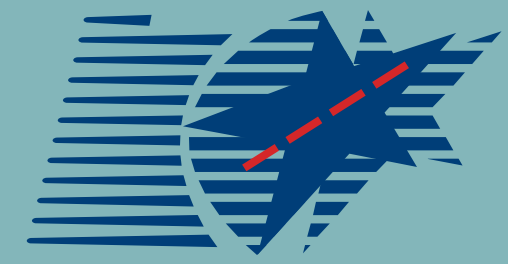

Board of Directors
Statewide ITS Development and Deployment Plan

Minnesota Department of Transportation
Office of Traffic Engineering/ITS

October 2002

Minnesota Guidestar
Board of Directors

STATEWIDE ITS DEVELOPMENT AND DEPLOYMENT PLAN

Minnesota Department of Transportation
Office of Traffic Engineering/ITS

October 2002

Prepared By:

ITS IMPLEMENTATION TEAMS
AND
SRF CONSULTING GROUP, INC.

STATEMENT OF SUPPORT

The undersigned support the Minnesota Guidestar Board's stated mission to:

> ***"…provide strategic direction and advice for statewide application of advanced technology and information systems in transportation to save lives, time and money, to enhance security and to protect the environment. The Board serves as a catalyst for innovative partnerships and resource investment to achieve desired outcomes."***

The Statewide ITS Development and Deployment Plan outlines how these outcomes are going to be achieved and the timeframe for achieving them.

Doug Weiszhaar, Commissioner Minnesota Department of Transportation	Charles Weaver, Commissioner Department of Public Safety

STATEWIDE ITS DEVELOPMENT AND DEPLOYMENT PLAN

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TABLE OF CONTENTS

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AAA	Automobile Association of America
AASHTO	American Association of State Highway Transportation Officials
APTS	Advanced Public Transportation Systems
ARTIC	Advanced Rural Transportation Information and Coordination
ATC	Advanced Traffic Signal Controllers
ATIS	Advanced Traveler Information Systems
ATMS	Advanced Traffic Management Systems
ATP	Area Transportation Partners
AVL	Automatic Vehicle Location
BAI	Business Area Initiatives
CAD	Computer-Aided Dispatch
CARS	Condition Acquisition and Reporting System
CATV	Cable Access Television
CCTV	Closed Circuit Television
CMS	Changeable Message Sign
COG	Council of Government
COMMS	Communications Infrastructure
CTS	Center for Transportation Studies
CVHS	Cooperative Vehicle Highway Systems
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DIVERT	During Incidents Vehicles Exit to Reduce Travel Time
DMS	Dynamic Message Signs
DNR	Department of Natural Resources
DOA	Department of Administration
DPS	Department of Public Safety
EMS	Emergency Management Systems
ESS	Environmental Sensor Stations
FHWA	Federal Highway Administration
GCM	Gary/Chicago/Milwaukee Corridor
GPS	Global Positioning System
HAR	Highway Advisory Radio
http	Hypertext Transfer Protocol
ICTM	Integrated Corridor Traffic Management
IRC	Interregional Corridor
IRM	Mn/DOT Information Resource Management
ITE	Institute of Transportation Engineers
ITIS	International Traveler Information Interchange Standards
ITS	Intelligent Transportation Systems
ITSA	Intelligent Transportation Society of America
IVI	Intelligent Vehicle Initiatives

LRMS	Location Referencing Messaging Specification
LRT	Light Rail Transit
MDC	Mobile Data Computer
MDT	Mobile Data Terminal
MMUTCD	Minnesota Manual on Uniform Traffic Control Devices
Mn/DOT	Minnesota Department of Transportation
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NTCIP	National Transportation Communications ITS Protocol
NWS	National Weather Service
OEC	Mn/DOT Office of Electronic Communications
OIRM	Mn/DOT Office of Information Resource Management
OM	Mn/DOT Office of Maintenance
ORION	Model Deployment Program in the Twin Cities Metro Area
ORSS	Mn/DOT Office of Research and Strategic Services
OTE/ITS	Mn/DOT Office of Traffic Engineering/ITS
PC	Personal Computer
PCRS	Pavement Condition Reporting Service
PDA	Personal Digital Assistant
PSS	Public Safety Systems
RDC	Regional Development Commission
RDS	Radio Data Service
RFP	Request for Proposal
RFPP	Request for Partner Proposals
RTMC	Regional Traffic Management Center
RWIC	UND Regional Weather Information Center
R/WIS	Road/Weather Information System
SAE	Society of Automotive Engineers
SAIL	Safety Automated Intelligent Locator
SDO	Standards Development Organizations
TC	Twin Cities
TCIP	Transit Communications ITS Protocol
TIC	Travel Information Center
TIN	Traveler Information Network
TIP	Transportation Improvement Program
TMC	Traffic Management Center (Twin Cities)
TMO	Transportation Management Organization
TOCC	Transportation Operations Communication Center
TRIM	Mn/DOT Transportation Research and Investment Management
U of M	University of Minnesota
UND	University of North Dakota
USDOT	United States Department of Transportation
VMS	Variable Message Sign
WIM	Weigh-in-Motion (Trucks)

INTRODUCTION

Program Background

Since its inception in 1991, Minnesota Guidestar has performed a broad range of ITS activities including needs assessments, research and development, full-scale operational testing, and deployment of ITS strategies and technologies. In addition to advancing ITS technology, the success of Minnesota Guidestar is based on a strong cooperation between the public and private sectors, which has produced innovative and unique programs and projects.

Minnesota Guidestar was founded as a partnership of the public, private and academic sectors to advance ITS in Minnesota. The Board of Directors includes officers and senior managers from both public- and private-sector organizations and representatives from academia and the general public. Mn/DOT's Office of Traffic Engineering and Advanced Transportation Systems (OTE/OATS) provides administrative support to the Minnesota Guidestar program, provides staff support to committees, administers funding, marketing, and management of selected projects, and acts as a liaison with local, state and federal organizations.

Plan History

In 1997, Minnesota Guidestar developed its first Strategic Plan. The Strategic Plan provided an overarching vision for the ITS program and led to the implementation of 14 separate projects within the state. In March of 2000, the Guidestar Board of Directors completed its own strategic plan, *Statewide ITS Strategic Plan 2000*. The updated plan outlined the mission (identified below) and restated the vision for Minnesota Guidestar's Board of Directors and the ITS community for the near- to mid-term timeframe.

MISSION

The Minnesota Guidestar Board provides strategic direction and advice for statewide application of advanced technology and information systems in transportation to save lives, time and money, to enhance security and to protect the environment. The Board serves as a catalyst for innovative partnerships and resource investment to achieve desired outcomes.

VISION

Minnesota's citizens, businesses and visitors will benefit from the application of ITS to the state's transportation system. ITS will be fully integrated into transportation strategies to enhance safety, security, mobility, and economic vitality, to protect the natural environment, and to develop sustainable communities.

The *Statewide ITS Strategic Plan 2000* explored the impediments and issues that needed to be overcome in order to fully implement ITS across the state. As part of the process, the Board developed a list of seven action items to address the impediments and issues.

Following the completion of *Statewide ITS Strategic Plan 2000*, the Guidestar Board of Directors requested that a detailed plan be developed to articulate the specific activities that should be undertaken to support the action items that were developed as part of the Strategic Plan. In 2001, the *Minnesota Guidestar Board of Directors' Statewide ITS Action Plan* was completed. This Action Plan identified specific ongoing, short-term and long-term activities to support the seven action items identified in the *Statewide ITS Strategic Plan 2000*.

After the Board of Directors adopted its Action Plan, it immediately began the process of developing this plan, the *Minnesota Guidestar Board of Directors' Statewide ITS Development and Deployment Plan*.

Statewide ITS Development and Deployment Plan

This plan was developed to create a means to implement the ongoing, short-term and long-term activities identified in the *Statewide ITS Action Plan*. As part of the process for organizing the approximately seventy-five Action Plan activities, these were summarized and grouped into four areas: Deployment Principles and Evaluation Criteria, Outreach, Partnerships, and Program Delivery. Specific activities were assigned to the appropriate category and placed in logical order of implementation. Appendix A identifies the implementation areas, as well as specific activities to be undertaken in each.

Implementation Teams for each of the categories were then created. Implementation Teams, made up of Board members, support staff and technical support associates, were charged with the task of developing an implementation plan to carry out the activities for their area. The Statewide ITS Development and Deployment Plan is the result of this effort.

Acknowledgements

We wish to acknowledge the Federal Highway Administration's contribution to this plan. Several FHWA publications were consulted during its preparation, including the *1996 Review of ITS Benefits: Emerging Success; the 2001 Update (Report FHWA-OP-01-024)*; and the *National Intelligent Transportation Systems Program Plan: A Ten-Year Vision*.

DEPLOYMENT PRINCIPLES AND EVALUATION CRITERIA

ITS Deployment Principles

As ITS projects and programs are ultimately developed and deployed, they should adhere to one or more of the following principles:

1. Increase the safety and security of transportation systems and their users.

2. Enhance mobility of people and freight on transportation corridors between and within regional trade centers and with other states.

3. Improve access to transportation options for people and freight.

4. Reduce energy use and impacts on the natural environment.

5. Support the integration of traffic, transit, commercial vehicle operations and emergency service operations across multiple jurisdictions.

6. Support an integrated statewide communications and information network that meets adopted standards and system architecture.

Criteria for Measuring the Success of ITS Deployment

In addition to providing high-level principles to guide ITS deployments, the Guidestar Board has concluded that criteria need to be established from which programs can be evaluated. Having such criteria in place will allow project managers and policymakers to determine if deployment efforts have been successful.

Program objectives should be developed prior to deployment. As deployment occurs, results should be monitored and compared against objectives. In addition, baseline conditions for projects and programs must be defined before deployment so that before-and-after comparisons can be made. Another way to measure overall progress would be to benchmark against peer cities, regions and states. Finally, project and program migration and mainstreaming targets should be developed. Mainstreaming targets should be established in the context of local and regional transportation plans. An annual review of targets should be conducted.

The following measures are recommended for assessing the level of success of ITS program deployments:

1. **Safety:** Measured in terms of reduction in number of crashes and fatalities, and resulting reduction in societal costs.

2. **Security:** Measured in terms of enhancing the security of transportation infrastructure and services.

3. **Mobility:** Measured in terms of congestion reduction (improved travel time) and improved travel time reliability for all modes.

4. **Access to Travel Options:** Measured in terms of enhancements that make options to single-occupant vehicles attractive to travelers.

5. **Energy and the Environment:** Measured in terms of the role of ITS in reducing transportation energy use and vehicle emissions.

6. **System Integration of Traffic, Transit, Commercial Vehicle Operations and Emergency Service Operations:** Measured in terms of the number of jurisdictions that share physical or virtual operations centers that lead to greater coordination, avoidance of duplication and economies of scale.

7. **Statewide Communications/Information:** Measured in terms of expansion of communications and traveler information infrastructure and networks.

Definitions

The following definitions are needed to better understand some of the concepts described in this plan.

ITS Projects

ITS Projects are defined as specific projects, be they basic or applied research, operational tests, developmental deployments or full deployments, that are carried out in an effort to grow discrete ITS functional areas into fully integrated, interoperable and seamless programs (Figure 1).

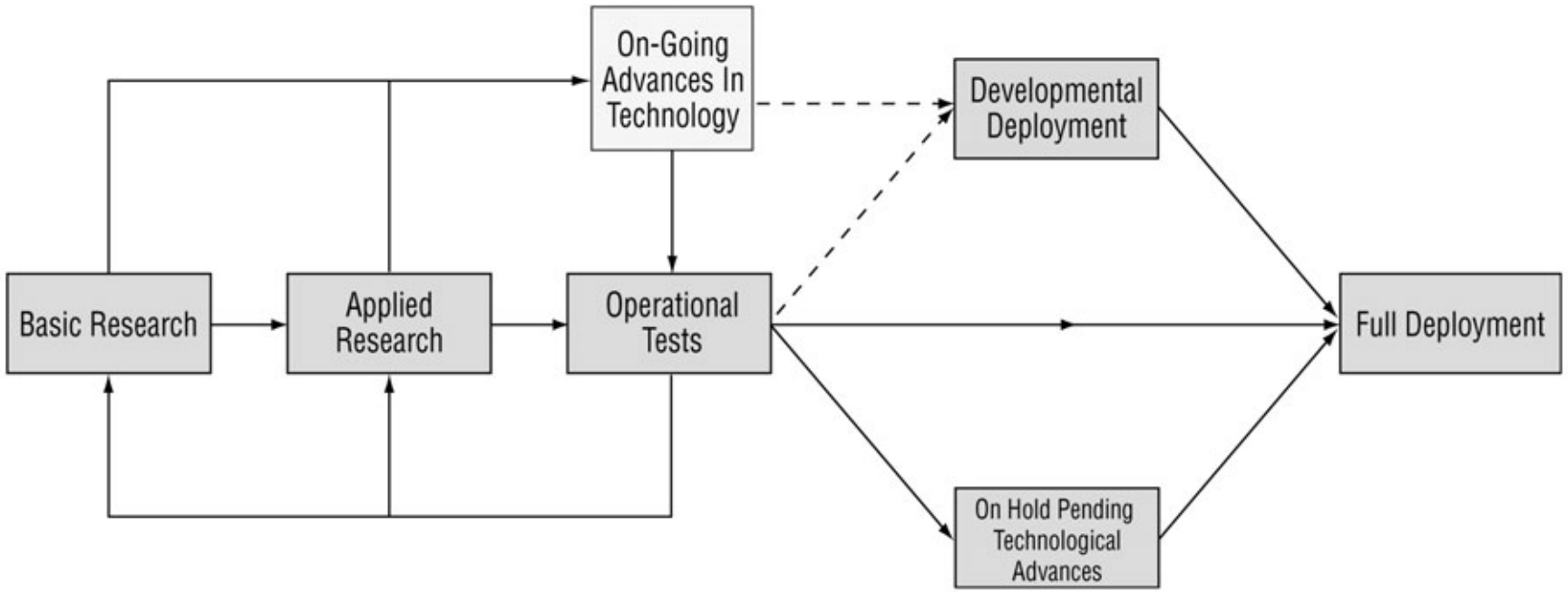
ITS Functional Areas

The Federal Highway Administration has created distinct areas for ITS analysis, testing, deployment and evaluation. Minnesota, along with most other states, has adopted these designations with some adjustments to fit local conditions.

The ITS functional areas are:

- Advanced Public Transportation Systems (APTS)
- Advanced Transportation Management Systems (ATMS)
- Emergency Management and Public Safety Systems (EMS/PSS)
- Commercial Vehicle Operations (CVO)
- Advanced Traveler Information Systems (ATIS)
- Intelligent Vehicle Initiatives (IVI)
- Communications Infrastructure (COMMS)

FIGURE 1 - ITS DEVELOPMENT AND DEPLOYMENT STAGES



ITS Programs

ITS programs are defined as the set of ITS deployments that is expected to be substantially in place once the ITS Development and Deployment Plan is achieved. These programs are:

- Statewide Communications Infrastructure
- Statewide Transportation Operations Network
- Statewide Traveler Information System
- Cooperative Vehicle-Highway System (CVHS)

These programs are the ITS deployment end-game that emerge as ITS functional area projects evolve into integrated, interoperable, seamless systems and networks. These programs are applicable at the regional, state and multi-state levels.

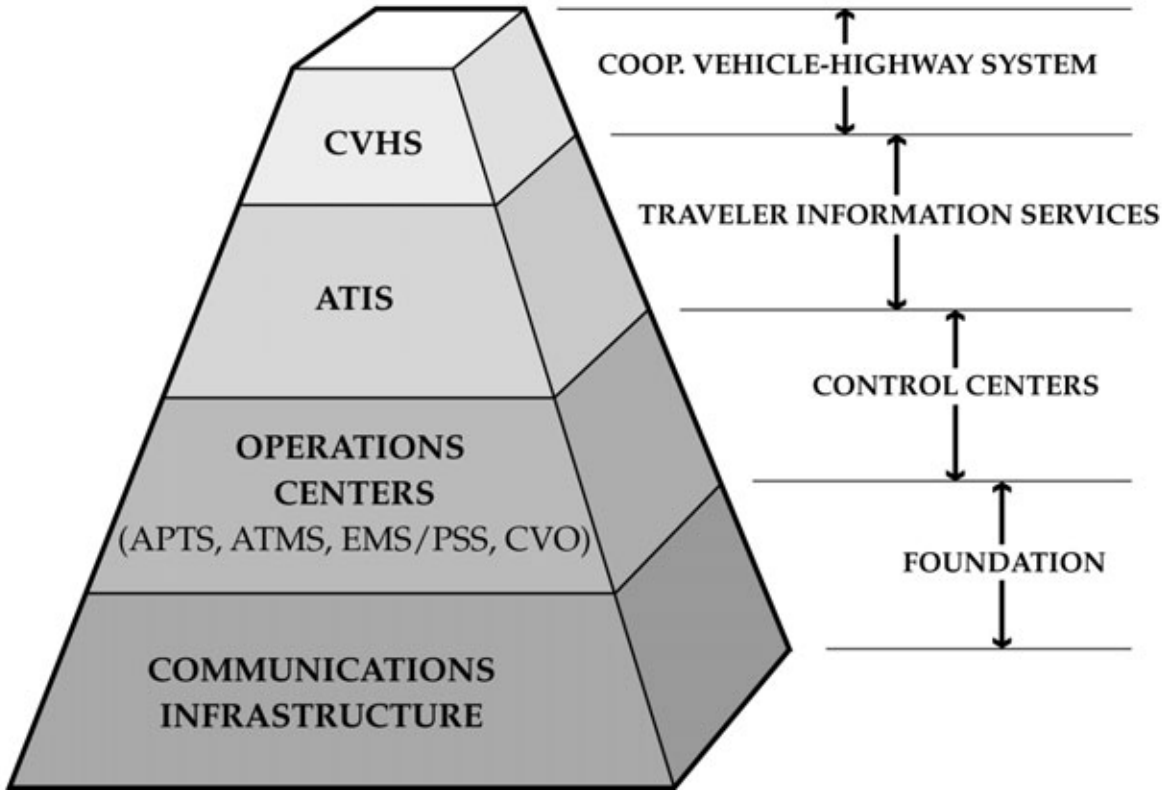
The relationship between ITS programs is depicted in Figure 2, with Communications serving as the foundation for all ITS programs.

Full ITS Deployment

Full ITS deployment is achieved once the current programs reach agreed-upon thresholds. Thresholds could be set in terms of market penetration (for traveler information), geographic coverage (for communications networks), or number of physical or virtual operations/communications centers deployed, etc. Full deployment also requires that levels of integration, interoperability and service be fully specified.

In general terms, "full" deployment would be achieved when ITS programs are substantially in place (say, at a 60- to 70-percent level of deployment). At this point, or even before, it would be understood that these ITS programs would become mainstreamed. Furthermore, the ITS functional areas may no longer exist as separate entities. Finally, "Full Deployment" refers to programs that are currently underway in the ITS Development and Deployment Plan. As technological advances occur, and as new concepts emerge, it is expected that subsequent Deployment Plans would identify new programs and set full-deployment thresholds for them.

FIGURE 2 - ITS PROGRAMS: BUILDING BLOCKS FOR SYSTEM DEVELOPMENT AND DEPLOYMENT



OUTREACH

Goals

Identifying the benefits of ITS and sharing that information with potential partners, stakeholders, policy-makers, transportation system stewards, the business community and the general public is important in building long-term support for ITS development and deployment. Because outreach to these groups is so important, two goals for the outreach process have been identified:

- Develop a benefits message that can easily be delivered and explained to targeted customers.

- Use the benefits message to assist in building coalitions and partnerships for promoting ITS programs.

Customer Categories

As indicated in the previous section, the benefits message needs to be shared with the appropriate customers. For purposes of simplifying all the potential recipients, four general categories have been identified: the general public, business interests, system stewards and policy makers.

General Public

The general public is made up of the people that use the highway system and local and regional transit systems not only for commuting, but also for recreational travel and completing errands.

Business Interests

Business interests are represented by a number of associations and groups. Business interests include shippers, carriers, business owners, chambers of commerce and transportation trade associations. Delivering the ITS benefits message can be done through resources such as the Minnesota Society of Association Executives and the Associated General Contractors. These organizations have access to business and trade associations that have a strong interest in transportation.

System Stewards

System stewards are the agencies that operate the transportation infrastructure and services and work to protect the mobility and the safety of the highway, transit and rail systems. Agencies such as Mn/DOT, Metro Transit and the Department of Public Safety are the stewards of state and regional systems. Stewards at the local level include the public works departments of cities and counties, Area Transportation Partnerships, police and sheriffs and local transit operators.

Policy Makers

Policy makers are the decision makers and those that have the ability to influence funding decisions. At the state level, this includes the state legislature and Commissioners of Transportation, Public Safety and Administration. At the local and regional level it includes city councils, county boards, Metro Mayor associations, and the Metropolitan Council and other Metropolitan Planning Organizations.

ITS Benefits

Because there are so many benefits associated with the implementation of ITS, it is important to group the benefits into categories that are easily understood by the targeted audiences; language and jargon that is familiar to system stewards may not be understood by the general public. To simplify the creation of the benefits message, five ITS benefit areas are identified: saving lives, saving time, saving money, enhancing security and protecting the environment. Each benefit area is described below in terms of documented benefits. Benefit-to-cost estimates should be completed as soon as possible.

Saving Lives

- ITS applications utilizing lane-keeping and collision-avoidance technologies reduce the number of crashes significantly. Data from Minnesota indicates that 60 percent of rural freeway crashes can be reduced using this technology. A reduction of 40 percent of run-off-the-road crashes (drivers leaving the driving lane into the ditch or across oncoming traffic into the ditch) leads to an annual reduction of 19,000 crashes nationally, as well as a reduction of 190 fatalities nationally.

- According to the Minnesota Department of Transportation, crashes on I-35W numbered over 420 annually in 1994. After ITS technologies were implemented along the corridor, that number dropped to less than 310 in 1996. A 27 percent reduction in crashes was achieved in less than two-years.

- Data from the Fatal Accident Reporting System indicates that properly working MayDay devices reduce the amount of time it takes to notify emergency response vehicles. On rural highways there has been a decrease of 9.6 to 4.4 minutes in average notification time. This decrease, when applied to 60 percent of rural crashes, would result in a 7 percent reduction in fatal crashes or 1,727 deaths annually.

- Analysis using empirical data to estimate the impacts of ITS strategies on commercial vehicles indicates that fatalities could be reduced by 14 to 32 percent nationally.

- Results from transportation models suggest that individual travelers who use traveler information Web sites prior to traveling along a particular corridor would experience a 0.5 percent reduction in crash rates.

- Transportation models indicate that over a one-year period, travelers using an in-vehicle navigation device could achieve a 4.6 percent reduction in crashes.

- Ramp meters have been shown to reduce crashes by 15 to 50 percent depending upon the area.

Sources of data: Assessment of ITS Benefits Early Results, US Department of Transportation, August 1995; Review of ITS Benefits: Emerging Success, US Department of Transportation, FHWA, September 19996; D. Duncan, Ford Motor Company, presentation made at the ITS America Sixth Annual Meeting, April 1996; ITS Benefits: 2001 Update, Report FHWA-OP-01-024, Mitretek Systems Inc.; TTI Report, Managing The System.

Saving Time

- Full ramp metering in the Twin Cities has resulted in a16 percent increase in travel speeds. Nationally, ramp metering can increase mainline speed by 8 to 20 percent.

- Ramp metering has increased lane capacity (throughput) from 1,800 to 2,200 – 2,300 vehicles per lane per hour in the Twin Cities. Nationally, ramp metering can increase vehicle throughput from by 8 to 22 percent.

- Cameras used to monitor the highway system enable traffic monitors to more easily dispatch Highway Helpers to crash and/or stall sites. Highway Helpers reduce the duration of a stall by eight minutes. That reduction decreases the amount of overall delay by over 30 minutes (each minute of delay due to a crash or stall results in 4 to 5 minutes of overall delay for motorists).

- Results from transportation models suggest that individual travelers who use traveler information Web sites prior to traveling along a particular corridor would experience reduction in delay of about 5 percent.

- Transportation models indicate that over a one-year period, travelers using an in-vehicle navigation device could achieve a reduction in delay of about eight percent.

- Optimized signal timing yields a 12 percent reduction in travel time. In some cases, time-savings can reach 22 percent.

- Basic traffic signal improvements can result in a 12 percent improvement in vehicle speed.

- Emergency vehicles that use signal preemption can reduce their travel time by about 20 percent.

Sources of data: TTI Report, Managing The System; Dr. Christine Johnson, presentation made at the National Governors Association; AHS Precursor Analysis, Activity Area A, Urban and Rural AHS Analysis, Batelle, BRW and Transportation Research Center, 1994; ITS Benefits: 2001 Update, Report FHWA-OP-01-024, Mitretek Systems, Inc.

Saving Money

- Implementation of commercial vehicle operation (CVO) technologies resulted in a savings of over $10,000 a month for a Minneapolis firm. Prior to the installation of the CVO systems, drivers previously lost about 15 minutes each day waiting to talk with dispatchers.

- Automatic vehicle location technology reduced San Jose paratransit expenses from $4.88 to $3.72 per passenger.

- New Jersey Transit estimates $2.7 million cash handling reduction and a 12 percent revenue increase by using electronic fare payment.

- The Smart Card System in Ventura County, California, resulted in a cost saving of $9.5 million per in reduced fare evasion, $5 million in reduced data collection costs and almost $1 million in cost savings by eliminating transfer slips.

- The reductions in crashes and fatalities save more than lives, they also save approximately $224 million annually.

- Ramp metering results in an annual benefit of $1.4 million in delay reduction.

Sources of data: Review of ITS Benefits: Emerging Success, US Department of Transportation, FHWA, September 1996; ITS Benefits: 2001 Update, Report FHWA-OP-01-024, Mitretek Systems Inc.

Protecting the Environment

- Results from transportation models suggest that individual travelers who use traveler information Web sites prior to traveling along a particular corridor would experience a 1.8 percent reduction in fuel consumption.

- Bostaon's traveler information system, SmartTravler, indicates that ITS technology reduced Nitrogen Oxide by 1.5 percent and Carbon Monoxide by 33 percent.

- Transportation models indicate that over a one-year period, travelers using an in-vehicle navigation device could achieve a 3.0 percent reduction in fuel consumption.

- The Automated Traffic Surveillance and Control program in Los Angeles, California, reported a 13 percent decrease in fuel consumption and a 14 percent decrease in emissions.

- The Automated Traffic Surveillance and Control program in Abilene, Texas, reported a 6 percent decrease in fuel consumption, a 10 percent decrease in Hydrocarbons, a 13 percent decrease in Carbon Monoxide and a 4 percent decrease in Nitrogen Oxide.

Sources of data: ITS Benefits: 2001 Update, Report FHWA-OP-01-024, Mitretek Systems Inc.; ITS Benefits: Emerging Successes 1996.

Enhancing Security

The widespread application of advanced technology and information systems for security purposes (at airports, banks and nuclear power plants, for example), is familiar to most. In the wake of recent events, the US Department of Transportation, Federal Highway Administration, American Association of State Highway Transportation Officials, Mn/DOT and many others are exploring the multiple ways in which advanced technology and real-time information systems currently in use in transportation can also be used to monitor, track, report and react to natural or manmade disasters and to terrorist activities. The benefits resulting from these types of ITS applications, while difficult to quantify, can be easily conveyed and grasped by all the customer groups identified.

Development of the ITS Benefits Message

The benefits message must be consistent, it should convey the full array of benefits associated with ITS, and should reflect the organization's ability to focus on the most important issues. When developing the specific benefits message, the following guidelines should be used to ensure consistency:

- Use the benefits identified in the previous section as a starting point. Include additional benefits as new technologies are refined and as additional benefits are identified. Whenever possible, include the rate of return of ITS programs.

- Keep the message and format simple, use facts and terms that are easily understood by the targeted audiences.

- Create standard templates for different presentation media (i.e., pamphlets, one-pagers, power point presentations, etc.).

- Identify and prioritize specific groups and organizations within the four customer categories identified.

- Taylor messages to the targeted audience.

- Focus the message on achieving practical transportation outcomes (i.e., saving lives, saving time, saving money, enhancing security and protecting the environment)

- Reflect the Board's vision for ITS, the Department's Strategic Objectives and importance of partnerships between the public sector, private sector and academic institutions.

- Reflect the ITS program deployment timeframe.

- Reflect the importance of a common communications infrastructure.

Delivering the Message

Once created, the ITS benefits message will need to be presented or distributed to the targeted groups. Guidestar Board members and support staff should assist in the initial and ongoing distribution of the message. In order to more effectively and efficiently deliver the benefits message, Board members and support staff should target organizations, agencies and associations within the four targeted areas (public, commercial interests, system stewards and policy makers). Once identified, Board members, support staff and others should meet with these groups to dialogue and present the ITS benefit message. This could be done at monthly, quarterly or annual meetings of these organizations, agencies and associations. Once the message has been delivered in these forums, members of the audience can in turn be used to spread the benefits message to other members of their organization, their constituencies and their legislators.

As Board members, support staff and others deliver the benefits message, it will be important to remember that the media is a vehicle from which to deliver the message, not a targeted recipient of the message.

PARTNERSHIPS

Goal

Minnesota Guidestar was founded as a partnership of the public, private and academic sectors. The Board of Directors includes officers and senior managers from both public- and private-sector organizations, as well as representatives from academia and the general public. This partnership has successfully produced innovative and unique programs and projects that keep Minnesota at the forefront of ITS implementation in the United States.

The Board of Directors has an ongoing goal of advancing ITS deployment through enhancing the innovative partnerships upon which it was founded. The Board hopes to achieve this goal by continually reviewing its membership and identifying areas where there are representation gaps that could be filled by new partners. The Board recently identified the following representation gaps:

- Public Sector – Metro Transit and other transit associations and the Department of Administration
- Private Sector – Auto industry and railroads
- Other – Mn/DOT Office of Communications and state legislative staff

Partnership Evaluation

One of the future tasks in the partnership area is to complete an evaluation of the partnership experiences between Minnesota Guidestar and the private sector. The evaluation should identify what elements have been successful; what elements were not totally successful, but could be improved based on past experience; and what elements did not work, and are not likely to work in the future.

This evaluation could be completed through hosting a forum of organizations that have been involved in recent ITS public-public, public-private or private-private partnerships. The forum would be structured to encourage frank discussion and to represent all points of view. It may be possible to have a neutral party to conduct interviews to solicit additional comments and feedback. Additional ideas for evaluating partnerships should be presented to the Board for their review and feedback.

Partnership Message

Similar to the ITS benefits messages in the previous section, once the partnerships have been evaluated it will be important to take the lessons learned and develop a partnerships message. The partnerships message will then be used to encourage continued partnership formation and recruitment efforts. Ultimately, it is hoped that the partnership message and the partnerships that are formed as a result of the message, will foster better working relationships and faster project delivery and deployment.

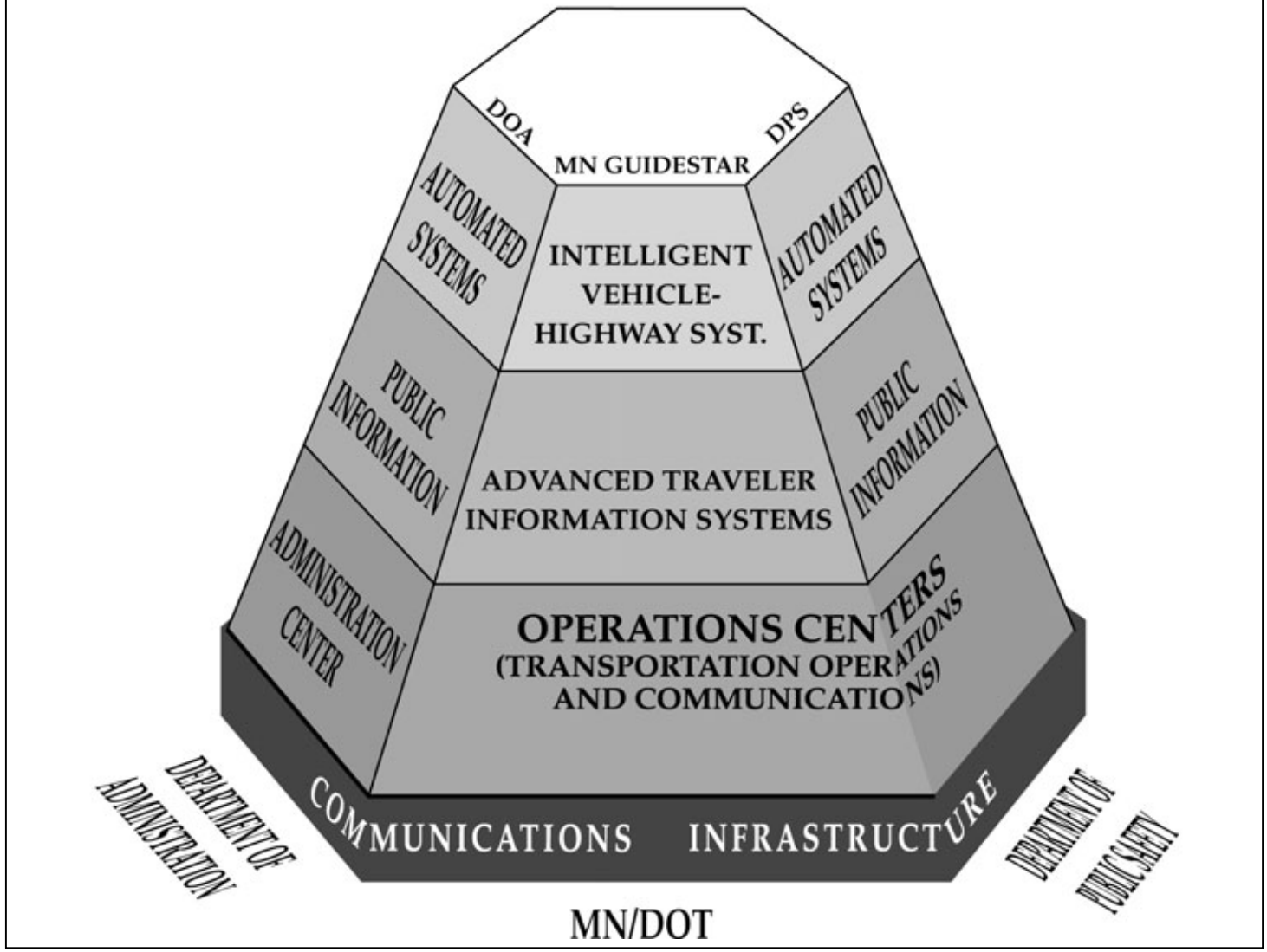
Partnership Message Delivery

Once the partnership message is developed, it will be important to share that information with the following groups:

- Agencies that share communications infrastructure needs. A group of partners that is important to bring into this discussion is the Department of Transportation Minnesota Guidestar, the Department of Public Safety and the Department of Administration. A successful partnership between these agencies, based on their need for a common communications infrastructure, could lead to a cooperative effort to seek legislative support for joint initiatives in this area. Figure 3 illustrates the communications infrastructure foundation that is required to support the activities of these departments.

- Cities and counties who are the implementing partners in ITS deployment, and whose support is needed to mainstream ITS.

FIGURE 3 - SHARED COMMUNICATIONS INFRASTRUCTURE



ITS PROGRAM DELIVERY

Program Delivery Steps

The following four steps have been formulated to ensure that an orderly and effective ITS delivery program is developed and deployed.

1. ITS Programs
2. ITS Development and Deployment Framework
3. Program Delivery Process
4. Ongoing operations Concepts

ITS Programs

ITS Programs are defined as the set of ITS development and deployments that is expected to be substantially in place once the ITS Development and Deployment Plan has been implemented. The following programs are proposed for implementation:

- ***Statewide Communications Infrastructure***

  A key component of any ITS development and deployment is the ability to effectively move information from collection to processing and finally to customers for the data. The efficient movement of information necessitates the construction of a well-integrated Statewide Communications Infrastructure. The Communications Infrastructure encompasses wireless radio voice and data systems, copper and fiber optic cabling, and wireless optical data transmission systems. The goal of the Infrastructure is to facilitate the movement of data across different systems and across communications media in as efficient and seamless manner as possible.

- ***Statewide Transportation Operations Network***

  As the ability to communicate between systems improves, so does the opportunity to integrate their functions to achieve greater efficiency in the use of resources as well as the quality of service provided to the users. Already, some Emergency Response (EMS) and Transportation Management (ATMS) functions are being combined into common physical centers, resources. As this trend continues, the traditional distinctions of APTS, ATMS, EMS/PSS, and CVO will become less meaningful and a single Statewide Transportation Operations Network will emerge. The Transportation Operations Network will enable sharing of facilities, resources and personnel to achieve the greatest possible efficiency of operation and maximize the value of services to the public.

- ***Statewide Traveler Information Systems***

  In the past, traveler information systems have existed as individually conceived, stand-alone services that the public would access in a manner unique to each system. As the value of "one-stop shopping" for traveler information has become clearer, the movement is now to integrate both the processing and distribution of ATIS. Examples of this thinking can be seen in the current 511 telephone project and the ATIS web project currently under consideration. Clearly, the fewer steps needed to access useful, high-quality traveler information, the greater the acceptance by the public, and therefore its overall impact.

- ***Cooperative Vehicle-Highway System (CVHS)***

  The current Intelligent Vehicle Initiatives (IVI) explore the possibility of incorporating greater sensing and data processing capabilities into vehicles to reduce driver workload and increase safety of travel on roadways. Still in their early stages, the infrastructure component of these systems is not well defined. It is clear, however, that some roadside and data processing (center) systems will eventually be necessary to enable the more ambitious IVI visions, such as self-guiding vehicles. These enabling infrastructure improvements are collectively referred to as Cooperative Vehicle-Highway System program. Under this general heading are grouped such technologies as magnetic guidance smart-tape, dedicated short range radio for communicating to on-board IVI systems, and real-time automated vehicle routing systems.

These programs are the ITS development and deployment end-game that emerge as ITS functional area projects evolve into integrated, interoperable, seamless systems and networks.

Full ITS Development and Deployment

A full ITS development and deployment state is achieved once the current programs reach agreed-upon thresholds that are defined as part of the ITS Development and Deployment Plan. These thresholds could be set, for example, in terms of market penetration (for traveler information), geographic coverage (for communications networks), or number of physical or virtual operations/communications centers deployed, etc.

"Full" deployment requires that levels of integration, interoperability and service be fully specified.

In general terms, "full" deployment would be achieved when ITS programs are substantially in place (say, at an 80-percent level of deployment). At this point, or even before, it would be understood that these ITS programs would become mainstreamed. Furthermore, the ITS functional areas would no longer exist as separate entities. Instead they would form part of the integrated programs.

Finally, "full deployment" refers to programs that are currently underway in the ITS Development and Deployment Plan. As technological advances occur, and as new concepts emerge, it is expected that subsequent plans will identify new programs and set full deployment thresholds for them.

ITS Development and Deployment Framework

The proposed ITS Development and Deployment Framework is shown in Figure 4. It portrays a movement from project-specific implementations within ITS functional areas to a program-based deployment over time. This evolution would be accomplished by:

1. Understanding current baseline conditions for each ITS functional area

2. Defining a timeline for "full" deployment to occur

3. Creating short-term business plans to ensure that project implementation is constantly advancing ITS programs and moving them towards full deployment.

4. Developing an operations and maintenance concept that defines the responsibilities and resources of each of the implementing partners (Mn/DOT, Metro Districts, DPS, City, County, etc.).

The Program Delivery Team is proposing that the Guidestar Board set its sights on a 10-year horizon for substantially achieving full deployment of ITS programs. Furthermore, the Team recommends that two-year business plans be developed to identify immediate steps for moving towards full deployment.

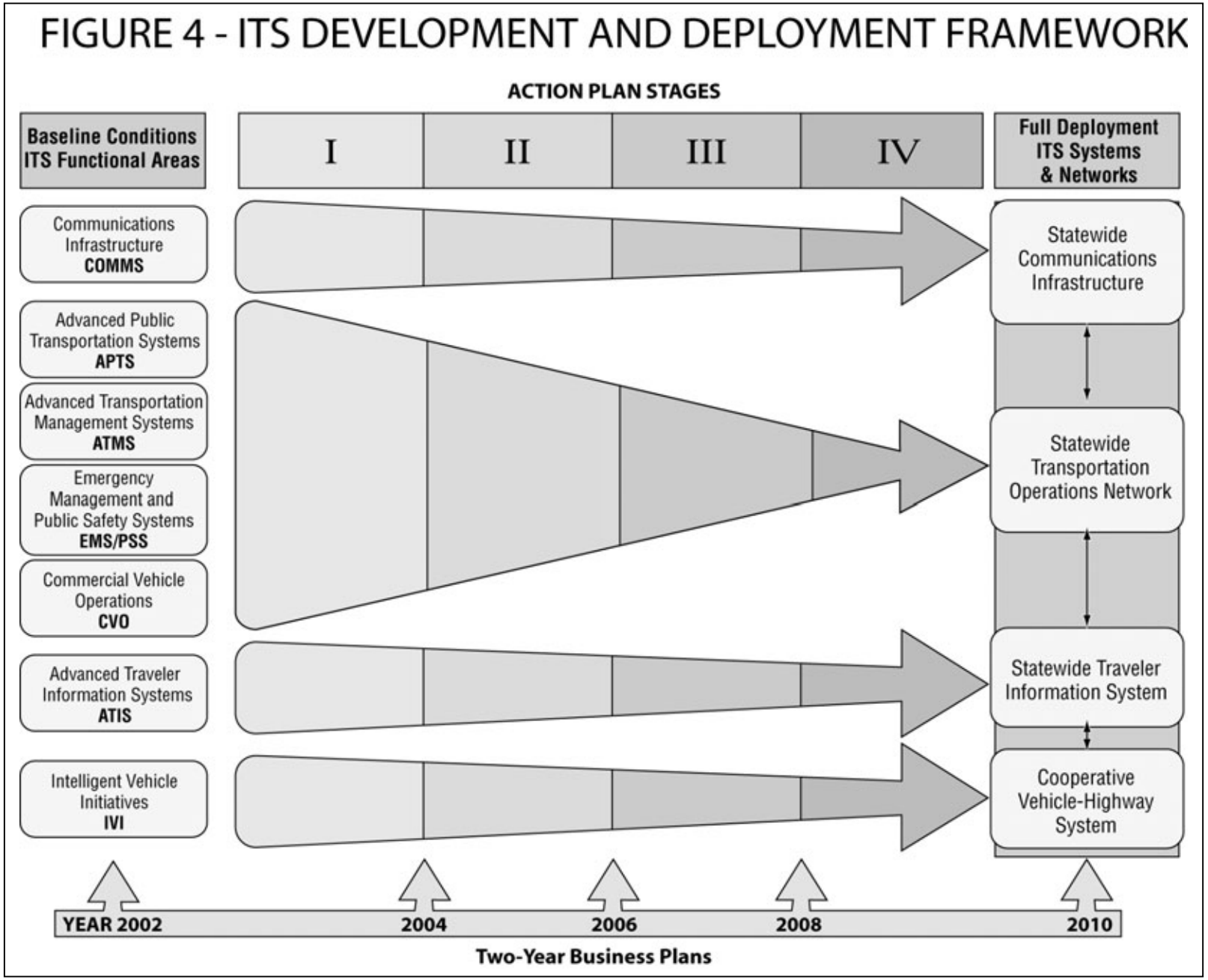
Program Delivery Process in the Context of the ITS Development & Deployment Framework

This section, with Appendix B, provides additional detail on the migration process required to advance each of the functional areas to full deployment programs. The ITS functional areas are:

- Advanced Public Transportation Systems (APTS)
- Advanced Transportation Management Systems (ATMS)
- Emergency Management and Public Safety Systems (EMS/PSS)
- Commercial Vehicle Operations (CVO)
- Advanced Traveler Information Systems (ATIS)
- Intelligent Vehicle Initiatives (IVI)
- Communications Infrastructure (COMMS)

The following process is proposed, in conjunction with the two-year business plans, for achieving program delivery.

FIGURE 4 - ITS DEVELOPMENT AND DEPLOYMENT FRAMEWORK



The model for migrating from current baseline conditions towards full deployment consists of defining the following elements for each of the ITS functional areas:

1. ITS technologies that comprise each functional area

2. Relevant development and deployment issues for each technology identified including:

   - Potential technological issues
   - Additional research and operational tests required
   - Applicable geographic area of coverage, extent or size
   - Interjurisdictional arrangements to be negotiated
   - Relationship to other functional areas and programs
   - Public and private sector roles and responsibilities
   - Potential barriers to continued deployment, including operations

3. Business plan development process

4. Responsibilities and resource requirements

5. Public and private sector roles

Since not all of these factors apply to every functional area, it will be important to conduct a thorough review to identify and address the applicable ones.

Appendix B expands on the five steps defined above for moving from current baseline conditions to full deployment for each of the functional areas identified.

Ongoing Operations Concept

Many of the benefits of Intelligent Transportation Systems deployment are derived from the efficiencies generated by integrating related transportation systems operated by different agencies. Early in ITS deployments, projects were conceived and implemented individually, without much consideration to how they would inter-operate with existing or future systems. Beginning with the ORION project in the late 1990s, integration was made a priority at both the system and jurisdiction level, resulting in a project that integrated across both technical and administrative boundaries. The US DOT places increasing emphasis on the necessity to plan for integration of ITS projects, with the intent of maximizing the benefits derived and eventually mainstreaming ITS.

Developing an integrated deployment program is a complex undertaking and requires careful planning for each deployment. Two tools that have proven useful are the Operations Concept and the Technology Roadmap.

Operations Concept

The Operations Concept is essentially a description of a proposed system that defines the following areas and attributes:

Planning

- Stakeholders
- Relevant needs of the stakeholders
- Information expected from stakeholders
- Information disseminated to stakeholders
- Ability of stakeholders to interact with information provided
- Administrative relationship to existing systems or procedures
- Technical relationship to existing systems or procedures
- Intended uses
- Technical life cycle

Deployment

Roles and responsibilities for:

- Definition of system
- Technical development
- Capital expenditures

Operations

Determine the following:

- Entity responsible for system inputs
- Entity responsible for system outputs
- Entity responsible for maintenance of each system component

Once this information is compiled, stakeholders can plan for commitment of internal resources and for the method by which they will interact with other partners in the project. Additionally, stakeholders will be able to use the Operational Concept to plan their strategies for internal systems that may complement, or be complemented by, the project.

The Operations Concept should also include a Memorandum of Understanding (MOU) signed by an authorized representative of each stakeholder group. The MOU should include a section with a summary of the Operations Concept and a section describing the commitments and responsibilities of each signing entity. The MOU will help ensure that resources are not wasted creating a system that will not be properly used, maintained or supported by the stakeholders.

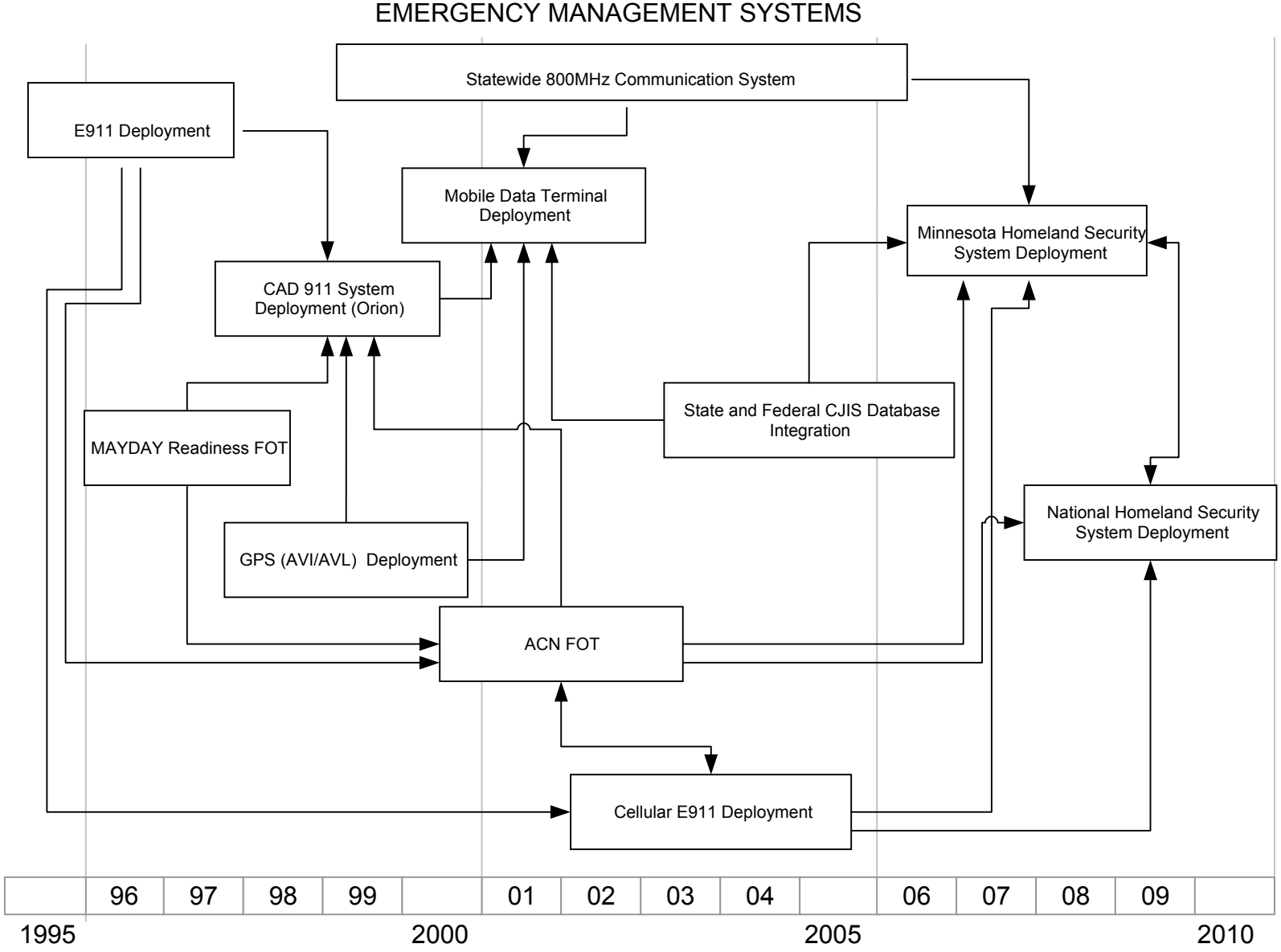
Operations Concepts are not intended to be detailed design documents, rather they provide the basis for creating the Systems Requirements Document and, from that, the system specifications. The Operations Concept should be reviewed (at least annually) to ensure that organizational changes do not make a stakeholder's commitment impossible to fulfill.

Technology Roadmap

The Technology Roadmap depicts the project and its relationship to other systems, either deployed or planned, within the context of a timeline. Figure 5 on the following page illustrates how a Technology Roadmap cold be applied to public safety systems in the 1995 to 2010 timeframe. While shifts in technology can alter the Roadmap, it is reasonable to include systems either deployed or planned that may support or complement the project. Supporting systems may either be other ITS deployments that make use of a project's inputs or outputs, or a system that, while not directly an ITS deployment, may provide the infrastructure necessary for a given project's operation.

When preparing the Technology Roadmap, all aspects of the system and their interrelation to other system should be considered. The Roadmap should be updated as deployment decisions affecting complementary technologies and systems are made. This implies that a technology map should be considered work-in-progress. Decisions about what full deployment consists of and a timeframe element need to be made since all required technologies may not be available at the same point in time. However, care should be taken to ascertain that only elements with a high degree of certainty of being deployed are represented for future years, since speculation may lead to incorrect decisions by both project stakeholders and others planning for system deployment based on the roadmap for the program.

FIGURE 5 - EXAMPLE OF TECHNOLOGY ROADMAP



APPENDIX A

MATRIX SUMMARY OF ACTION ITEMS

Action Items by Implementation Area

	Base Input		Development of Deliverables	Dissemination and Implementation
	Ranking Order	Action	Action	Action
Implementation Area 1 - Program Deployment Principles and Criteria	1	Identify applicable deployment principles for each program. Create program-specific measures to assess the level of effectiveness in increasing safety, efficiency and quality of life.	As programs and projects are deployed, compare deployment results to objectives.	
	2	Document program history. Conduct a comprehensive review of past ITS projects and programs to determine cost, benefits, and lessons learned and resulting deployments. Develop a review process that identifies "lessons learned."	Complete post-project review that identify "lessons learned," pros, cons and improvement areas.	
	3	When applicable, develop baseline conditions for all programs and projects.	Record conditions after deployment so that a comparison can be made to baseline conditions.	
Implementation Area 2 - Outreach	1	Review reported ITS benefits from other sources. Continue to seek input on the benefits of ITS from agencies and organizations.	Develop a comprehensive list of benefits associated with ITS that can be incorporated into the ITS message.	
	2	Develop a prioritized list of targeted message recipients for the next year. Continue to update and refine a list of targeted recipients. Make sure the message that was developed for the group still applies.	Develop a primary ITS benefits message that is flexible enough to allow it to be targeted to multiple groups. Begin to develop a package for message distribution that does not necessarily require face-to-face meetings with the targeted audience.	Use the materials developed for delivering the ITS message. Refine the materials as needed. Create press releases highlighting the benefits of ITS (e.g., benefits of the snowplow given the significant amount of snowfall this year).
	3	Develop a list of organizations and agencies that can help deliver the ITS message.	Contact organizations and agencies to enlist their assistance in delivering the ITS message. Continue to look for appropriate venues for delivering the ITS message (conferences, lunches, forums, etc.).	Host forums and participate in conferences where researchers, practitioners and the private sector are together. Work closely with ITS America, ITS Minnesota, NCITE and other groups to disseminate the message. Prepare quarterly updates on outreach activities.

Action Items by Implementation Area (continued)

		Base Input	Development of Deliverables	Dissemination and Implementation
	Ranking Order	Action	Action	Action
Implementation Area 3 - Partnerships	1	Review Board of Directors' membership to make sure that groups are not underrepresented. Document partnership history and experience.		Promote the mix of the Guidestar Board of Directors so that there is equal representation of the private and public sectors. Bring in people to Guidestar Board Meetings to talk about partnerships that they have participated in.
	2	Create a list of best management practices in forming partnerships.		Distribute a list of best management practices in forming partnerships.
	3	Generate a list of firms and agencies that are interested in partnering on ITS projects.	Create a message for promoting partnerships. Create a message for promoting partnerships.	Deliver the message on partnerships. Host forums and participate in conferences where researchers, practitioners and the private sector are together.
Implementation Area 4 - Delivery	1	Develop a glossary of the key components of research, operational testing and deployment. Define and distinguish operational tests from deployment efforts.	Outline a general process for bringing a product to deployment. Create and implement a database that identifies and tracks research operational tests. Develop a message that focuses on the importance of research and operational testing to deployment.	Deliver the message on research, operational testing and deployment. Bring in people to Guidestar Board Meetings to talk about research and partnerships that they have participated in.
	2	Determine what activities and programs need to be integrated and to what extent they should be integrated. Develop a list of groups that should receive information on the importance of system integration and interoperability.	Develop a message that explains the importance of system integration and interoperability.	Deliver the message that explains the importance of system integration and interoperability. Launch pilot projects that have standards that the private and public sectors can follow and model. Ensure that products are compatible with the state's infrastructure.
	3	Develop a form or select a software program that can help project managers create a detailed plan for program and project delivery. Break programs into logical projects. Define "timely delivery" at the start of each project and set a realistic delivery date. Break the project up into short tasks. Select appropriate points in the process for evaluating progress. Once projects are broken into tasks, create a detailed plan for each project that outlines scheduling, testing and budgets.	Compare schedule and mainstreaming targets against actual progress.	Monitor program and project process.

APPENDIX B

ITS FUNCTIONAL AREAS: MIGRATION PROCESS

Advanced Public Transportation Systems (APTS)

APTS are intended to enhance public transportation choices, safety and efficiency. The goals of the APTS program are to: (1) promote the use of advanced technologies in public transportation vehicles and the guideways and dispatch centers they use, and (2) to help break down jurisdictional barriers to communication and cooperation through the sharing of technologies.

1. ITS Technologies that Define APTS

Vehicle Systems

- Automated Vehicle Location
- Computer-Aided Dispatch
- Automated Dispatch
- Advanced Fare Payments (e.g., Smart Cards)
- Vehicle Data/Voice/Video Communications
- Internet-Ready Ports
- Bus/Rail Priority at Traffic Signals

Customized Services

- Itinerary Planning (minimize transfer, wait time on telephone)
- At-home transit subscription services (e.g., faxed route/schedule changes)

Center Systems

- Dispatcher Vehicle Data/Voice/Video Communications
- Consolidated Dispatching Functions
- Consolidated Emergency Response

2. Identify Relevant Development and Deployment Issues

- Potential Technological Issues (e.g., availability of communications infrastructure, integration of legacy systems, etc.)
- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication; sensing, measurement, and control systems; social and economic policy issues related to ITS technologies)

- Applicable Geographic Area/Size (e.g., Metro Area versus Greater Minnesota, number of Public Transit Operations, number of Transit Vehicles, etc.)
- Interjurisdictional Arrangements (e.g., co-location when consolidating services such as dispatching or emergency response, cost-sharing and benefits-sharing, etc.)
- Relationship to Other Functional Areas and Programs (e.g., communications infrastructure availability, traffic operations center availability, etc.)
- Public and Private Sector Roles and Responsibilities (e.g., agreement among partners of who is responsible for what operations, areas or elements agreement on what level of service each should provide, etc.)
- Potential Barriers to Continued Deployment (e.g., training and education necessary to avoid process difficulties and initial resistance to technologies, identification of procurement requirements and ongoing operations and maintenance costs, etc.)

3. Business Plan Development

Once baseline (2002) and full deployment (10-year) states are defined for APTS as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required.

The ITS APTS Business Plan should be coordinated with Mn/DOT's Office of Transit Business Plan; working closely with the Metropolitan Council (Metro Transit) for the metro area.

4. Responsibilities and Resources

Ultimately the responsibility for each ITS solution implemented to achieve the goals will rest with those charged with the day-to-day operation of the system. Support from state agencies that make decisions about funding and regulation will be required. Without this support, there is a risk that systems will be deployed without adequate resources (funding, administrative, operations, maintenance etc.). Before deployment can occur, the following questions must be asked and answered:

- What is the role of the Department of Transportation, Department of Public Safety, and other pertinent offices within agencies (e.g., Office of Transit, Mn/DOT Metro and Districts, Met Council)?
- What commitments must be made to persuade system operators that they will not be "abandoned" following deployment?
- Who is the champion within each operator's office?
- What is the policy regarding operations and maintenance costs?

5. Public and Private Sector Roles

Champions within each of the public agencies involved in APTS as well as among private sector interests will need to be identified and their efforts coordinated.

The public and private sectors have provided varying levels of participation and commitment to different ITS implementations. This seems unlikely to change in the near future. Decisions are made by government entities for their own services, but in many cases, cooperation with private-sector companies will need to occur. Questions such as the following will need to be answered through negotiations:

- What will the Return On Investment (ROI) be for any solution under consideration?
- For what minimum acceptable level of service (provided by the public sector) is the ROI defined?
- Will a government investment adversely affect a private entity providing similar functions? (Itinerary planning)
- Are public and private concerns compatible for achieving solutions?

Advanced Transportation Management Systems (ATMS)

ATMS seeks to gather information relating to traveler movements and other conditions that may affect mobility and, using that information, to improve the overall performance of transportation systems, particularly safety, travel time and travel time reliability. The goals of the ATMS program goals are to: 1) promote the use of advanced techniques and technologies in transportation management centers, monitoring and communication systems; and 2) foster cooperation between multiple jurisdictions managing differing modes and levels of transportation systems.

1. Identify ITS Technologies that Define ATMS

Roadside Systems

- Visual Monitoring Systems
- Vehicle Detection Systems/Speed Travel Time Measurement Systems
- Incident Detection Systems
- Work Zone Management
- Access Control Systems (ramp meters, etc.)
- Roadside Information Systems (VMS, HAR, etc.)
- Signal Control Systems

Communications Systems

- Wireless Communication Systems
- High-Bandwidth Communication Systems (fiber optics, etc.)

Center Systems

- Traffic Management Systems
- Data Processing/Storage Systems
- Incident Management Systems (CAD, Highway Helpers, etc.)
- Consolidated/Coordinated Emergency Response/Safety Enforcement
- Consolidated/Coordinated Maintenance Dispatch

2. Identify Relevant Development/Deployment Issues

- Potential Technological Issues (e.g., large communication infrastructure needs, lack of technology maturity that hinder effective deployment, complex systems with large operations/maintenance requirements, etc.)
- Additional Research/Operational Tests required (e.g., human performance and behavior; computing, information and communication; technologies for modeling, managing and operating transportation systems)
- Applicable Geographic Area/Size (e.g., Metro Areas versus Greater Minnesota, freeway and arterial corridors, number of modes/miles of roads to cover, etc.)
- Interjurisdictional Arrangements (e.g., management of differing classification roads by differing jurisdictions, co-location of differing services, cost sharing, etc.)
- Relationship to Other Functional Areas and Programs (e.g., communications infrastructure availability, integration with Public Transportation Systems, Emergency Response/Enforcement Systems, and Commercial Vehicle Operations)
- Public and Private Sector Roles and Responsibilities (e.g., use of privately-owned communications infrastructure, contracted operations to private firms, agreements on data collection sharing and roles for each sector, etc.)
- Potential Barriers to Continued Deployment (e.g., deployment of advanced technologies can be prohibitively expensive, need to clearly define roles of operating agencies, stewardship of deployed resources utilized by multiple entities, liability issues related to deploying new technology, etc.)

3. Business Plan Development

Once baseline (2002) and full deployment (10-year) states are defined for ATMS as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required and will address the need to evaluate technology, as it is incrementally deployed.

The ITS ATMS Business Plan should be coordinated with TMC, TOCC and IRC plans.

4. Responsibilities and Resources

Because of the large resource commitment necessary for some ATMS deployments (surveillance networks, etc.), every effort should be made to be certain that these systems would benefit multiple users. In this way, the resources of multiple entities can be pooled to fund deployment and operational costs. However, to fully realize this benefit, careful planning must occur to define what a system may, and perhaps more importantly, may not be used for. For example, if a video surveillance system is jointly funded by public safety and transportation entities, should it be available for non-transportation law enforcement uses? Some of the questions to consider prior to deployment should be:

- What uses of the system will benefit the public the most?
- Should an official policy be created to determine the priority of ATMS subsystem uses?
- How will the public react to surveillance and control systems deployed on road or rail networks?

5. Public and Private Sector Roles

Operation of Transportation Management Systems has traditionally been the charge of public entities; however, significant opportunities for public/private cooperation have been shown to be successful. Private entities can operate transportation facilities entirely, as with toll roads, or can provide operations services under contract to a public agency, as with the ARTIMIS system in Ohio. To satisfy the business requirements of private firms and the operational needs of public agencies, the following should be considered:

- How will ownership and uses of data collected by ATMS be determined?
- Is the public sector commitment sufficient for long-term private investment?
- Is private sector commitment sufficient for the public sector to realize its goals?
- Can the operation of ATMS be sufficiently flexible for private firms to respond to changing market conditions?

Emergency Management and Public Safety Systems (EMS/PSS)

EMS/PSS comprises a wide range of incident response, public safety management and disaster management systems. The goal of EMS/PSS is to minimize response times and provide the most appropriate level of response in the most efficient and cost effective manner possible in order to save lives and minimize traffic disruption.

1. Identify ITS Technologies that Define EMS/PSS

Vehicle/Personal Systems

- Automated Vehicle Location (AVL)
- Mobile Communications

- Enhanced Vehicle Collision Information
- Automated Collision Notification
- Mobile Computing
- Machine Vision Systems
- Voice Recognition Systems
- Identification Biometrics (thumbprint scanners, face recognition, etc.)

Roadside Systems

- Red-light running

Center Systems

- Consolidated 911/Dispatching Functions
- Computer Aided Dispatch (CAD)

2. Identify Relevant Development/Deployment Issues

- Technological Barriers (e.g., communications availability, accuracy/reliability of systems, privacy/citizens rights concerns, etc.)
- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication; sensing, measurement, and control systems; social and economic policy issues related to ITS technologies)
- Applicable Geographic Area/Size (e.g., metro vs. rural coverage, agency roles, etc.)
- Interjurisdictional Arrangements (e.g., joint dispatch facilities for multiple jurisdictions/services; communications/notifications for jurisdictions not included in central dispatching; understanding and agreeing on the roles of emergency response, public safety and Mn/DOT operations personnel; among others; etc.)
- Relationship to Other Functional Areas and Programs (e.g., data/facility sharing with ATMS centers, data sharing with ATIS, etc.)
- Public and Private Sector Roles and Responsibilities (e.g., public sector historically has sole law enforcement responsibilities, private sector has provided medical (ambulance, etc.) services, both sectors must have accurate and timely data from the other for effective management, etc.)
- Potential Barriers to Continued Deployment (e.g., cost, law enforcement personnel resistance to tracking/data collection systems, resistance to data collection/data sharing between agencies, etc.)

3. Business Plan Development

Once baseline (2002) and full deployment (10-year) states are defined for EMS/PSS as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required.

The EMS/PSS Business Plan should be coordinated with the Department of Public Safety and TOCCs plans.

4. Responsibilities and Resources

EMS/PSS operators have substantial operations and maintenance responsibilities due to the 24-hour required uptime of the systems dealing with public safety. Careful consideration should be given to the staffing resources that must be dedicated to any EMS/PSS project in addition to the capital costs of the systems.

If systems are to share or access previously protected data, EMS/PSS operators should dedicate resources to working with the legislature to assure that policy makers understand the need for any legal changes and that data will continue to be protected.

5. Public and Private Sector Roles

Since it is in the private sector where technologies are typically developed, the public sector should maintain close relationships to these developers to be certain that EMS/PSS needs are well understood and addressed in products. Public sector agencies should take on the responsibility for formally documenting needs, procedures, and operational requirements to allow private sector firms to minimize costs involved with development.

Private sector EMS/PSS providers such as ambulance services should seek ways to integrate their dispatching information (if not actual operations) into regional 911 centers. Two-way data sharing between systems can make response both more rapid and more appropriate.

Commercial Vehicle Operations (CVO)

CVO is a diverse collection of technologies that are deployed to help reduce costs and improve commercial vehicle fleet mobility, safety and security. CVO can advance these goals by minimizing the time vehicles are stopped for credential verification, weight and safety inspections and reducing the number of incidents that involve commercial vehicles.

1. Identify ITS Technologies that Define CVO

Roadside Systems

- Weigh-in-motion systems
- VMS for advanced information (parking availability in rest areas, weight restrictions, speed warnings on curves or high-grade downhills, congestion information, etc.)
- Oversize/over height detection systems

Vehicle/Personal Systems

- Automated vehicle location
- Automated safety
- Vehicle smart tags
- Electronic weight restriction notification
- Computerized manifests
- Better in-vehicle data systems
- Automated safety detection systems (brake overheating control and warning system)

Center Systems

- One-stop computerized permitting for multiple jurisdictions
- Computerized dispatch and tracking systems (GPS/AVL)

2. Identify Relevant Development/Deployment Issues

- Technological Barriers (e.g., agreement on standards, acceptance and penetration of technologies, costs to private vehicle operators/fleet operators, technology lag (brake overheating controls), equipment reliability, etc.)
- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication; sensing, measurement, and control systems)
- Applicable Geographic Area/Size (e.g., multi-state/national systems need, roadside systems requirements along major freight corridors, etc.)
- Interjurisdictional Arrangements (e.g., need for federally-mandated equipment, multi-state coordination requirements, processes and equipment, etc.)
- Relationship to Other Functional Areas and Programs (e.g., CVO may connect directly or indirectly to public safety (EMS/PSS) agencies for enforcement, other agencies may wish to have access to CVO data for safety and traveler information purposes, etc.)

- Public and Private Sector Roles and Responsibilities (e.g., private sector must equip vehicles, public sector must coordinate between jurisdictions to minimize cost/complexity for operators, public/private sectors must collaborate on standards, some CVO operational aspects may be performed under contract by the private sector, etc.)
- Potential Barriers to Continued Deployment (e.g., costs to both public and private sectors, inability to agree on requirements for use, inability to agree on technical standards for equipment differing legal restrictions between jurisdictions, etc.)

3. Business Plan Development

   Once baseline (2002) and full deployment (10-year) states are defined for CVO as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required.

   The ITS CVO Business Plan should be coordinated with Mn/DOT's Office of Motor Carrier Services Business Plan.

4. Responsibilities and Resources

   The public sector must actively work with other jurisdictions to establish standards for vehicle restrictions, data collection needs, procedures and permitting requirements. Without these basic "ground rules" in place, it would be difficult, if not impossible to create systems with sufficient standardization to be economically feasible. These standards should be agreed upon by the regulating agency and private industry and advanced on the legislative level.

5. Public and Private Sector Roles

   Since commercial operators are concerned primarily with profitability, projects will win support from the private sector if clear benefits from the investments can be shown in the short to mid-term. Efforts with unclear benefits or those that are simply mandated by law will receive opposition from the private sector.

Advanced Traveler Information Systems (ATIS)

ATIS seeks to provide accurate and timely information to travelers, when and where they need it, so they can make better choices (route, mode, time), improve their travel time reliability (by reducing the impact of incidents and accidents), and improve safety (by reducing the potential for crashes).

1. Identify ITS Technologies that Define ATIS

ATIS systems are nearly universally assembled to provide travelers easy access to information that may affect the quality, duration or safety of their trip. Most commonly used are:

Roadside Systems

- Roadside information (Variable Message Signs, Advisory Signs)
- Radio-based systems (these can be voice highway advisory type or Radio Data Service (RDS) (FM sideband) data type)

Vehicle/Personal Systems

- In-vehicle systems (OnStar type)
- Personal Digital Assistant (PDA) page services
- Cellular Phones
- Navigational Systems

Center Systems

- Telephone-based information systems (CARS: weather, trip times, incidents, construction, detours)
- Web-based systems
- Dedicated television channels
- E-mail-based update systems

2. Identify Relevant Development/Deployment Issues

- Technological Issues (e.g., availability of a distribution channel to travelers, reliability of new technologies, real-time data management/distribution, bandwidth availability, etc.)
- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication; sensing, measurement, and control systems; technologies for modeling, managing, and operating transportation systems; social and economic policy issues related to ITS technologies)
- Applicable Geographic Area/Size (e.g., state to state/regional compatibility, metro areas versus rural area system availability, roadway classification limits, etc.)
- Interjurisdictional Arrangements (e.g., data for local roads/transit available on state operated system, staffing for data on dissimilar modes or road classes, etc.)
- Relationship to Other Functional Areas and Programs (e.g., closely tied to ATMS to manage travel flow, may have an EMS/PSS/incident management component, etc.)

- Public and Private Sector Roles and Responsibilities (e.g., either public or private sector can do collection or dissemination. Which is appropriate will depend on the specific program goals and the characteristics of the market in a given area, etc.)
- Potential Barriers to Continued Deployment (e.g., availability of data, availability of appropriate distribution mechanisms, market size and perceived value, ability to publicize service availability, etc.)

3. Business Plan Development

Once baseline (2002) and full deployment (10-year) states are defined for ATIS as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required.

The ITS ATIS business Plan should be coordinated with Mn/DOT's Office of Traffic Engineering/Intelligent Transportation Systems (OTE/ITS) Business Plan.

4. Responsibilities and Resources

Because of the wide range of data types involved, ATIS generally requires sharing of information between public and private entities. Substantial resources are also required to fund the data collection effort:

- Who will define the operations concept for the integrated system?
- Are regional centers responsible for data collection within their regions? How do they interface with cities, etc.?
- Is data collection a dedicated staff function? How is it funded?
- Who has responsibility for the quality of the data? The collecting agency? Mn/DOT?
- Is a central database to be used? Mn/CARS? DDN?

5. Public and Private Sector Roles

ATIS is the ITS functional area most commonly thought of as having substantial private sector roles. Since it involves dealing directly with the traveler at some stage, there may be sales or marketing opportunities available. However, some issues should be considered:

- Are private and public expectations compatible? For example, the State may wish to minimize the number of pages viewed on a web site to convey a traveler's information. However, a private entity may wish to maximize the pages viewed as it derives revenue from advertising on each page.
- Is the public sector offering a product that may adversely affect a competitive market?

- Should the public sector continue to provide safety and system efficiency information while the private sector offers more customer-service type of information, by adding value to basic information? (See Guidestar's ATIS Strategic Plan.)

Intelligent Vehicle Initiatives (IVI)

IVI covers a broad range of both vehicle and roadside systems that allow a spectrum of functionality from simple driver prompts (lane reminders, "dozing" driver warnings), to driver assistance systems (active cruise control), to fully automated self-guiding vehicles. These systems seek to maximize safety and system capacity through the use of technologies that can outperform their human counterparts for the similar tasks.

1. Identify ITS Technologies that Define IVI

Vehicle Systems

- Collision Avoidance
- Driver Condition Sensors
- Vehicle Location Sensors (GPS)
- Machine Vision
- Vehicle Impact Sensors
- Guidance/Routing Software

Roadside Systems

- Vehicle Positioning (magnetic sensors, smart tape)
- Wireless Data Communications

Center Systems

- Digital Mapping (GIS)

2. Identify Relevant Development/Deployment Issues

- Technological Issues (e.g., reliability / maturity of various technologies, cost to consumers for in-vehicle devices, cost to operating entity for roadside systems, communications availability, interoperability of different manufacturer's systems, availability of performance and technical standards, etc.)
- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication; sensing, measurement, and control systems; social and economic policy issues related to ITS technologies)

- Applicable Geographic Area/Size (e.g., interstate compatibility, metro areas versus rural area system availability, etc.)
- Interjurisdictional Arrangements (e.g., system support on local roads, technology to be mandated in vehicles, etc.)
- Relationship to Other Functional Areas and Programs (e.g., supporting systems (lane markers, stripes, etc.) closely tied to construction/maintenance, vehicle operational changes can affect planning and design functions, etc.)
- Public and Private Sector Roles and Responsibilities (e.g., large private sector role as many devices must be consumer products, public sector to set standards, if systems require vehicle to roadside interaction, standards must be agreed upon by both public and private sectors, etc.)
- Potential Barriers to Continued Deployment (e.g., high costs to consumers, legal/liability issues, public acceptance of tracking/monitoring technologies, lack of standards (chicken and egg problem), lack of installed base for users, etc.)

3. Business Plan Development

Once baseline (2002) and full deployment (10-year) states are defined for IVI as a whole, as well as for each technology application, two-year business plans should be established that define and track what activities must be undertaken in each business plan cycle to ensure that full deployment will be achieved as planned. The business plans will also identify responsibilities and resources required.

Coordinate the IVI Business Plan with Mn/DOT's OTE/ITS Business Plan.

4. Responsibilities and Resources

The public sector can encourage deployment of IVI by assembling high-level legislative and policy support and offering technical resources to work cooperatively with private firms for IVI development. The public sector should take responsibility for assuring that any technology deployed appropriately protects traveler safety and privacy expectations.

The ITS IVI Business Plan should be coordinated with Mn/DOT's OTE/ITS Business Plan.

5. Public and Private Sector Roles

Responsibilities for the public sector will center on the development and deployment of roadside devices. This may take the form of either providing standards and right-of-way access for private firms or the actual purchase and installation of the devices themselves. For devices in the vehicles themselves, the private sector will have ultimate responsibility for developing the hardware, services and market. Public sector involvement will likely be limited to standards development, unless a purchase subsidy is involved.

Communications Infrastructure (COMMS)

All Intelligent Transportation Systems, by their nature, rely on the transfer of information at some point in their operation. The goal of the Communications Infrastructure deployment for ITS should be to provide reliable service with suitable bandwidth for the required functions in the targeted coverage area. Many and different solutions exist for communication of voice, video and machine-readable data. The mechanism for any given application should be chosen to maximize the inter-operability of systems while providing the information transport required for the application's needs.

1. Identify Communications Infrastructure Technologies

Vehicle/Personal Systems

- Cellular Handsets
- Satellite Receivers
- MDTs and MDCs
- Mobile Computing Devices
- Digital and Analog Mobile Radios
- Wireless Modems/Network Adapters
- AVL Systems

Roadside Systems

- RF/Cellular Towers
- RF/Cellular Base Stations
- Wireless Access Points
- Dedicated Short Range Radio
- Copper and Fiber Optic Cables
- Wired or Wireless Regenerators/Repeaters
- Gantry Systems

Center Systems

- Telco Central Offices
- Network Operations Centers

2. Identify Relevant Development/Deployment Issues

- Potential Technological Barriers (e.g., standards/compatibility, range, bandwidth, and reliability of transmission systems, system security and resistance to infiltration, etc.)

- Additional Research/Operational Tests (e.g., human performance and behavior; computing, information and communication)
- Applicable Geographic Area/Size (e.g., regional versus statewide, etc.)
- Interjurisdictional Arrangements (e.g., frequency cross-licensing, frequency sharing, bandwidth sharing, data security and access for multiple jurisdictions, etc.)
- Relationship to Other Functional Areas and Programs (e.g., nearly all other areas interact with the communication infrastructure at some level)
- Public and Private Sector Roles and Responsibilities (e.g., public sector may chose to build its own facilities, private sector frequently will provide landline facilities or RF frequencies on a lease basis, etc.)
- Potential Barriers to Continued Deployment (e.g., cost, agreements must be in place between jurisdictions regarding use, available right-of-way for landlines or available spectrum for RF systems, etc.)

3. Business Plan Development

It will be important to work closely with Mn/DOT's Office of Electronic Communications to coordinate the business plan development for ITS development and deployment programs with those of the Office of Electronic Communications.

The ITS Communications Plan should be coordinated with Mn/DOT's Office of Communications Business Plan.

4. Responsibilities and Resources

Mn/DOT's Office of Electronic Communications has taken an active role in the planning and deployment of large-scale, transportation-oriented communications systems and should continue to provide coordination, planning and deployment support for ITS systems.

Due to the long deployment times, regulatory compliance requirements, and large costs sometimes associated with communication systems, legislative support is frequently needed for successful deployments. Close communication with policymakers is therefore highly desirable.

5. Public and Private Sector Roles

Either public or private entities can, and have, taken responsibilities for the design, construction, and operation of any type of communication system.

Generally, the decision of whether to lease or purchase infrastructure is based on a comparison of the costs of acquisition and long term maintenance to the recurring costs of purchasing communications as a service from a private sector provider.