Intelligent Transportation Systems (ITS) for Critical Infrastructure Protection

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ITS Programs and National Security

The September 11, 2001 attacks on the World Trade Center and the Pentagon ushered in a new era of concern for homeland defense and security.

ITS programs have an opportunity to contribute to national defense and security.
Tools for Prevention and for Response

• ITS can provide powerful tools in assisting law enforcement, medical emergency services and other public safety entities with their efforts
  – to prevent disasters and attacks and,
  – to respond to emergency situations and disasters

• Urgent need for rapid development and deployment of ITS-related homeland defense and security technologies and systems

• Research, Development and Deployment Centers such as CCIT will provide assistance to government and industry in deploying innovative systems to improve efficiency and security of all modes of transportation
Deployment and Commercialization of ITS for Infrastructure Protection

- Rapid development, commercialization and deployment of ITS technologies and systems will:
  - Add public safeguards against terrorist actions
  - Assist in rapid mobilization and deployment of military and emergency services force
  - Provide real-time traffic information to the public during terrorist-related emergencies
  - Provide additional public safety and security and general well-being
Examples of ITS Technologies for Infrastructure Protection

• Automated Vehicle Location Systems (AVL) can track and monitor transport of hazardous materials and monitor and track movement of transit busses, trucks and emergency vehicles

• Advanced Traffic Management and Information Systems that can monitor and control the flow of traffic and provide emergency information

• wireless-enhanced 9-1-1 systems and on-board navigation and communications systems that can provide automatic location information and links between drivers and public safety agencies.
ITS Elements

Traveler Information Services
Advanced Traffic Management Systems
Advanced Fleet Management Systems
Vehicle Control / Collision Avoidance
Vehicle Control / Automated Highways
CVO & APTS

Cross Cutting Issue
Critical Infrastructure Protection (Security)
ITS Advantages

Improved Productivity: New & Existing Systems
Enhanced System Interoperability
New Safety Options
Surveillance
Improved System Security
Infrastructure Protection
Improved Response
Using California’s Freeway Management System To Improve Security

Purpose of the System

The purpose of the freeway management system can be summarized in three easy statements:

Keeping the region’s freeways flowing efficiently and safely

Responding rapidly to accidents and stranded motorists

Providing travelers with the timely and accurate information needed to choose the best mode, time, and route of travel

Using ITS elements to improve Security
Field Equipment

- Ramp, Connector & Mainline Meters
- Call Boxes
- Vehicle Detectors
- CCTV Cameras
- Changeable Message Signs
- Highway Advisory Radio
Linked for efficiency and Security

TRAFFIC MGMT CENTER

FLEET OPS CENTER/ Info Service Providers

SMART TRAVELLER

SMART VEHICLES
Existing Infrastructure is a Testbed for Continued Research and accelerated ITS Deployment
ITS Research, Development, Testing, Evaluation and Deployment

Performance Measurement
Intelligent Infrastructure
Real Time Traveler Information
Vehicle Intelligence
Vehicle/Infrastructure Cooperation
Leveraging ITS for Security and Infrastructure Protection
New Research & Development Areas

• New Sensors to detect large amounts of explosive materials on vehicles
• Smart Loops and VIPS
  – California PATH, Berkeley Highway Lab
• Integrate security into the traffic management system
  – Use existing and new surveillance systems cooperatively
  – Vehicle infrastructure cooperation
• Identification and hand-off technology
• New institutional cooperation
• Privacy versus security
How Can ITS Help

- Protecting transportation infrastructure from terrorist attacks
- Keeping transportation systems up and running during terrorist actions and providing real-time traffic and transportation information to the public
- Assisting emergency services operations during terrorist-related emergencies
- Assisting priority routing and movement of military forces
- Assisting in interdiction of potentially dangerous individuals and cargo at U.S. border crossings with Canada and Mexico
Data Collection, Surveillance and Traffic Management

Smarter Freeway sensors every 1/3 mile
Cameras for major freeways and bridges
Ramp meters
Roadside Readers
WIM
Electronic Clearance
Call boxes
Electronic Toll Collection
Cellular Telephones
Other Detectors to be Connected to TMCs
The Technology For Traveler Information can be used to Improve Security

- Freeway Sensors
- Incidents and closures
- Probe vehicles
- Cameras
- Electronic tags
- Cellular signals

Improved Algorithm Engine for Security

- Travel time
- Best route
- Security Info.
- Rapid evacuation

Server

- WAP
- PDAs
- Phones
- Pagers
- Web
- In-car Nav.
- Fleet
Example of ITS Applications/ Networking and Software that can be Improved to Enhanced Security

Safety Information
- In-vehicle signing, work zone warning
- Intersection Collision Warning
- Emergency vehicle signal preemption
- Direct vehicle to vehicle warnings

Electronic Transaction at POS
- Toll transaction
- Parking, gas, fast food
- Rental car processing

Traffic Management
- Roadway data collection, CMS control
- CVO (inspection)

Infotainment
- Maps, directions from the web
- Music, movies, web radio
- Rental car, flight, hotel booking

Vehicle in motion
- Time-critical but local data
- Local transaction
- Wide-area transaction
This proposed Delay Sensitive LAN Protocol for ITS Local Area Networking can be used to Improve Security.
Intelligent Car Architecture

- End-to-End Networked Vehicle Architecture
- Node on the network
- Internet Connected
- Land Server
- Wireless Network
- Car Server
- Embedded Devices
Geographic Addressing and Routing can also be used to improve Security and Vehicle Tracking.

- The network address is simply its GPS position
  - No special network address to learn
  - Re-engineer existing systems to incorporate security while not compromising privacy
Trend: Fully Connected

• Current Focus
  – Home/Vehicle/Office
  – Internet Car
  – Smart Refrigerator, etc.
  – All connected with In-Vehicle System
  – Efficiency/Utility

• How about Security?
  – Can the vehicle help protect the infrastructure?
Vehicle as an Autonomous Cooperative Sensor

Improved information:

- more independent information sources (real time cooperation among vehicles)
- information beyond sensor range or outside line of sight of individual vehicle
- dealing with information that cannot be sensed (predicting intentions?)
- faster information availability
- more precise information

More intelligent use of information

- active negotiation of maneuvers
- opportunity for system-level optimization
Transportation Safety, Efficiency, Security and Comfort

- Vehicle Based
- Infrastructure Supported
- Bundling Services
- New Market Opportunities
- Transportation/Consumers/Economy Benefit
- Safety/Efficiency/Entertainment
- Security and Privacy
New Security and transportation system protection focus @ CCIT

• Researchers, faculty, students and transportation practitioners working with industry to accelerate the Commercial Deployment of ITS Technologies

• Integrating Technology into the Vehicle and infrastructure for safety security and efficiency

• Advance Transportation Technology while Creating New Market Opportunities

• Sustainable and Secure Transportation Systems
Thank you, and

for more information on CCIT, please go to:

www.calccit.org

and for more information on the California PATH Program, please go to:

www.path.berkeley.edu