Emergency EDAPTS Retainer Support

Final Report

Division of Research
& Innovation

Report CA07-0760
December 2008

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Report No. CA07-0760

December 2008

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STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT DOCUMENTATION PAGE

TR0003 (REV. 10/98)

1. REPORT NUMBER	2. GOVERNMENT ASSOCIATION NUMBER	3. RECIPIENT'S CATALOG NUMBER
CA07-0760		

4. TITLE AND SUBTITLE	5. REPORT DATE
EMERGENCY EDAPTS RETAINER SUPPORT	June 29, 2007
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Jeffrey Gerfen	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NUMBER
Cal Poly State University at San Luis Obispo San Luis Obispo, CA	11. CONTRACT OR GRANT NUMBER 65A0198
12. SPONSORING AGENCY AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
California Department of Transportation Division of Research and Innovation, MS-83 1227 O Street, P.O. Box 942873, Sacramento, CA 95814	Final (4/18/2005 to 6/30/2007) 14. SPONSORING AGENCY CODE

15. SUPPLEMENTAL NOTES

16. ABSTRACT

The Efficient Deployment of Advanced Transportation Systems (EDAPTS) Smart Transit System Project required various quick-response deployment support activities over the 26-month period from April 18, 2005 to June 30, 2007. These activities required immediate, short-term support from the original EDAPTS research development team at Cal Poly State University at San Luis Obispo. These efforts were in support of the Federal Transit Administration's (FTA) interest in helping Caltrans move the EDAPTS concept of lower cost Intelligent Transportation Systems into the mainstream transit marketplace.

Under this contract, Cal Poly provided research support services to Caltrans for presentations at national transit conventions, updated marketing materials, supported technical interchange meetings with potential suppliers, researchers and end users and maintained the San Luis Obispo Transit EDAPTS system as needed to keep the system available for demonstrations to potential users and suppliers.

17. KEY WORDS	18. DISTRIBUTION STATEMENT	
EDAPTS, transit, ITS, SLO Transit, Cal Poly, San Luis Obispo, Caltrans, FTA	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161	
19. SECURITY CLASSIFICATION (of this report)	20. NUMBER OF PAGES	21. PRICE
Unclassified	6	

EMERGENCY EDAPTS RETAINER SUPPORT

FINAL REPORT

CALIFORNIA POLYTECHNIC STATE UNIVERSITY

JUNE 29, 2007

PREPARED FOR CALTRANS DEPARTMENT OF RESEARCH AND INNOVATION

This final report, "Emergency EDAPTS Retainer Support", was submitted in fulfillment of Caltrans contract #65A0198 by California Polytechnic State University under the sponsorship of Caltrans Department of Research and Innovation. Work was completed as of June 29, 2007.

DISCLAIMER

The statements and conclusions in this report are those of the contractor and not necessarily those of Caltrans Department of Research and Innovation. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

1. INTRODUCTION

The Efficient Deployment of Advanced Transportation Systems (EDAPTS) Smart Transit System Project required various quick-response deployment support activities over the 26 month period from April 18, 2005 to June 30, 2007. These activities required immediate, short-term support from the original EDAPTS research development team at Cal Poly State University at San Luis Obispo. These efforts were in support of the Federal Transit Administration's (FTA) interest in helping Caltrans move the EDAPTS concept of lower cost Intelligent Transportation Systems into the mainstream transit marketplace.

2. PROJECT RESEARCH AND DEVELOPMENT

As part of this contract, support efforts in seven areas were identified as necessary to support EDAPTS deployment-related activities:

1. Developing EDAPTS presentation and marketing materials for use by Cal Poly and/or Caltrans personnel.
2. Writing technical papers on EDAPTS for publication in transit and transportation journals.
3. Refurbishing and maintaining the EDAPTS trade-show hardware demonstration console that was developed during the Phase 2 EDAPTS project.
4. Supporting Caltrans in developing and presenting EDAPTS concepts at transportation related trade shows, seminars or workshops throughout the United States.
5. Providing booth support staff for EDAPTS displays at transportation related trade shows, seminars or workshops throughout the United States.
6. Coordinating and giving EDAPTS presentations and demonstrations, either in San Luis Obispo or at other locations in California and the United States.
7. Maintaining an inventory of EDAPTS publication materials and open-source release material for distribution as needed by Caltrans.

To this end, the following work has been accomplished:

Cal Poly worked with Caltrans Department of Research and Development (DRI) to develop an EDAPTS status Power-point presentation to be presented at the Community Transportation

Association of America (CTAA) EXPO in May of 2005. Cal Poly also received input and revised the EDAPTS color brochure. One thousand copies were printed for future use.

Cal Poly refurbished the EDAPTS trade-show demonstration console that was developed during the Phase 2 EDAPTS project. This console is used to provide a hands-on demonstration of EDAPTS on-board hardware systems.

Cal Poly EDAPTS researchers traveled to Cal Poly Pomona and presented EDAPTS to Cal Poly Pomona researchers and parking/commuter services staff, and Calfornia Center for Innovative Transportation (CCIT) staff to facilitate possible EDAPTS test deployment at Cal Poly Pomona. This meeting laid the groundwork for future joint EDAPTS work between Cal Poly San Luis Obispo, Cal Poly Pomona, and CCIT. A follow-on meeting between these three institutions was held in San Luis Obispo to further develop the concept of an EDAPTS deployment package.

EDAPTS researchers met with RouteMatch Corp. and Cal Poly Pomona in August of 2005 to discuss future partnership and deployment possibilities for EDAPTS. Researchers also met with potential system integrators at this meeting. EDAPTS researchers hosted a pre-project kickoff meeting March of 2006 with RouteMatch Corp., a potential EDAPTS integrator. Topics relating to how a private company might work as an EDAPTS integrator were explored. Potential future EDAPTS projects were discussed when researchers hosted a meeting with the Kerry Klinger group. Cal Poly researchers also supported the EDAPTS Technical Working Meetings, Cal Poly San Luis Obispo in June of 2007. Cal Poly Pomona and CCIT were in attendence at these working meetings.

Jeff Gerfen of Cal Poly traveled to the CTAA conference and a made a joint presentation on May 25th, 2005 with Mr. Chapman of Caltrans and Mr. Brian Cronin of Federal Transit Administration (FTA). The title of the Cal Poly presentation was "*EDAPTS Concept: A Unique Approach to Transit Research.*" Jeff Gerfen also presented the EDAPTS system at the National Rural ITS (NRITS) conference in Big Sky, Montana in August, 2006. The title of the NRITS presentation was *"EDAPTS ITS: Steps to Commercialization."*

The EDAPTS pagers in SLO Transit Smart Transit Signs were upgraded, allowing the system to continue to be demonstrated to interested partners or integrators. This upgrade was required to

keep the Smart Transit Signs compatible with the communications service provider. A PC workstation was purchased to support future EDAPTS efforts, including potentially storage and hosting of open-source release materials and the yet-to-be released EDAPTS Performance Specification and Standards.

3. SUMMARY AND CONCLUSIONS

The EDAPTS support retainer provided the Cal Poly EDAPTS research team with the ability to further the objectives of the EDAPTS system. This work included: maintaining and updating trade-show presentation materials and demonstration equipment, meeting with potential EDAPTS system integrators to pave the way for wide-spread commercial deployment, presenting the EDAPTS system at transit and ITS-based conferences, and helping to keep the San Luis Obispo EDAPTS system operational so that it can continue to be used to show the system providing benefits to a local transit property and its patrons. This support retainer has aided in the promotion of EDAPTS as a viable and cost effective transit management aide.

Appendix 1

EDAPTS Emergency Support Presentation

EDAPTS Concept: A Unique Approach to Transit Research

Presented at:
Community Transportation Association of America (CTAA) Annual Meeting
St. Louis, MO
May 2005

EDAPTS Concept: A Unique Approach to Transit Research

Jeff Gerfen
Cal Poly San Luis Obispo

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The EDAPTS Research Perspective:

"Big-City" Solutions for Small-Town Transit

- Large APTS systems are not easily scaled down for small operations
- Be flexible and extensible
- Meet needs, not wants

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EDAPTS Research Goals

Adaptable Design

- TCIP and National ITS Architecture consistency
- Open-Source and accessible to small transit properties
- Support incremental deployment and changing needs

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EDAPTS Research Processes

System Implementation

- Features driven by stakeholder needs
- Structure driven by the emerging TCIP and National ITS Architecture
- Developed and tested under a strong stakeholder partnership

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EDAPTS Research Outcomes

Deployed Operational Prototype

- Smart Transit Signs
- Mobile Data Terminals
- Dispatch Center
- Planning support tools

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EDAPTS Research Outcomes

System is Standards-Based

- Based on the National ITS Architecture
- Utilizes TCIP objects & messages
- TCIP influenced by EDAPTS
- Included in California Central Coast ITS deployment plan

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EDAPTS Research Outcomes

System is Open-Source

- Hardware designs
- Software source-code and documentation
- Project final report

EDAPTS Research Outcomes

A Great Student Experience!

- Unusual learning opportunity
- Real-world experience for more than 25 Cal Poly San Luis Obispo students
- Multi-disciplinary design, implementation, and test teams

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EDAPTS Research Outcomes

Strong Local Partnerships

- San Luis Obispo Public Works Department (SLO Transit)
- Cal Poly Parking & Commuter Services
- First Transit Corporation

EDAPTS Research Outcomes

Strong Local Partnerships

- Continuing cooperative relationships
- Prototype system supported by financial agreement
- System functionality has been expanded

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EDAPTS Research Outcomes

Local Partners Fund System Extensions

- Automatic transit pass validation
- Automatic stop annunciation
- Real-time ID validation
- Electronic Fare Collection

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EDAPTS Lessons Learned

Constraints Lead to Better Design: Solar Powered Signs

- Need for solar powered signs was unanticipated
- Solar powered design increases sign deployment options
- Final sign design is simple to site, install, & operate

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EDAPTS Lessons Learned

Wireless Data Communications Tradeoffs

- Long term implications
- Performance tradeoffs must be fully evaluated
- Initial & long-term data capacity of system must be considered
- Incremental options may exist

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EDAPTS Lessons Learned

TCIP & National ITS Architecture Aid System Definition

- A framework for system breakdown by function/feature
- Unobvious functions and users will be identified
- Early system analysis aids incremental deployment

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EDAPTS Lessons Learned

Developing a Standards-Based System

- A non-trivial process
- Well worth the effort
- Early adoption was tough
- Finalization of standards & guidelines will help others

Ongoing EDAPTS Work

Performance Spec. Areas:

- Communications
- Computational performance
- Interfaces & standards
- Data accuracy
- Ruggedness
- Ergonomics
- Installation and maintenance
- Power consumption

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EDAPTS Lessons Learned

Flexibility and Adaptability

- New features facilitated by:
  - Comprehensive functional breakdown
  - Early consideration of various features
- Flexibility ensures meeting current and future stakeholder needs

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EDAPTS Lessons Learned

Cooperation = Success

- Inter-agency cooperation is crucial to success
- This was easier said than done!

Appendix 2

EDAPTS Emergency Support Presentation

EDAPTS ITS: Steps to Commercialization

Presented at:
National Rural Intelligent Transportation System (NRITS) Conference
Big Sky Montana
August 2006

EDAPTS ITS
Steps to Commercialization

Jeff Gerfen
California Polytechnic State University
San Luis Obispo

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EDAPTS ITS:

What it's all about

- Designed as a cost-effective method for implementing ITS
- First deployment provided prototype hardware & software
- Flexible & extensible open source software & designs

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EDAPTS ITS:

- Key Features of the first deployment:
  - AVL
  - Validation of boardings
  - Estimated arrival time to passengers waiting at stops
  - Planning tools
- San Luis Obispo (SLO) Transit and Cal Poly Parking & Commuter Services provide ongoing support

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The Next Step for EDAPTS:

Commercialization

- Integration options are necessary
- Full-service integration required for most potential users

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Ongoing EDAPTS Work

The Second Deployment

1. Performing a cost-benefit analysis of the first deployment in San Luis Obispo, CA
2. Develop performance-based specifications for EDAPTS

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Ongoing EDAPTS Work

The Second Deployment

3. Performing a test deployment on shuttle system at Cal Poly Pomona in Southern CA:
   - Identify commercial suppliers for EDAPTS
   - Look for complementary projects to entice suppliers
   - Test the application of the new performance-based specifications

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Defining the Second Deployment

- Understand the existing Pomona Bronco Express shuttle operation in detail
- Determine how EDAPTS can best provide operational improvements
- Create a performance-based procurement package

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Expected Outcomes of the Second Deployment

- Improved customer service:
  - Riders will know arrival time more precisely
  - Riders will have more frequent opportunities to catch the bus
  - Rider confidence will be significantly improved

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Expected Outcomes of the Second Deployment

- Improved operational efficiencies:
  - Driver breaks better managed and hence more time in service with vehicle
  - Simpler driver operations and record keeping
  - Dramatically reduced reporting effort for contractor
  - Comprehensive boarding & route schedule adherence information available for fleet operations planning

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Expected Outcomes of the Second Deployment

- Identification and availability of commercial suppliers
- Identification and articulation of funding sources for small transit properties

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Appendix 3

EDAPTS Emergency Support Marketing Material

EDAPTS ITS: Descriptive Brochure

Smart Transit System Smart Transit System Smart Transit System Smart Transit System Smart Transit System

Smart Transit Sign

The Smart Transit Sign displays current bus arrival information to passengers waiting at transit stops. The sign is capable of providing arrival information for multiple routes and multiple agencies serving an individual stop. Information is received via paging receiver. All signs in an agency listen to the same broadcast messages, so only a single paging plan is required.

The sign is solar powered, allowing easy installation at sites without access to AC power. The sign face is made of two ten-character rows of high-contrast characters. The resulting three-inch alphanumeric characters are consistent with the Americans with Disabilites Act (ADA), and are readable from approximately one-hundred and fifty feet. The sign is housed in a zinc-plated powder-coated steel enclosure that is both weather and vandal resistant.

Mobile Data Terminal

The Mobile Data Terminal (MDT) consists of an embedded PC compatible computer, a Global Positioning Satellite (GPS) receiver, and a keypad / display. The MDT communicates with Central Management Software via the analog voice radio / radio-modem system. The MDT is flexible and extensible. New features such as magnetic stripe card or smart card readers, electronic fare boxes, or automatic passenger counters can be added later.

The MDT is housed in a rugged steel case that is mounted in the vehicle driver compartment. All MDT components are available from commercial sources. The MDT is designed so that it can be assembled, tested, installed, and maintained by personnel with personal computer technician skills.

Central Management Software

The Central Management Software provides dispatch and management control of the EDAPTS Smart Transit System, as well as controlling wireless data communications with transit vehicle modile data terminals and the Smart Transit Signs. Dispatch features provided by the software include vehicle location on route, vehicle schedule adherence, emergency button monitoring and logging, Smart Transit Sign control and diagnostics. Management features include fare and load statistic reporting, and route schedule adherence statistics and reporting.

The software is Java based for improved reliability and flexible network communications. JDBC and ODBC database components are utilized to aid integration with other applications commonly used in transit and transportation management.

Voice and Data Communications

The EDAPTS Smart Transit System utilizes data radio-modems that operate with the trunking voice radios currently used by many transit systems. The analog radio / radio-modem combination provides both voice and data communications that is cost effective to install and operate. In small systems, the current voice channel can frequently carry both the voice and data traffic without increasing communications cost.

National Architecture for ITS and NTCIP

Software and communications elements of the Smart Transit System are consistant with the National Architecture for ITS and the emerging Transit Communications Interface Profiles (TCIP) standards. The Smart Transit System has been designed and built from the ground up in accordance with these standards.

For inquiries regarding the EDAPTS Smart Transit System, please contact:

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Smart Transit System Smart Transit System Smart Transit System Smart Transit System Smart Transit System

Efficient
Deployment of
Advanced
Public
Transportation
Systems

EDAPTS Smart Transit System

Bringing the benefits of Intelligent Transportation Systems to small and medium sized transit properties at a low cost.

Helping Transit Work Better

Smart Transit System Smart Transit System Smart Transit System Smart Transit System

Efficient Deployment of Advanced Public Transportation Systems

Smart Transit

Passenger and Driver Safety

A driver-initiated Silent Alarm will notify the dispatcher of a dangerous or life-threatening situation on the vehicle so that law enforcement may be called.

When a driver presses the hidden Silent Alarm button on a vehicle, an automatic ALERT is sent to dispatch via the radio communications system. The dispatcher is immediately notified of a problem, provided the current location of the vehicle, and requested to notify appropriate authorities that assistance is required.

Transit Management Tools

Collecting and analyzing route information including passenger boarding statistics and schedule adherence performance allows transit managers to develop routes and timetables that better meet rider and transit provider needs.

The Central Management Software automatically collects and reports schedule adherence and passenger loading data. Schedule adherence and passenger counts by type (i.e. student, senior, disabled, general fare) are collected, reported, and archived for each stop on each route for each operational hour of the day.

Improved On-Time Performance

Schedule adherence status is displayed to the vehicle driver via the Mobile Data Terminal and to the dispatcher via the Central Management Software graphical user interface..

Schedule adherence is calculatied on-board each vehicle using route time-tables and position estimation via Global Positioning Satellite (GPS). This information is displayed to the driver on the Mobile Data Terminal and is also transmitted to the dispatch center via wireless link for vehicle monitoring.

System Flexibility and Extensibility

The EDAPTS Smart Transit System is flexible, aiding the systematic deployment of ITS, meeting user needs and budget.

Solar-powered operation of the Smart Transit Sign simplifies installation. Simple, one-way pager link Smart Transit Sign control reduces recurring operations costs. Vehicle-to-dispatch data communications can utilize existing voice communications equipment and / or service to further reduce operations costs in small systems.

All design and implementation details of the Smart Transit System are non-proprietary and open source. This includes: computer source code and documentation, mechanical design drawings, parts lists, assembly instructions, test data sheets and procedures, and any other documentation required to build, operate, and maintain Smart Transit System elements.

Increased Passenger Confidence

Time to arrival is displayed at transit stops on high visibility electronic Changeable Message Signs. Vehicle location and arrival information is also provided to passengers via the World Wide Web.

The Central Management Software tracks all in-service vehicle locations and arrival times. This information is relayed to passengers via Smart Transit Signs and the optional World Wide Web portal.

Smart Transit System Smart Transit System Smart Transit System Smart Transit System