed. In order to assure that all project participants have an opportunity to make use of and evaluate those wireless technologies acquired for the project, measures will be taken to assure that both wireless test and control groups are established and scheduled from the outset of the project start date in January 2003. The structuring of student cohorts into both wireless test and control groups will also assure that the learning experience specific to lab and field exercises and deliverables is measured and evaluated in terms of both site-specific variables (such as field conditions and the effectiveness of learning modules and exercises designed for the project), and the enhancement of said experience as per the deployment of "appropriate technologies" specific to wireless telecommunications.

Given that students will provide self-assessments of their overall learning experience – while at the same time articulating their satisfaction with wireless telecommunications and related devices deployed for this project initiative -- at three points in the semester, the mandated midterm evaluation will be significantly enhanced by way of that level of documentation provisioned by the participants through the course of the learning experience. Concomitantly, it should be noted that this method for evaluating the effectiveness of the learning experience has long been employed by the principal investigator to evaluate and enhance teaching effectiveness (Mendoza, 2001d).

At the mandated point at which documentation and evaluation of project-based learning activities and research are undertaken, said evaluation and assessment of progress in meeting project goals and objectives will be facilitated by way of the development and deployment of survey instruments intended to rate the overall learning experience, as well as the documented effectiveness of those wireless technologies deployed for the demonstration project in question. In this regard, the Instructional Design Consultant will serve as a point of reference and advising in the development and design of the survey instrument to be used. As noted, both the wireless test cohort and control group will be evaluated for the overall learning experience, whereas the wireless test cohort alone will provide a self-assessment of overall satisfaction with those wireless and broadband technologies and peripherals employed during the course of the first half of the term. This latter self-assessment for satisfaction with wireless technologies will then be repeated at the end of the term for the former control group. Where shortcomings or potential benefits of specific wireless and broadband applications or resource configurations are identified via the review of any and all survey evaluations and self-assessments, these sources of information will be taken into account at the mid-point of the project with an eye toward enhancing the learning experience for the second cohort of students to make use of the technologies in question.

Ultimately, our objectives are to refine the potentials of data collection and resource management via wireless PDA, Internet, and broadband applications identified with remote field research settings as per those science, technology, and visualization research and development goals and initiatives specific to the mandates and mission of the Institute for Archaeological Science, Technology, and Visualization. Moreover, a prime objective of the proposed project is to facilitate a demonstration project in lab and field archaeology and museum anthropology with demonstrable research outcomes, thereby provisioning undergraduate students with an authentic research experience based on primary resources and materials in the social sciences specific to archaeology, museum anthropology and GIS and GPS applications. To that end, those project deliverables – including field notes, journals, electronically-generated maps and illustrations, and related primary resource documents, will serve as the ultimate testimonials of the extent to which the project met its mandated goals and objectives. The publication and dissemination of scholarly research results by the principal investigator will in turn serve to document the pedagogical impacts, scientific merits, and technical feasibility of wireless and broadband applications in both archaeological field research and museum anthropology teaching and learning contexts.

Timeline for Activities

January 2003 -- Project startup. Includes start dates for personnel hired to facilitate equipment orders, develop or monitor project initiatives including wireless hardware and software installations, upgrades, field tests, and multimedia and Internet program development as needed prior to beginning of academic term. Preliminary setup of online instructional materials and multimedia, and the initiation of efforts to enhance and upgrade both existing and new multimedia for student use by multimedia design technicians. This effort will include the inventory and numbering of PDAs for student ID purposes and multi-user access. At this time all PDAs will be pre-configured with security passwords for multi-user access and privacy considerations; initial field tests of project laptops (including server/base station) and wireless PDAs will be undertaken by IT Technical Support Consultant in concert with the PI; Internet-based data entry capabilities from field settings at Old Mission San Juan Bautista and the Carl Luck Museum will be tested; and initial wireless technology orientations and project overviews for student project assistants, facilitators, and community participants by PI and project IT consultants will be scheduled. The end of January will see the onset of activities specific to the first week of classes, including the initial orientation and training in the use of PDA technology and wireless solutions for matriculated students and docent volunteers of SBS 224s/324s and 260s/360s. The PI, in concert with other project personnel, will be responsible for coordinating the orientations in question. At this time the Instructor of Record (aka: Principal Investigator) will subdivide SBS 224s/324s lab students into at least two project test cohorts, including a wireless test cohort and non-technology assisted control group. This will be done in order to serve as a measure of the extent to which PDAs and wireless technologies serve to enhance the lab and field teaching and learning experience over non-technology enhanced teaching and learning. A second round of field tests with wireless PDAs, the laptop base-station, and broadband wireless will be undertaken on the "campus" at this time. Campus-based field test will serve as initial point of departure for student use and deployment of technology in campus-based lab and field settings.

February 2003 – By this point the project will turn to orienting students in the use of wireless handheld computers and Smartpad and InkLink peripherals, as well as basic training in the use of Online Journals and database entry over the broadband network link to the CSU Monterey Bay Institute for Archaeology remote database server. Specific activities will include a daylong on-site orientation to archaeological field methods initiated at Old Mission San Juan Bautista with initial student deployment of broadband and wireless PDA usage in field-based setting; field tests of wireless data entry and broadband connection from the nearby Carl Luck Museum; the first cohort of PDA users will submit initial Online Journal and SmartPad generated field notes via field-based laptop server base station and broadband connection to CSU Monterey Bay Institute for Archaeology database server; the first cohort of PDA users will submit initial postings of observations on wireless technology applications to Institute's "Wireless Field Reports" electronic poster session; and archaeological field investigations will be initiated in concert with the initial field project deployment of wireless and broadband technologies for data collection and analysis. Both SBS 224s/324s and SBS 260s/360s students will share in the following lab and field experiments: Archaeological excavations will be conducted and all specimens' data entry will take place on PDAs equipped with WriteShield screen protectors; students will be introduced to the use of the SmartPad and the InkLink Handwriting System for the generation of digitized handwritten notes and illustrations to be uploaded via broadband – along with Online Journals -- to the CSU Monterey Bay Institute for Archaeology database server.

March 2002 – Midterm assessment and evaluation of wireless and broadband data collection and analysis, and PDA usage by first test cohort of student participants by Principal Investigator and Instructional Design Consultant. Second cohort of students, serving as non-technology enhanced control group during first half of semester will commence technology-enhanced portion of their internship. Original test group reverts to exclusive use of hard copy journals and lab and field forms. Midterm evaluation will test for achievement of targeted learning outcomes in technology, field note, and database management proficiencies in both wireless test and control-group learning cohorts. At this time students

will post the results of learning lab modules and field exercises akin to those posted at <http://archaeology.csumb.edu/Workshops/archInfo.htm>

April 2002 – Both wireless test and student control groups participate in field tests of GPS (Global Positioning System) mapping with wireless PDA systems and GPS modules, and SmartPad data transfers and image upload to campus server and Internet for remote viewing by community partners via live online reports hosted by campus-based Institute for Archaeology Internet data server. This activity will be conducted in conjunction with the Historic American Buildings Survey of San Juan Bautista and the Carl Luck Museum. See <http://archaeology.csumb.edu/Workshops/Modules/HistAmerBuildings.pdf> for the specific learning module to be used in this instance.

May 2002 – Student project submissions and assessment via wireless PDAs and broadband network, including password student access to online Institute for Archaeology end-term term evaluations assessing technology skills, GPS map making, note taking and technical writing, and scientific illustration efforts completed via wireless medium. At this time students will submit end-term self assessments that serve to outline and review specific dimensions of the wireless experience that proved most useful and most feasible to students in both test and control group cohorts.

May 31, 2003 -- Completion of wireless projects including submission of all required project assessment and evaluation reviews by both Principal Investigator and Instructional Design Consultant.

Appendix A: Project Personnel

Ruben G. Mendoza, Ph.D., Principal Investigator/Project Archaeologist

Institute for Archaeological Science, Technology, and Visualization, CSU Monterey Bay, Seaside, CA

Roles and Responsibilities: Dr. Ruben G. Mendoza will serve as the Principal Investigator, project archaeologist, and instructor of record for each of the two learning experiences held central to the deployment of the project initiative in question. Professor Mendoza will oversee the research and instructional design dimensions of the project, while at the same time assuring that his students are best served by the learning outcomes and research methodologies employed through the course of the project.

Experience with Related Technology Initiatives

Dr. Ruben G. Mendoza is the founding Director and Principal Investigator of the Institute for Archaeological Science, Technology, and Visualization – aka: ASTV -- of CSU Monterey Bay. The Institute for Archaeological Science, Technology, and Visualization has as its prime objective the testing and deployment of technologies and multimedia appropriate to the enhancement of facilitated teaching and learning in both online and distributed learning environments (Mendoza, 2001d; 1999c). To that end, students are challenged to engage innovative and cutting-edge technologies and applications specific to Global Positioning Systems (GPS), Geographic Information Systems (GIS), and Electronic Distance Measurement (EDM) for the purposes of effectively recording geographic and topographic data specific to the recording and mapping of archaeological sites and specimens. As such, this grant application for the Wireless Technologies for Teaching & Learning program is intended as the first step in a broader effort to introduce wireless and online technologies into that arena of teaching and learning specific to lab and field archaeology and museum studies (Mendoza, 2001c).

Experience with Distributed Learning

The Internet site of the Institute of Archaeology – located at <http://archaeology.csumb.edu> -- provides a documented case study of how the Institute has sought to make use of project-based and technology-mediated approaches and applications in both teaching and research. To date, this investigator has moved the entire curriculum of the Institute for Archaeology into online and Internet-based venues and has been doing so since the fall of 1995, when CSU Monterey Bay and the Institute of Archaeology were founded. Past projects include several funded efforts to enhance seat-time and distributed learning instructional approaches, and include online database deployment (see

<http://archaeology.monterey.edu:2000/>), online syllabi (<http://archaeology.csumb.edu/Syllabi/index.html>), online journals (<http://archaeology.csumb.edu/Journal/Journals.html>), portable document file forms (<http://archaeology.csumb.edu/Guidelines/ProjGuidelines.html>), online assessment and Filemaker Pro 5 templates (<http://villa.monterey.edu/faculty/mendoza/portfolio/default.htm>), Flash 4/5 multimedia slide shows (<http://archaeology.csumb.edu/SlideShows/Crescent/RockdfghShelter3.swf>), QuickTimeVR models, online video streams, and related media (<http://archaeology.csumb.edu/Media/media.html>), CD-Rom demonstration projects (<http://archaeology.csumb.edu/CDromProject/index.html>), Cosmo Virtual Reality Models (<http://archaeology.csumb.edu/VRnavigation.html>), LightWave 3D Modeling (<http://archaeology.csumb.edu/VirtualArchaeology/3Darchaeology.htm>), AutoCad 14 EDM-Based architectural maps (<http://archaeology.csumb.edu/VirtualArchaeology/ElectronicMaps.html>), and online resource archive demonstration projects (<http://archaeology.csumb.edu/sjbhs/index.html>), among others.

Experience Managing Other Grant Projects

Finally, it should be noted that during the course of the past two years I have garnered some \$64,000 in historic preservation and conservation grants targeting the restoration of specific artworks within the collections of both Old Mission San Juan Bautista and San Carlos Borromeo. In addition, I recently facilitated the actualization of a commitment to fund the restoration of the Old Mission San Juan museum to a total of \$80,000. I served as a project grant development team member responsible for the technology design and budget for a \$150,000 grant awarded the Carl Luck Library through the California State Library Services and Technology Act grants program. In each instance, I have served as the principal investigator, grant writer, and or on-site facilitator of each project brought to successful completion. To this should be added some \$20,000 in grant funds targeting instructional multimedia and online database development projects undertaken in the past four years at CSU Monterey Bay (Mendoza, 1999c, 2001d).

Ken Halla, M.A., Instructional Design Support Consultant

Idea Lab, California State University Monterey Bay, Seaside, CA 93955-8001

Roles and responsibilities: Mr. Halla will provide instructional design support and teaching and learning self-assessment criteria for students participating in the project. Mr. Halla will participate in the design of such assessments in collaboration with the Principal Investigator at the midterm and end-term portions of the project.

Experience in managing other grant projects

- **Co-Director: CalStateTEACH Technology Enhancement Project:** Mr. Halla currently serves as the Co-Director of the CalStateTEACH Technology Enhancement Project (CSTEP). Recipient of a \$1.5 million U.S. Department of Education "Preparing Tomorrow's Teachers for Using Technology" (PT3) grant, CSTEP provides multimedia and instructional design support to the CSU system-wide online and field-based teacher certification program. In his capacity as Co-Director, Mr. Halla oversees fiscal activity, coordinates and monitors grant activities, manages multimedia development, and directly supervises design and production staff. In addition he has primary responsibility for coordinating evaluation activities with the project's external evaluator.
- **Director Ventana Learning and Technology Collaborative:** Mr. Halla has also served as the Director of the Ventana Learning and Technology Collaborative at California State University, Monterey Bay. Funded through the CSU Office of the Chancellor, this project received \$400,000 over two years to provide professional development in the use of Educational Technology to K-12 teachers. In his capacity as Director, Mr. Halla conducted needs assessments, established project goals and activities, monitored fiscal activity, and coordinated with County Office of Education personnel.

Experience with Distance Learning Teaching

- **Senior Instructional Designer:** In addition to serving as Co-Director for the CalStateTEACH Technology Enhancement Project, Mr. Halla also serves as the project's Senior Instructional

Designer. In this capacity, Mr. Halla works directly with multimedia developers and instructional designers to produce interactive media supporting the CSU System's online teacher credentialing program. Materials developed directly support distributed learning for teachers in the areas of technology integration, performance assessment, and instructional strategies.

Christian Graves, IT Technical Support/Consultant

1513 Oyster Bay Court, Salinas, California 93906. Tel: 831-449-5758. admin@archaeology.csumb.edu

Roles and Responsibilities: Hardware and software configuration, and necessary programming in Macromedia Flash MX and Visual Studio 6.0 for both lab and field devices, including desktop and laptop based field servers and wireless PDAs. Will in turn coordinate and synchronize the use of PDA devices and field-based laptop server for wireless data entry, Internet postings, and broadband connectivity.

Computer Technical Experience

- Internet Service Technician/WinVNC Remote Display Control Manager. Institute of Archaeology, California State University Monterey Bay, 100 Campus Center, Seaside, CA 93955-8001. 1997-2002. Duties: Institute NT-server maintenance and administration, graphics and web design and development, JavaScript, multiple software applications and development. <http://archaeology.csumb.edu>
- Computer Technician. DKA Computers, 971 N. Main Street, Suite A, Salinas, CA 93906. 1998-2000. Duties: Hardware and software maintenance and implementation; computer assembly, hardware installation and repair of various computing platforms; including Microsoft Windows 95, 98, 2000, NT Workstation.
- Multimedia Developer: Institute for Archaeology, California State University Monterey Bay, 100 Campus Center, Seaside, CA 93955-8001. June-August 2000. Duties: Lead Macromedia Flash 4.0 and Javascript/CGI interface design and content developer for CD-ROM authored by Professor Ruben G. Mendoza and titled *Old San Juan: A Mission Media Project* (2000).
- Network Technician. WWD Corporation, 2801 Monterey-Salinas Highway, Monterey, CA 93955. 2001-2002. Duties: Maintain and employ 16 Windows 2000 workstations and servers, upgrade clients with current software, ensure network functionality for all users in electronic mapping and survey firm.
- Database Developer/Consultant. Institute for Archaeology, California State University Monterey Bay, 100 Campus Center, Seaside, CA 93955-8001. 2002-present. Duties: Installed and developed a museum software management system for archaeological specimens, museum collections, and photographs. Also responsible for development of Digital Image Management, Barcode Scanning, and Virtual Exhibitions portions of museum software systems in question.

Software Applications

Adobe Photoshop 7; Flash MX; Dreamweaver MX; Sambar Server 4.8; Microsoft Visual Studio 6.0; WinVNC Virtual Network Computing/Remote Display Controller; PastPerfect 3.0 Museum Software; Microsoft Windows professional desktop applications and numerous other Internet-related tools and applications.

Computing Languages

Visual C++; Visual Basic; HTML, JavaScript; CGI.

Operating Systems

Windows NT Workstation; Windows 95, 98, Me, 2000; Cygwin (UNIX environment for Windows).

Malcolm Mejia, B.A., Multimedia Developer/Consultant

3224 Gettysburg, Marina, CA. Phone: 831-883-0421

Roles and Responsibilities: Will facilitate the ongoing development of multimedia-based teaching and learning modules in archaeology in concert with the Principal Investigator, and will enhance existing multimedia learning modules for use within the context of the wireless project initiative.

Education

- B.S. Computer Science w/emphasis in Social and Behavioral Sciences, California State University, Monterey Bay, 2001.
- GIS Certificate, Geographical Information Systems, Social and Behavioral Sciences, California State University, Monterey Bay, 2001.
- A.A. General Studies, Foot Hill College, Los Altos, CA.
- Certificate, Commercial Music, Foot Hill College, Los Altos, CA.
- Certificate, Speech and Communications, Foot Hill College, Los Altos, CA.

Multimedia Technical Experience

- Multimedia Ethnographer, Social and Behavioral Sciences, California State University, Monterey Bay, Seaside. Prepared field research and created multimedia specific to the delivery of ethnographic data for distance learning; employed hybrid or cross-platform software applications for developing multimedia in hybrid format; produced documentary and ethnographic video footage; employed appropriate visual anthropology methods and strategies for creating and developing video, photography, and multimedia; and created Macromedia Flash multimedia slide shows.
- Multimedia Technician, National science foundation Funded Project. Supervisor: Dr. Manual Carlos. January-December, 1999. Design and development of a CD-ROM multimedia ethnographic research methods instructional package.
- Audio Visual Technician, Foothill College 12345 El Monte Road Los Altos Hills, CA 94022; 1997-1998. Supervisor: John Vandercook.
- Music Studio Manager and Engineer, Foothill College, 12345 El Monte Road, Los Altos Hills, CA 94022; 1997-1998. Supervisor: Mark Anderson.
- Television Producer/ Production assistant, Foothill College 12345 El Monte Road Los Altos Hills, CA 94022; 1997-1998. Supervisor: Marilyn Ackerman.

Recent Publications and Acknowledgements

- Conference paper, titled "The Integration of Computer Science and Anthropology," presented before the National Conference on Undergraduate Research (NCUR), 2001.
- Publication: "The Use of Computer Science and Digital Multimedia in Ethnographic Applications Involving the Reconstruction and Representation of a People's Culture and Life Ways," In *NCUR Proceedings*, 2001.
- Award: Outstanding Achievement In Public Access Television, 1997, and 1998.

Software Applications

Adobe Photo Shop, Illustrator, and Premier, HTML, Macromedia Flash, AfterEffects, QuickTime Movie Pro, Media Cleaner Pro, Media 100, Authorware, Dream weaver, Sound Edit 16, Master Tracks, Microsoft Access, DreamWeaver Ultra Dev, and basic server applications.

Appendix B: Proposed Project Budget**WIRELESS TECHNOLOGY DEMONSTRATION PROJECTS****PROPOSAL BUDGET**

CATEGORY	REQUEST
PERSONNEL	

Salaries and Wages (Professional and Clerical hourly rates)	
Ruben Mendoza-overload	6,000.00
Student Assistant (2)	4,000.00
Subtotal Personnel	10,000.00
FRINGE BENEFITS	
Fringe benefits @ 35% (50% or more time, Fdn. permanent employees)	
Fringe benefits @ 11% (part-time, temporary employees, students)	1,100.00
Fringe benefits @ 26% (faculty buyout, state employees)	
Subtotal Fringe Benefits	1,100.00
SUPPLIES	
WriteSHIELD Deluxe 3-pak E310/740 Kit @ 10 units	390.00
Electronic Storage Media	500.00
Subtotal Supplies	890.00
EQUIPMENT	
Toshiba Pocket PC e740 @ 10 units	5,990.00
SanDisk 256MB Secure Digital Card @ 10 units	1,899.90
SanDisk 256MB CompactFlash Card	159.99
Dell Latitude C840 Customized Laptop	3,487.15
Dell Latitude C840 Customized Laptop/Server	3,265.30
Dell PowerEdge 4600 Customized Server	5,280.00
SmartPad for Pocket PC @ 5 units	769.75
InkLink Handwriting system	82.51
Wasp Barcode WandReader @ 2 units	290.00
SanDisk CF-SD/MMC Dual Reader @ 2 units	59.98
QuickCam Pro 4000	99.95
DirecTV DIRECWAY Satellite Broadband @ 2 units w/ one year subscription	2,599.72
Pharos Pocket GPS Portable Navigator @ 2 units	599.90
PocketTop Wireless Keyboard for PDA @ 2	200.00
C-Pen 600C @ 2 units	378.00
Subtotal Equipment	25,162.15
TRAVEL	
Conference Travel	1,500.00
Subtotal Travel	1,500.00
CONSULTANTS	
Network Consultants	5,500.00
IT Design and Multimedia Development Consultants	4,000.00
Subtotal Subcontracts	9,500.00
OTHER (Printing, phone, postage, etc.)	
GPS Navigation and Related Support Software	500.00
Subtotal Other	500.00
TOTAL DIRECT COST	48,652.15

Appendix C: Project Budget Justification

Personnel: Because the principal investigator is also the instructor of record for the two project-based learning labs to be used in this research and demonstration project, the principal investigator has opted to avoid course release time so as to facilitate the objectives of the project as stated. The salary amount noted for the overload in question is significantly less than that amount required for course release time; and as such, this option was seen as the most feasible alternative where the project budget is concerned.

Where student assistants are concerned, the desire of the principal investigator to see through the ongoing collection of both evaluation and assessment information, and the very real need to actualize the correct methods and procedures for archaeological excavations, data entry, and materials handling in this instance require that archaeology students familiar with extant methods of data collection and analysis are available so as to mediate any and all data entry via the wireless and broadband networks proposed. Student assistants will also provide on-site assistance with the identification of lab and field specimens and the use of equipment appropriate to each setting. Because said student assistants will also be trained in the fundamental usage of the wireless devices to be used in this instance, their role will also be that of lab and field technical support. Fringe benefits will accrue in this instance as these are a standard requirement of student employment, and as such they are noted under the category stated.

Supplies: Given the specific field conditions relevant to archaeology and museum anthropology, the *WriteShield* screen protectors are seen as a critical element for protecting the PDA or handheld computer screens from damage due to particulate matter such as dust and soils. Resources sufficient to obtain storage media such as Zip disks and CD-Rs have been included as files will need to be backed up on an ongoing basis so as to safeguard against the potential loss of primary source documents and field notes lost during anticipated transmission failures in the field.

Equipment: The primary devices that will serve to facilitate the mandated wireless and broadband connection include the Customized Laptop/Server to be used in concert with an access point for connection to the broadband satellite receiver/transmitter required of this project operation, as well as a second Customized Laptop that will serve as a field station for student use and the manipulation of PDA files and related resources. The specific connection to the broadband network will be facilitated by way of the installation and subscription to a two-way wireless broadband network facilitated by way of a satellite receiver/transmitter installed at both the Carl Luck Museum and Old Mission San Juan Bautista. Both costs for the satellite receivers/transmitters, and a one-year month-to-month contract, have been factored into the fees as quoted herein. At the campus end, the now obsolete database server currently in use will be upgraded by way of replacement with a Customized Server deemed critical to use and deployment with the wireless project as proposed. Other key equipment includes 10 wireless PDA units for the purposes of provisioning a cohort of 10 students identified with the wireless test cohort. All ten units will be upgraded with a 256MB secure digital card for the purposes of enhancing Internet reception and downloads. An existing Institute digital camera will be upgraded with a 256MB compact flash card for student use in documenting the progress of the field investigation. Two of the units in question will in turn be outfitted with the GPS portable navigators for the purposes of facilitating a student lab module in satellite-mediated mapping techniques in archaeology. Two PDAs, and or laptops, will be outfitted with barcode wand readers for the purposes of field specimens inventory identification conducted in concert with the application of self-adhesive barcode labels applied to any and all specimens recovered from the field sites specific to archaeology. The barcode readers will in turn permit their use in the ready identification and data entry modification of records for which barcodes have been applied. Two students will be provisioned with C-Pens for scanning information directly from historic primary resource documents specific to archaeological investigations identified with Old Mission San Juan Bautista, as well as from those historic resources or museum captions found within the confines of the Carl Luck Museum of San Juan Bautista. The ability to download or beam said information to the laptops or PDAs

will provide one additional critical demonstration of appropriate technologies for teaching and learning in archaeology and museum anthropology. The InkLink Handwriting System will be obtained so as to provide a single user with the option of using this device to automatically and electronically record and upload to PDA or laptop devices handwritten text and illustrations – primarily maps -- entered onto a standard or letter-sized writing or illustration pad or scientific notebook or journal. In addition, five SmartPads for Pocket PCs will serve the same function for more students dependent on a smaller writing area specific to note taking during lab and field investigations. The wireless keyboards will be deployed with at least two students who may find the use of the PDA pen too limiting or difficult to use in field settings requiring a significant amount of data entry or typewritten notes. So that we may provide a real-time link for community partners, the QuickCam Pro will be installed on the secondary field laptop used for data entry, eBook field guides, and related support materials needed in locations away from the laptop-based field server and remote base station.

Travel: Conference travel has been factored in here so that the principal investigator, and the network consultant, may provision a multimedia presentation in a professional conference venue so as to disseminate results and findings arising from the wireless and broadband demonstration project as proposed.

Consultants: Those consultants selected will serve as both short and long-term project participants in this instance. While the Network Consultant will facilitate the initial setup and ongoing maintenance of all wireless hardware and software support and applications specific to the project, said consultant will also see through the enhancement or Visual Studio-based modification or scripting of existing multimedia learning modules for the purposes of compatibility with both wireless PDA and laptop devices. The IT Design and Multimedia Development Consultants will in turn assist with the design, enhancement, or modification of those multimedia-learning modules to be used during the course of the proposed project. The Multimedia Development Consultant in this instance will provision expertise in the ongoing development of electronic field manuals or field guides to archaeological and historical specimens and related resources.

Appendix D: Letters from Community Partners

Letters of project commitment from institutional officials at partnering organizations include the following (see attachments):

- Father Edward Fitz-Henry, Old Mission San Juan Bautista
- Georgana Gularte, Carl Luck Museum/San Juan Bautista Historical Society

Appendix E: Status of CSUMB Human Subjects Policy Approval

In Progress: Because the proposed project will directly engage students in the use of wireless technologies in a research and demonstration project setting, Human Subjects Policy Approval forms will be submitted so as to account for the student and community cohorts participating in the effort noted.

References Cited

Barber, Russell J. 1994. Doing Historical Archaeology: Exercises Using Documentary, Oral, and Material Evidence. Upper Saddle River, New Jersey: Prentice Hall.

Cable News Network. 1994. The Diet Detectives. In CNN Presents: Food to Die For, and Headline News, Cable News Network, CNN Nutrition Special Reports, New York, N.Y. Aired: November 24, 1994. Featured Study: Professor Mendoza's Denver Garbology Project.

McPherron, Shannon P., and Harold L. Dibble. 2002. Using Computers in Archaeology: A Practical Guide. Boston: McGraw-Hill/Mayfield.

Mendoza, Ruben G. 2002i. Mission Ceramics: A Virtual Type Collection in Historical Archaeology (CD-ROM). Forthcoming.

Mendoza, Ruben G. 2002h. San Juan Bautista: An Archaeologist's View of an Early California Mission. Text and Photos by Ruben G. Mendoza. Sacramento: California Missions Foundation.

Mendoza, Ruben G. 2002e. This Old Mission: San Juan Bautista, Archaeology, and the Hispanic Tradition. In Hispanic Outlook in Higher Education. 12(9): 28-31. Paramus, New Jersey. February 2002.

Mendoza, Ruben G. 2001d. The Virtual Learning Lab: Facilitated Teaching and Learning in the Online Environment. In Emerging Technologies in Teaching Languages and Cultures -- Effective Use of Technology for Language Learning: What Works and What We've Learned. Yoshiko Saito-Abbott, Richard Donovan, Thomas F. Abbott, and Phillip Kennedy, editors. Pp. 167-195. San Diego, California: LARC Press, Language Arts Resource Center, California State University, San Diego.

Mendoza, Ruben G. 2001c. An Archaeological Approach to Teaching U.S. Cultural Diversity. In Cultural Diversity in the United States: A Critical Reader. Edited by Ida Susser and Thomas C. Patterson. Pp. 414-433. Oxford, UK: Blackwell Publishers.

Mendoza, Ruben G. 2001. Old San Juan: A Mission Media Project (CD-ROM). San Juan Bautista, California: Old Mission Multimedia. [Forthcoming]

Mendoza, Ruben G. 1999c. Archaeology, Multimedia and Online Collections Management for Old Mission San Juan Bautista. In Southwestern Mission Research Center Newsletter 33(121): 22-28. Tucson: Arizona State Museum. December.

Mendoza, Ruben G., and Ken Halla. 1999b. Missions of the Spanish Friars. In Encyclopedia of North American History. John C. Super, Consulting Editor. Pp. 801-803. Tarrytown, New York: Marshall Cavendish Corporation.

Menn, H. E. Sir Richard Joseph, and Ruben G. Mendoza. 2002. San Carlos Borromeo del Río Carmelo: A Proposed GPR Survey and Archaeological Recovery of the Wine Cellar of an Early California Mission. A grant proposal for a Ground Penetrating Radar Survey of the Carmel Mission submitted to the California Missions Foundation, San Francisco, August 7, 2002.

Rathje, William, and Cullen Murphy. 1992. Rubbish: The Archaeology of Garbage. New York: HarperPerennial.

Whittaker, John C. 1994. Flintknapping: Making and Understanding Stone Tools. Austin: University of Texas Press.