

CONSORTIUM FOR ITS TRAINING AND EDUCATION

INTRODUCTION

This proposal describes an exciting approach for the enhancement of an ongoing successful program that provides Internet-based distance learning on high technology applications within the surface transportation industry. The proposal addresses the critical need within the transportation industry for training and education on these applications within the transportation industry if scarce funding for this technology is to be wisely invested. Perhaps equally important, it is anticipated that the results of this work will be generalized to the more general problem of providing training to individuals unfamiliar with high technology, in a society where success is increasingly dependent on a working knowledge of this subject.

THE NEED FOR INTELLIGENT TRANSPORTATION SYSTEMS (ITS) EDUCATION

Every year billions of dollars are allocated to State and local agency Departments of Transportation to address the increasing levels of traffic congestion plaguing our nation's cities. The cost of congestion in U.S. cities is increasing by 7 percent annually, and very conservative estimates currently assess this cost at over \$70 billion per year in 68 major U.S. cities. During the past 20 years, highway capacity has increased by 2% while vehicle miles of travel have increased 77% as a result, the highway system has not been able to keep up with increasing levels of demand and the resulting congestion (1). The decades-old panacea of pouring more and more concrete neither solves our transportation problems nor meets Congress' long-term vision of an efficient transportation system. A broad spectrum of technologies, known collectively as intelligent transportation systems (ITS), offers the answer to many of our transportation problems. ITS involves the development and operation of an integrated communication and information processing infrastructure intended to efficiently manage the available transportation resources.

Broad-based education and training of both current and future practitioners is essential to achieve the greatest return on the federal and state financial investments in ITS. The implementation of a vast array of ITS technologies has created a strong demand for highly skilled professionals. A number of reports, including the U.S. Department of Transportation (DOT) Five Year Strategic Plan for Professional Capacity Building (2), conclude that "trained professionals do not currently exist, nor are they entering the workforce in sufficient numbers to effectively deliver the expected deployment of ITS." Education and training programs for ITS professionals have been initiated by a number of universities, agencies, associations, and companies (3). These efforts, while individually successful, are not sufficient to meet current or emerging needs.

To be fully prepared for a career in ITS, students must be provided with an interdisciplinary curriculum covering transportation engineering (a branch of civil engineering), computer science, systems engineering and business. U.S. universities rarely offer this eclectic curriculum. Most universities experience difficulties in attracting a critical mass of students to concentrate on ITS as a specialty. As a result, it is too costly and impractical for most universities to develop the required broad-based curriculum. A more cost effective solution involves a collaborative effort to develop courses that can be used by a large number of universities. This context was the basis for the establishment of the Consortium for ITS Training and Education (CITE).

CONSORTIUM FOR ITS TRAINING AND EDUCATION (CITE)

CITE is a worldwide consortium of over 60 universities in North America, Europe, Middle East, Australia and Asia. CITE is also supported by a number of other organizations in the transportation community who have the objective of developing, offering or obtaining ITS training and education, including the U.S. Department of Transportation and ITS America (the

CITE's mission is to encourage and facilitate the creation and delivery of an effective education and training program for ITS.

industry association representing the ITS community). CITE was formed in November 1998 with the adoption of a Statement of Principles that defines CITE's purpose, mission, objectives and organization.

CITE's audience includes both graduate students and industry professionals. Graduate level for-credit courses developed by CITE are offered through CITE university partners (at no cost to the partners). Training courses for continuing education units are available directly through CITE for an enrollment fee.

CITE completed the development of its first semester-long course, "Fundamentals of ITS and Traffic Management" in June 2000. This course consists of 11 modules, each focused on a different aspect of ITS. The course serves as a gateway course providing students with a broad knowledge of ITS including a complete picture of its technologies and methodologies. The topics covered in the course are listed in Table 1. The course was designed to provide a working-level understanding ITS. While the course does not contain adequate detail to make the students an expert in any topic, it is a necessary first step in the development of a comprehensive ITS curriculum.

Table 1. Fundamentals of ITS and Traffic Management course

Module	Developer
Corridor Management	Virginia Tech
Dynamic Route Guidance and In-vehicle Systems	Rensselaer Polytechnic Institute
Incident Management and Emergency Management	New York Polytechnic University
Interoperability: ITS System Architecture and Standards	University of Maryland
Introduction to Information Technology	University of Arkansas
Introduction to Intelligent Transportation Systems	Morgan State University
Introduction to Telecommunications Technology	Rensselaer Polytechnic Institute
The Tools of ATMS	New York Polytechnic University
Traffic Flow Theory as Applied to ITS	University of Massachusetts - Lowell
Traffic Signal Systems Fundamentals	University of Massachusetts - Lowell
Transportation Management	University of Virginia

As shown in Table 1, the Fundamentals course was developed by a team of faculty members from CITE's participating universities. Authors for each module were selected based on their expertise in the

subject matter and were compensated with a small honorarium in recognition for their contribution to the course development. The honorarium represented a small fraction of the true cost of the module development. However, since CITE's success is dependent upon the participation of its members, the university partners generously donated the time necessary for the module preparation.

A pilot version of the Fundamentals course was offered between January and May 2000. Two sessions of the course were offered simultaneously. One session included 20 graduate students from the University of Toronto and Rensselaer Polytechnic Institute (RPI). Students received graduate level credit from their university for taking the course. The second session was made up of 51 ITS professionals from state DOT's, toll authorities, the private sector, the Federal Highway Administration, graduate students from additional universities, and several people from various other public agencies. One of the conclusions reached from the pilot was that a full semester course proved too demanding for many current professionals because of their additional commitments. As a result, stand-alone versions of the individual modules of the Fundamental course were developed as individual short-courses.

In June 2000, CITE began offering twelve ITS courses -- the Fundamentals course and 11 short-courses (the individual modules of the Fundamentals course). CITE offers all of its courses to ITS professionals and provides continuing education units (CEU's) upon the course's successful completion. CITE's university partners offer the Fundamentals course to their students for graduate level credit.

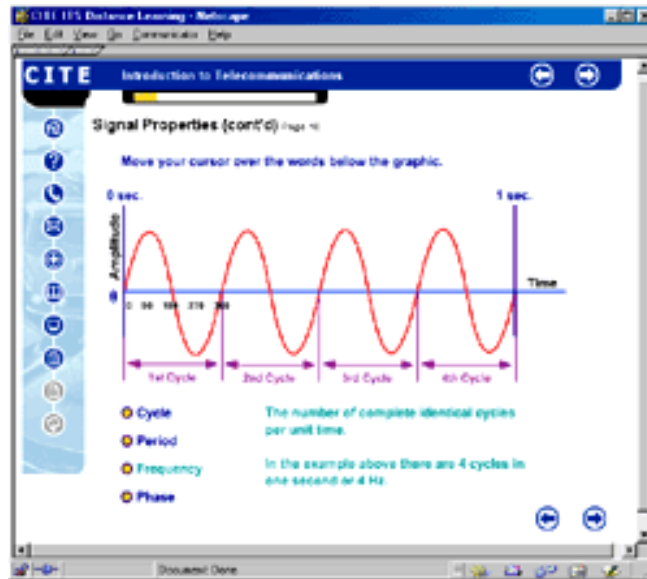
In June 2001, CITE added another short-course to its curriculum: "Applied Systems Engineering for Advanced Transportation Projects." This new course has been designed for transportation professionals interested in broadening their knowledge of the technical aspects of the planning, design and the implementation of ITS projects. This course and a complimentary course under development by the ITS JPO called "Introduction to Systems Engineering," were identified as one of the top 10 ITS competency areas needed to advance ITS deployment (4). Support for the development of this two-day course was provided by ITS America.

A second, one-semester course called “ITS Applications and Management” has been outlined and is discussed under Objective 4 below. This course complements the material of the existing one-semester Fundamentals course and emphasizes the many non-technical issues that are receiving increased attention within the ITS community, such as project management, public-private partnerships and legal issues. While some of the resource material has been developed for this second one-semester course, it has not yet been converted to a web-based distance-learning format. The completion of this one-semester course by September 2002 is one of the objectives earmarked for the use of LAAP funding.

As of February 2001, CITE included 60 university partners worldwide. Nearly half of these universities are taking advantage of CITE’s courses. William Sproule from Michigan Technological University stated: "At universities with small graduate programs (like ours) it allowed us to offer a course that goes beyond the expertise of our faculty, and is cost effective." Enthusiasm for the course was not limited to faculty, as shown in this quote from a university student who took the Fundamentals of ITS and Traffic Management course: “I was one of the University of Massachusetts students who took the ITS course under the guidance of Dr. Jonathan Upchurch last semester (Spring 2000). I learned a lot through the course and it really encouraged me to go for a career in ITS.”

Because CITE courses are offered to university partners at no cost, significant benefits are realized by Historically Black Colleges and Universities (HBCUs) and other minority colleges. Several HBCUs are already CITE members, and have proved to be among the more active users of the courses. One of CITE’s goals is to significantly increase its number of university partners, both nationally and internationally, in order to expand the geographical span of graduate level ITS course offerings and thus, increase the number of ITS-trained graduate students entering the workforce. The needs of HBCUs and other minority colleges are emphasized in achieving this goal.

All CITE courses have been developed using an interactive web-based distance learning format delivered over the Internet. CITE has designed a web interface (see figure) that incorporates many innovative features, enhanced based on the experience gained from course delivery. Interactive training is provided through a stimulating mix of participatory activities such as simulations, self-study quizzes and exercises, drag-and-drop pages, crossword puzzles or jeopardy games. These activities are used to support and reinforce the text-based information.



CITE's initial funding was received from the I-95 Corridor Coalition (Coalition). The Coalition is a regional partnership of 30 transportation agencies from Maine to Virginia, which was established to address ITS solutions to shared transportation problems and challenges in the northeastern U.S. The Coalition funding recognized two key benefits of CITE. First, distance learning offers a convenient way to provide ITS training to its member's existing employees. Second, CITE facilitates graduate level ITS education for potential new employees and offers the opportunity to attract students to a career in ITS. The Coalition funded the development of the existing one semester course.

Management and administration of CITE is performed under the umbrella of the Center for Advanced Transportation Technology (CATT) at the University of Maryland. The overall goals and directions for CITE are established by its member universities and supporting organizations. CITE generates operating revenues from its course offerings, and supports the development of additional courses with funding received from its supporting organizations and other contracting opportunities. Operating revenue is used for the non-labor components of marketing and course maintenance (other direct costs). Unfortunately, at this early stage of CITE's life cycle, there is no discretionary funding available from either operating

revenue or course development income, to permit exploration of new delivery technologies, development of new courses, enhancement of existing courses, and the expansion of CITE's University partners. In spite of the shortage of discretionary income, it must be emphasized that CITE is funded and organized as an ongoing program. LAAP funding will enable CITE to significantly expand the effectiveness of its delivery and increase the number of students.

The LAAP PROPOSAL FOR ENHANCEMENT OF CITE'S ACTIVITIES

Objectives

This proposal is based on a prioritized evaluation of CITE's requirements for the development of new technologies, new courses and the expansion of its university partners. These needs were prioritized based on the following high-level goals:

- Expand CITE's university partnerships, with an emphasis on minority colleges and universities, to increase the number of students entering the ITS profession.
- Add to the current curriculum and provide incentives to take advantage of these offerings, in order to further improve the availability and capabilities of the pool of skilled ITS personnel.
- Improve current delivery techniques of technology-related courses to facilitate the training of individuals with little prior knowledge of the technologies discussed in the course.

These goals form the basis of the specific three-year objectives for the LAAP program shown in Table 2. Detailed descriptions of these objectives are provided in subsequent paragraphs.

Objective 1 - Increase the Number of College Level Students Exposed to ITS, Especially Underserved Students: In a single year, CITE and its university partners were able to educate more than 250 students. This represents many more students than are enrolled in the transportation engineering programs of any U.S. university. Broadening the base of CITE's university partnerships will ensure a constantly growing number of well trained students and future ITS professionals.

Table 2. LAAP Program Goals and Objectives

Goals and Objectives	Evaluation Indicators	Related GPRA Indicators
Goal – Expansion of partnerships with emphasis on minority universities		
Objective 1. Increase the number of college students receiving ITS training, with emphasis on underserved students	<ul style="list-style-type: none"> • Increase CITE college and university partners by 25% annually • Increase participation by minority colleges/universities to 25% of total CITE membership • Increase number of students taking CITE courses by 50% annually 	<ul style="list-style-type: none"> • Innovative partnerships • Education for diverse groups • Continuation and expansion
Objective 2. Increase number of college students choosing ITS as a career	<ul style="list-style-type: none"> • Develop a two-hour course for students on “Careers in ITS” by Jan. 2003 • Expand evaluation to track influence of CITE curriculum on career choices 	<ul style="list-style-type: none"> • Innovative partnerships • Education for diverse groups
Objective 3. Translate one-semester Fundamentals course into Spanish	<ul style="list-style-type: none"> • Complete translation of one-semester Fundamentals course by Jan 2003. • A total of 5% of CITE’s students will be taking the fundamentals course in Spanish annually 	<ul style="list-style-type: none"> • Innovative partnerships • Education for diverse groups
Goal – Increase available ITS Course Offerings and incentives		
Objective 4. Expand the CITE Curriculum	<ul style="list-style-type: none"> • Complete 2nd one-semester course by Sept. 2002 • Complete 3 additional short courses by June 2003 • Complete 3rd one-semester course by June 2004 	<ul style="list-style-type: none"> • Innovative partnerships • Continuation and expansion
Objective 5. Implement a Certificate Program	<ul style="list-style-type: none"> • Implement a certificate series for ITS professionals by Jan. 2002 • A total of 15% of CITE students will receive certificates annually 	<ul style="list-style-type: none"> • Quality and accountability
Goal – Improve mechanisms for technology-based training		
Objective 6. Addition of interactive capabilities	<ul style="list-style-type: none"> • Develop an interactive course on transportation management techniques by June 2002 • Incorporate a spread sheet model in the transportation project management course by Dec. 2002 • Incorporate simulation-based training in the Traffic Signal Systems Fundamentals course by Sept. 2003 	<ul style="list-style-type: none"> • Quality and accountability
Objective 7. Enhance course development software	<ul style="list-style-type: none"> • Develop and test an enhanced version of the CITE development software by Sept. 2004 	<ul style="list-style-type: none"> • Quality and accountability

This objective will be achieved through the development of an aggressive outreach program for university faculty of both CITE member and non-member institutions. This outreach will include:

- Development of a direct marketing campaign specifically directed to increase the number of colleges and universities who are members of CITE. Particular emphasis will be placed on increasing the number of participating Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), including Hispanic Serving Institutions and Tribal Colleges and Universities. The marketing campaign will include development of a “Benefits of Membership” brochure, a direct mail campaign, and invitations to attend CITE meetings and workshops. CITE memberships will be further encouraged through direct contacts.
- Preparation of a “Course User’s Manual” for CITE partners that will describe alternative techniques for using the CITE course material. The manual will describe instructional techniques currently being used by CITE members such as hybrid instruction, in which CITE and classroom course modules are alternated. The manual will also discuss alternatives for delivery of graded exams, including the use of randomly generated question sets.
- Articles and presentations for student chapters of the Institute of Transportation Engineers (ITE), encouraging students to participate in courses with ITS content.
- Surveys of CITE university members to determine which additional courses and course features would enhance their existing programs. CITE members have already requested courses with collaborative problem-solving features. Additional discussion on this subject is presented under Objective 6.
- At least two workshops will be held. These workshops will be used to help instructors reluctant to abandon traditional classroom methods, to consider experimenting with the ITS distance learning curriculum.

This objective will be achieved by following the management plan shown in Table 3.

Table 3. Objective 1 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Increase CITE college and university partners by 25% annually and increase participation by minority colleges/universities to 25% of total CITE membership	
UMD will document the number of CITE member universities including identification of minority colleges/universities.	October 1 each year
UMD will develop and annually update a Benefits of Membership brochure that will be reviewed by its partners.	November/December 2002
UMD will develop a database of colleges/universities to support the direct-mail campaign. Contacts at non-member universities will be solicited from CITE members. A separate list will be kept of minority colleges/universities.	October/November/ December 2001, 2002, 2003
UMD will develop the letter to be mailed to potential universities. The letter will be reviewed by current CITE partners.	December 2001, 2002, 2003
UMD will mail out the Benefits of Membership Brochure, CITE Course Brochure and membership forms to potential new universities.	January 2002, 2003, 2004
UMD will initiate personal follow-ups with individuals who did not respond to the direct mail campaign. CITE members will be asked for their assistance in contacting the universities/colleges.	March/April 2002, 2003, 2004
Performance Indicator: Increase number of students taking CITE courses by 50% annually	
UMD will initiate a survey of CITE partners utilizing its courses to determine the manner in which the material is used and tests are delivered. The survey will request suggestions for new courses and enhancement of existing material.	January 2002, 2003, 2004
Based on material gathered from the surveys to CITE members, UMD will develop a "Course User's Manual" for CITE partners that will describe alternative techniques for using the CITE course material. The manual will be updated annually.	March 2002, 2003, 2004
UMD will prepare articles and presentations for student chapters of the Institute of Transportation Engineers. They will be distributed to CITE partners for delivery in their region.	February 2002
UMD and several CITE partners will conduct a workshop on the use of distance learning for ITS instruction.	ITS America Annual Meetings May 2002 & 2003 TRB Annual Meeting January 2003
UMD will survey CITE members every semester to determine the number of students and the student's opinions of the material and whether they plan to enter the ITS field as a career.	April/May and December 2001, 2002, 2003, 2004

Objective 2 - Increase Number of College Students Choosing ITS as a Career: A number of comments have been received informally, from CITE college and university students, indicating that the CITE courses have influenced their career decisions. Three activities are proposed to further encourage this process:

- Formalize the evaluation of the impact of CITE courses on students career choices, by modifying the existing course evaluation questionnaire.
- Prepare a two-hour web-based course describing the benefits of a career in ITS. The course will emphasize the societal benefits and opportunities of such a career, as well as opportunities for growth and the stability of the job market.
- As of now, CITE courses are available through the civil engineering departments of U.S. universities. However, it is equally important to attract students with computer science, electrical engineering, systems engineering, government, business management and public policy backgrounds. As the growth in the number of opportunities in the information technology industry slows, ITS will become a more attractive career choice. With the assistance of its members, an outreach program to the other departments of CITE universities will be initiated. This outreach program will draw on of the two-hour web course and a brochure encouraging pursuit of ITS as a career.

This objective will be achieved by following the management plan shown in Table 4.

Table 4. Objective 2 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Develop a two-hour course for students on “Careers in ITS” by Jan 2003	
Course developer will be selected from CITE membership	April 2002
Course developer will provide draft text and graphics to UMD. An independent consultant will perform a design review.	September 2002
UMD will host the course, initiate a second review by the developer and offer it to CITE members. An expert review and small-group review will be performed by the evaluator, Interactive Instruction Inc.	January 2003
UMD will publicize the availability of the course. Students of CITE will review the module during their semester course. The independent consultant will use data from this activity for a formative evaluation of the course.	January/September 2003, 2004
Performance Indicator: Expand evaluation to track influence of CITE curriculum on career choices.	
This is discussed in objective 1 above.	

Objective 3 - Translate One-Semester Fundamentals Course into Spanish: Spanish language versions of the CITE curriculum will serve two invaluable purposes. First, they will permit the

diversification of ITS training to the Hispanic population of the United States through the participation of the large number of Hispanic Serving Institutions located primarily in the southwestern U.S. Second, the availability of Spanish language courses will also permit CITE to expand its foreign membership to include many of the universities in South America, many of whom have already contacted CITE to explore the availability of Spanish language versions of the course.

This objective will be achieved by following the management plan described in Table 5.

Table 5. Objective 3 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Complete translation of one-semester Fundamentals course by Jan 2003.	
UMD will contract to have the existing Fundamentals of ITS and Traffic Management course translated into Spanish.	October 2001
Translation completed	March 2002
UMD will host the Spanish version of the course.	August 2002
Elemx Group, LLC will review the Spanish version of the course for accuracy of the translation.	Sept – November 2002
UMD will make final edits to the course.	December 2002
UMD will market the course to both member and non-member Hispanic Serving Institutions. Non-members contacted through direct mail and personal contacts as described in objective 1.	January 2003
Performance Indicator: 5% of CITE’s students enrolled in the Spanish version of the Fundamentals course annually.	
UMD will track the number of students taking the course each year using the survey discussed in objective 1.	Annual

Objective 4 - Expand CITE Curriculum: In order to remain up-to-date with the rapid change in ITS technology and policy, the development of additional courses and the updating of existing courses is essential. Curriculum expansion is also required to increase the technical depth of the course material being provided. A primary example of this need can be found in the rapid emergence of wireless Internet services throughout the United States. An important element of ITS technology is the provision of traffic information to motorists to permit them to modify their travel plans or itinerary when incidents occur. The availability of in-vehicle information from the Internet offers the possibility of providing this service. This capability represents a significant change in the availability and application of ITS technology.

Similarly, both engineering and management courses are needed that offer increased depth and hands-on experience. To use a simple example, the value of instruction in the principles of project management is significantly increased by providing students with in-depth discussions of the underlying principles of the scheduling,

"Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime."

Chinese Proverb

tracking risk management and cost estimating processes. This would include detailed descriptions of work breakdown structure, earned value, and the critical path method as well as hands-on experience with scheduling software. This increased depth of understanding would equip students to participate in project activities, rather than to monitor passively the activities of others. Both the public and private sectors would realize significant benefits.

These two requirements are reflected in the evaluation factors identified for objective 4. The following activities are proposed for this project subject to the approval of the LAAP COTR and the CITE curriculum committee:

1. A second one-semester course will be developed that addresses the broad scope of ITS, as a complementary course to the existing one semester Fundamentals course. This second course will include the following subjects:
 - a. Advanced Vehicle Control and Safety (includes Human Factors)
 - b. Commercial Vehicle Operations (CVO)
 - c. Deploying ITS: Strategic Planning and Implementation
 - d. Electronic Payment Systems (EPS)
 - e. Evaluating ITS Projects
 - f. ITS Project Management
 - g. ITS Telecommunications Applied
 - h. Intermodalism
 - i. The Roles of the Public and Private Sectors in ITS
 - j. Rural ITS
 - k. Traveler Information Systems
 - l. Transit Management

2. A third one-semester course will be developed that addresses the management issues associated with ITS. This course will include the following subjects, subject to the review and approval of the CITE curriculum committee:

- a. Advanced project management
 - b. Software acquisition
 - c. Systems engineering
 - d. Procurement principles
 - e. Management of ongoing operations and maintenance
 - f. Project planning
 - g. Quality control and project performance measurement
 - h. Engineering economics
 - i. Partnering (public-private partnerships, public-public partnerships)
 - j. Legal aspects of management (intellectual property rights, privacy, contracts)
 - k. Project decision making
3. Three short-courses will also be developed that provide additional depth of engineering study. Short-courses planned for this project include:
- a. Traffic signal timing theory and practice
 - b. Human factors considerations for in-vehicle displays
 - c. Principles and practices of multi-agency incident management

Development of all new courses will be follow the multi-step procedures used by CITE.

1. Course developed by domain expert
2. Material chunked (divided into screen-size segments) by educational expert
3. Addition of interactive features – simulation, crossword puzzles, Jeopardy-style games, quizzes and final exams by domain expert, educational expert and programmer
4. Addition of graphics (all CITE courses use graphics extensively)
5. Assembly of material into complete course
6. Review by domain expert
7. Pilot testing and evaluation
8. Further revisions
9. Release of course.

This objective will be achieved by following the management plan described Table 6.

Objective 5 - Implement a Certificate Program: At a recent CITE meeting, a suggestion was made to implement a certificate program that would recognize the completion of a subset of the CITE curriculum in a selected area of specialization within a given time period. The purpose of the curriculum is to recognize the accomplishments of CITE students and to overcome the natural procrastination of students that appears to be a characteristic of the distance learning environment. (“The course is always available, so why not wait until tomorrow to get started?”) Providing students with appropriate

recognition will also enable them to identify their accomplishments with both potential and existing employers

Table 6. Objective 4 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Complete 2 nd one-semester course by Sept. 2002 Complete 3 rd one-semester course by Sept. 2004	
UMD will begin putting the available text for the 2 nd semester course on-line. Interactive Instruction, Inc, the course evaluator will review of the course design.	October 2001
UMD will contract for the development of the three modules of the course that have not yet been completed.	October 2001
Course developers will review their modules as UMD completes putting them into the interactive web-based format. This will be part of an expert review performed by the evaluator.	November/December 2001
UMD will pilot the completed 2 nd semester course. The evaluator will use data gathered during this pilot/field test for the formative evaluation.	January –April 2002
UMD will edit the course based on student feedback and evaluation results.	May/June 2002
UMD will publicize the availability of the course for the Fall 2002 semester to CITE partners.	July/August 2002
Performance Indicator: Complete 3 additional short courses by June 2003 and 3 rd one-semester course by June 2004	
Discuss and agree upon topics for 3 new short courses and 3 rd full semester course at general CITE meeting.	January 2002
UMD will solicit module/course content developers for the new CITE courses. Execute agreements with developers.	January/February/March 2002
Content developers will provide UMD with draft text and graphics. Evaluator performs a design review of the course modules as they are received.	Short courses: July 2002 Semester course modules: January - March 2003
Course developers will review their modules as UMD completes putting them into the interactive web-based format. This will be part of an expert review done by the evaluator.	Short courses: Nov/Dec 2002 Semester: June – Dec 2003
UMD will pilot the new courses. This activity will also serve as the field test. The evaluator will use feedback received from this pilot/field test for inclusion in the formative evaluation.	Short courses: Jan – Mar 2003 Semester: Jan – April 2004
UMD will edit the course based on feedback received from the students and the evaluator.	Short courses: April-May 2003 Semester: May 2004
UMD will publicize the availability of the courses.	Short courses: June 2003 Semester: June 2004

CITE has completed its initial planning for a certificate program. These plans currently include the award of certificates for completion of a core curriculum of 3 courses, along with two additional electives.

Courses are to be completed within a one-year time frame and students must receive a passing grade on the final examination of each course. Certificates would be awarded for completion of traffic engineering, information technology and management curriculums.

LAAP funding will permit the implementation of the program through the following management plan described below:

Table 7. Objective 5 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Implement a certificate series for ITS professionals by Jan. 2002	
The CITE Curriculum Committee will develop a certificate series for review by the full CITE membership.	October 2001
Course developers will be asked to provide questions for a final examination that students would need to pass in order to complete the certificate program.	November 2001
UMD will prepare a tri-fold brochure describing the significance of the certificate, along with a diploma to be awarded to students who have successfully completed their certificate program.	November/December 2001
UMD will announce the availability of the certificate program using the CITE website (www.citeconsortium.org), and through publicity in industry publications.	January 2002
Performance Indicator: A total of 15% of CITE students will receive certificates annually	
UMD will document the number of students who received certificates in one year.	January 2003, 2004

Objective 6 – Addition of Interactive Capabilities: The challenge of developing a suite of 11 modules dealing with a broad range of technical subjects precluded the introduction of advanced distance learning techniques. LAAP funding will be used for the development of collaborative learning, in which CITE students participate in joint problem-solving exercises that will provide them with the hands-on experience that is an essential element of a meaningful education program. Hands-on experience will be further developed through the use of simulation techniques to provide realistic training exercises. While this work will be of immediate value for ITS training, it will also be relevant to the delivery of many other types of technical training related to information technology.

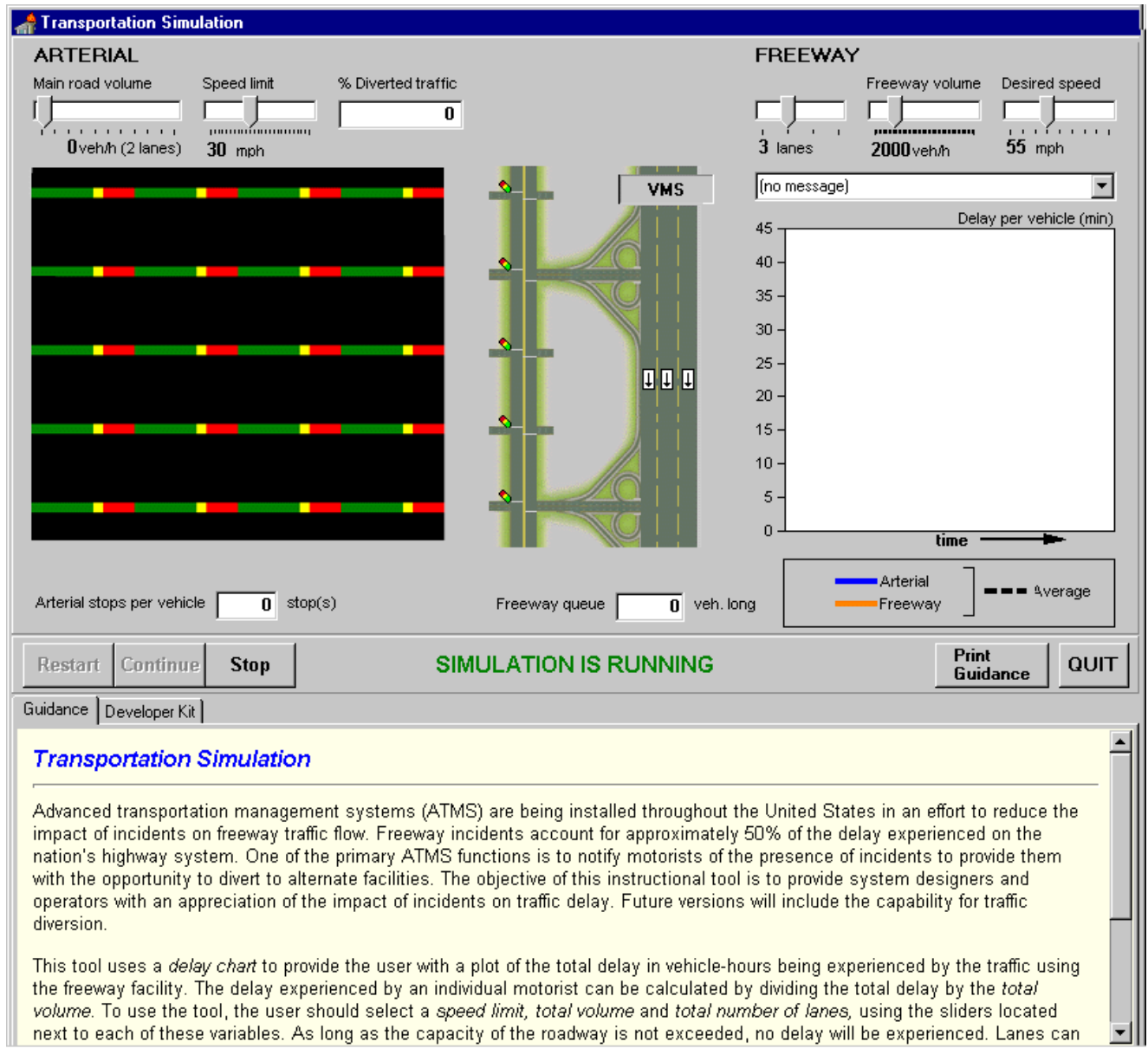
Interactive features will be developed for three of the new courses identified under Objective 4. These courses, the category of techniques employed and the manner in which they will be developed are defined in Table 8.

Table 8. Interactive Course Features

Course	Category	Approach
Project Planning	Simulation Collaboration	Provide student “project team” with information technology project. Students plan an ITS project using scheduling and budgeting tools. Simulation is used to execute the project and provide students with the results of their plan.
Traffic signal timing theory and practices	Simulation	Signal timing simulation developed at the University of Maryland using the SimPLE educational scaffolding used to provide students with an understanding of the interaction of signal split, offset and cycle length on vehicle stops and delays. (Additional details provided in the text.)
Principles and practices of multi-agency incident management	Collaboration	Incident management requires coordination of transportation and emergency services. Principles of incident management are currently taught through incident management workshops attended by representatives of these services. The distance learning equivalent to these workshops will be developed, during which the principles of incident management will be provided. Students will then be organized in teams based on the service that they represent. Teams will be given incident situations, and asked to plan the response and activities associated with their management.

SimPLE (Simulated Processes in a Learning Environment) is an educational scaffolding developed at the University of Maryland under an National Science Foundation grant for constructing simulation-based learning environments. It combines the power and flexibility of a generic simulation package with the advantage of a custom user interface. Learning environments developed with SimPLE use dynamic simulations and visualizations to represent realistic time-dependent behavior and are coupled with guidance material and other software aids that facilitate learning. The software architecture allows independent contributions from developers representing educational content (e.g., simulation models, guidance materials) and software development (e.g., user interface) to be assembled easily. Thus, the content (e.g., simulation models and guidance materials) can be developed by the specialists with domain experience without requiring educational and software development skills.

As shown in the accompanying figure, the SimPLE environment includes three elements: a graphic representation of the process being simulated, numerical output of the performance of the process (for dynamic, time-varying process this display is shown as a plot of process performance vs. time), and a textual description. The text is a particularly powerful feature of SimPLE in that it can be hyper linked to the graphics, providing instructional information that is directly related to the elements being described.



Not shown in the figure is the simulation that controls SimPLE's response to student's inputs. The simulation receives inputs from the student's manipulation of the elements of the graphic, processes the

resulting environmental conditions, and communicates its outputs to the student either on the graphic or the numerical output of the process.

The objective of the transportation implementation of SimPLE shown in the figure was to create an educational environment that would provide a better understanding of the rudiments of coordinated control of freeways and signalized arterials by multiple agencies. The traffic signal version of this software will serve as the basis for the LAAP project.

The following management plan will be used to achieve objective 6:

Table 9. Objective 6 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Develop an interactive course on transportation management techniques by June 2002	
Identify a developer for the incident management component of the transportation techniques course.	September 2001
Course developer provides draft material including collaborative problems to UMD.	March 2002
UMD converts draft material to distance learning format. Evaluator reviews course material.	April 2002
As in Objective 4, UMD conducts pilot.	May 2002
As in Objective 4, UMD edits course based on feedback.	June 2002
As in Objective 4, UMD publicizes course availability and offers to CITE partners.	July 2002
UMD modifies evaluation form for student feedback of collaborative course effectiveness. Evaluator assesses effectiveness and recommends guidelines for future development.	July 2003
Performance Indicator: Incorporate a spread sheet model in the transportation management course by Dec. 2002	
These steps are the same as those indicated for the interactive course development above. They are performed for the transportation management course.	Feb.2002 – Dec. 2002 Evaluation through Dec. 2003
Performance Indicator: Incorporate simulation-based training in the Traffic Signal Systems Fundamentals course by Sept. 2003	
These steps are the same as those indicated for the interactive course development above. They are performed for the Signal Timings Fundamentals course.	Nov. 2002 – Sept. 2003 Evaluation through June 2004

Objective 7 - Enhance the Course Development Software: Currently, CITE is using software for its interactive web-based courses that has been custom designed to meet its needs. This software allows the use of a secure web interface for course development and modification. The interface enters uploaded information into a database and displays the information to CITE students. This custom approach is used

to accommodate interactive features such as quizzes, crossword puzzles, jeopardy games, etc. that cannot be readily accommodated by available course management packages. Through a separate administrative process, CITE course participants are provided with a user ID and password in order to log on and be recognized by the administrative database. This database keeps track of each user's access, his/her test results and all survey/evaluation data. CITE's software is designed in such a way that the course content is kept in a database separate from the student login, evaluation, and testing database. CITE has found this to be very limiting for several reasons.

- CITE is unable to implement a book-marking feature for each individual student. Distance learning students typically do not complete the entire course in one session. A bookmark feature that permits students to readily return to the point at which they left off would be very useful.
- The results of self-study quizzes taken by the student within the course materials cannot be tracked at the present time. While students are provided with feedback for all questions on all quizzes, it is currently not possible to track these results.
- A number of techniques might be used to simplify course development. Course developers have provided a number of suggestions that would reduce the cost of this process and improve the quality of the material presented.

To accomplish this objective, CITE plans to team with the developer of its existing software, Solutions in Motion, to develop an improved version of the software. Solutions in Motion has volunteered to enhance the software at minimal cost to the project. CITE will provide suggestions for improvements and will test the software at the appropriate times. A free version of the software will be provided upon completion. Solutions in Motion plans to market and sell the enhanced software product upon its completion.

Table 10. Objective 7 Management Plan

Activity/Responsibilities	Timing
Performance Indicator: Develop and test an enhanced version of the CITE development software by Sept. 2004	
Solutions in Motion will make enhancements to the existing software in three phases. An independent consultant will perform design and expert reviews before/during the development of each phase. UMD will test the software after each phase of development. The third phase will test the completed product. Our evaluator will perform one-on-one and/or small group reviews at the end of each phase once the software is in a beta-test form. Over the summer of 2004, the consultant will perform a field test review and provide a summative evaluation of the product.	June 2002, 2003, 2004
Solutions in Motion will deliver to UMD the final enhanced version of the software.	Sept 2004

Evaluation

Interactive Instruction, Inc (III), an independent consultant, will perform a formative evaluation of the software during the course of each development cycle. A formative evaluation is the assessment of a software program during the course of its development. The formative evaluation of the project may include some or all of these reviews:

1. Design Review – instructional goals met, appropriate for target audience, prerequisite skills addressed, appropriate test questions.
2. Expert Review – accurate and up-to-date content, consistent perspective, instruction appropriate to audience.
3. One-on-one Review – types of students, materials used, how instruction is done, role of testing.
4. Small Group Review – number and types of students, materials used, procedure, questionnaire, debriefing, role of testing.
5. Field Test Review– materials used, conditions and setting, procedure, exportable.

III will also perform a summative evaluation of the product at the end of each development cycle. A summative evaluation is the final evaluation process assessing whether or not the project or program met its goals. The summative evaluation concentrates on learner outcomes rather than only the program of instruction. The summative evaluation of the project will include:

1. The administration of criterion-referenced tests based on the course's instructional objectives.
2. The measurement of user satisfaction.
3. The recording of unintended outcomes.

III's experience is embodied in the credentials of their employees, whose resumes are provided with this proposal.

Roles of Partners

The Center for Advanced Transportation Technology (CATT) of the University of Maryland (UMD), will lead this project on behalf of the CITE consortium. CITE has been managed directly by the CATT since its inception. Philip J. Tarnoff is the director of both CITE and the CATT. Kathleen M. Frankle is CITE's Program Manager. UMD will lead all the activities outlined in the proposal with assistance from its partners with both Mr. Tarnoff and Ms. Frankle playing an active role in the project.

To date, CITE consists of over 60 universities worldwide with half of them offering CITE courses material. Many of these universities have agreed to partner and provide cost share towards this proposal; others are partnering without providing cost share. Several firms have also agreed to partner with CITE. Each of the partners plays various roles in this proposal. The management plans under each objective specifically describe the roles that the university partners will play in support of the activities in this proposal. Table 11 provides a list of partners and their roles in the project.

Many universities were unable to provide cost share for this proposal but will be participating in objectives 1, 2, and 4 along with the cost-share providing universities. The list of these universities includes: Oklahoma State University, Portland State University, Rutgers University, Texas A&M

University, University of Dayton, University of Kentucky, University of Louisville, University of Massachusetts, University of North Carolina – Charlotte, and the U.S. Merchant Marine Academy. Under objective 1 CITE plans to increase the number of universities offering CITE courses. Therefore, throughout the program, the list of universities participating but not providing cost share will increase

Table 11. Objectives Partners are Participating

Partner	Role: Participate in which objective(s)	Cost Share
University of Maryland Elemx Group, LLC Interactive Instruction, Inc. Solutions in Motion	Lead Partner Objective 3 Evaluation Objective 7	\$471,765
George Mason University	Objectives 1, 2, 4	\$10,413
Kansas State University	Objectives 1, 2, 4	\$70,600
Michigan Technological University	Objectives 1, 2, 4	\$ 18,000
Morgan State University	Objectives 1, 2, 4	\$ 18,000
New York Polytechnic University	Objectives 1, 2, 4	\$ 21,384
North Caroline A&T University	Objectives 1, 2, 4	\$ 21,550
Texas Southern University	Objectives 1, 2, 4	\$ 18,000
University of Vermont	Objectives 1, 2, 4	\$ 18,000
University of Virginia	Objectives 1, 2, 4	\$ 18,000
Virginia Tech	Objectives 1, 2, 4	\$ 27,969

Several partners are providing cost share that are shown under the UMD. Elemx Group, LLC (\$1,200) will be working on objective 3 reviewing and providing comments/edits to the Spanish translator for the Fundamentals course. Interactive Instruction, Inc. (\$16,200) is the independent evaluator for the project. Solutions in Motion (\$92,880) will be working on objective 7 and will develop an improved version of the CITE development software.

The experience of these firms is reflected by the qualifications of their employees, as presented in the resumes.

Access to CITE’s Program for Underserved Students

CITE is currently modifying its course development software to bring it into full compliance with Federal Section 508, as detailed in Federal Rule 508 - Web-based Intranet and Internet Information and Applications (1194.22). These requirements concern the accessibility of electronic and information

technology to people with disabilities. Enhancements to CITE's software will be completed by July 1, 2001 and all courses will be in compliance by September 31, 2001. .

As discussed earlier, CITE plans to translate its Fundamentals course into Spanish to reach the Hispanic community. CITE also plans to reach out to HBCU's and OMC's to increase their participation in CITE and provide free access to ITS courses for their students.

CLOSING

One of the primary factors leading to the formation of CITE was the national requirement for effective ITS training and education. CITE has endeavored to fulfill this need, and is clearly having a significant impact on the technical education of the ITS workforce. But this impact will be significantly increased if CITE is able to carry on the enhancements outlined in this proposal. CITE's ultimate goal of contributing to the expansion of the ITS professional community and increasing the quality of its work, can be attained by:

- Increasing the number of CITE partnerships, particularly with minority institutions, to ensure increased student enrollment; a number of strategies have been outlined in the proposal, including an aggressive outreach program, a course on the benefits of career in ITS, and a Spanish version of the Fundamentals course as an additional means to reach the Hispanic community.
- Increasing the available ITS course offerings and incentives, through expansion of the existing curriculum and the creation of a Certificate Program. These strategies will ensure that CITE offerings retain their high quality, and will reinforce their attractiveness to potential students.
- Further adding to the effectiveness of CITE's distance-learning techniques through the addition of varied interactive capabilities and improved course development software; these strategies will assist students in many respects, from helping the inexperienced with internet-based distance learning to hands-on (and more participatory) education.

CITE is eager to implement this ambitious program and the probability of accomplishing this would greatly increase through the participation of LAAP.

REFERENCES

1. Tarnoff, Christiansen, “Moving Toward a National Agenda of Transportation Operations and Mobility Research, Report of the Operations and Mobility Working Group”, prepared for the National Research and Technology Partnership Forum, sponsored by the Transportation Research Board and the Federal Highway Administration, Washington, DC, November, 2000.
2. “Five-Year Strategic Plan for Professional Capacity Building”, U.S. Department of Transportation, March, 1996.
3. “Intelligent Transportation Systems Education and Training Efforts at U.S. Universities”, Draft Report U.S. DOT ITS Professional Capacity Building Program, Virginia Tech, November, 1998.
4. “ITS Professional Capacity for Metropolitan Transportation Systems-Recommendations on the Fundamental Competencies, Staffing, and Curricula for Transportation Professionals, Transportation Agencies and Typical Transportation Projects”, U.S. Department of Transportation - ITS Professional Capacity Building Program, ITS Joint Program Office, January, 1999.