Advanced Rural Transportation Systems (ARTS)

Strategic Plan

August 1997

ADVANCED RURAL TRANSPORTATION SYSTEMS (ARTS) STRATEGIC PLAN

EXECUTIVE SUMMARY

The U.S. Department of Transportation (U.S. DOT) created the Intelligent Transportation Systems (ITS) Joint Program Office (JPO) to manage the ITS program. JPO is housed within the FHWA, but has liaisons with each modal Administration (except the Federal Aviation Administration) within the U.S. DOT. The JPO also receives policy guidance directly from the ITS Management Council which is chaired by the Deputy Secretary of Transportation. Although this document will be issued by the FHWA, that agency will hereinafter be referred to as the U.S. DOT in order to reflect the variant roles of each modal Administration in the ITS program.

This Strategic Plan has been developed for the Advanced Rural Transportation Systems (ARTS) portion of the ITS Program. The plan focuses on the Federal Government's role in developing rural ITS options and prudently managing emerging ITS technologies within rural settings from conception to viable options for implementation. The Strategic Plan meets the needs of the US DOT by providing a basis for sound decision-making for program development, as well as being consistent with the Government Performance and Results Act of 1993 (GPRA). Items in italics are references from, ``Strategic Planning, An Overview for Complying with GPRA,'' by Philip Blackerby. The plan also looks at the ARTS program's role in developing and fostering the application of ITS in rural areas over the next twelve years. It describes the program's vision, mission, goals, objectives, and measures. Because of the diversity of needs and varied settings in rural America, this plan also developed seven critical program areas (clusters) which provide areas of common interest and focus within the overall program.

Appendix A contains the ARTS Program Plan which proposes five years (FY 97- FY 01) of USDOT projects and activities to advance the ARTS in partnership with other national, state and local public agencies, and with the private sector. Public sector activities will be focused on an ARTS infrastructure that will support various services to transportation providers and users. The ARTS will be fully coordinated with the national ITS through a common national architecture and standards. The ARTS will focus on rural needs and conditions, but will be interoperable with extensions of metropolitan ITS, and will be seamless for travelers and commercial vehicles. The Strategic and Program Plans for the ARTS are being coordinated by the multi-administration Rural Action Team within USDOT.

Note: For Purposes of this report, rural America is defined as communities or areas with less than 50,000 residents.

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INTRODUCTION

The GPRA requires each Federal agency to prepare: (1) Strategic plans that define an agency's mission and long-term goals; (2) annual performance plans containing specific targets; and (3) annual reports comparing actual performance to the targets set in the annual performance plans.

US DOT has already put forth significant efforts to assure that the overall ITS program is consistent with the GPRA, including the preparation of the ITS Strategic Plan and the development of a set of measures for evaluating the program's progress[1].   While every element in the ITS program should respond to the overall goals and objectives provided in the overall ITS program, it is recognized that conditions and needs vary greatly across the United States and, as a result, the focus of the ITS program and its elements may vary from area to area. Accordingly, the ITS Architecture identified the following three separate transportation environments to aid in thinking about and analyzing the different needs and required focus:
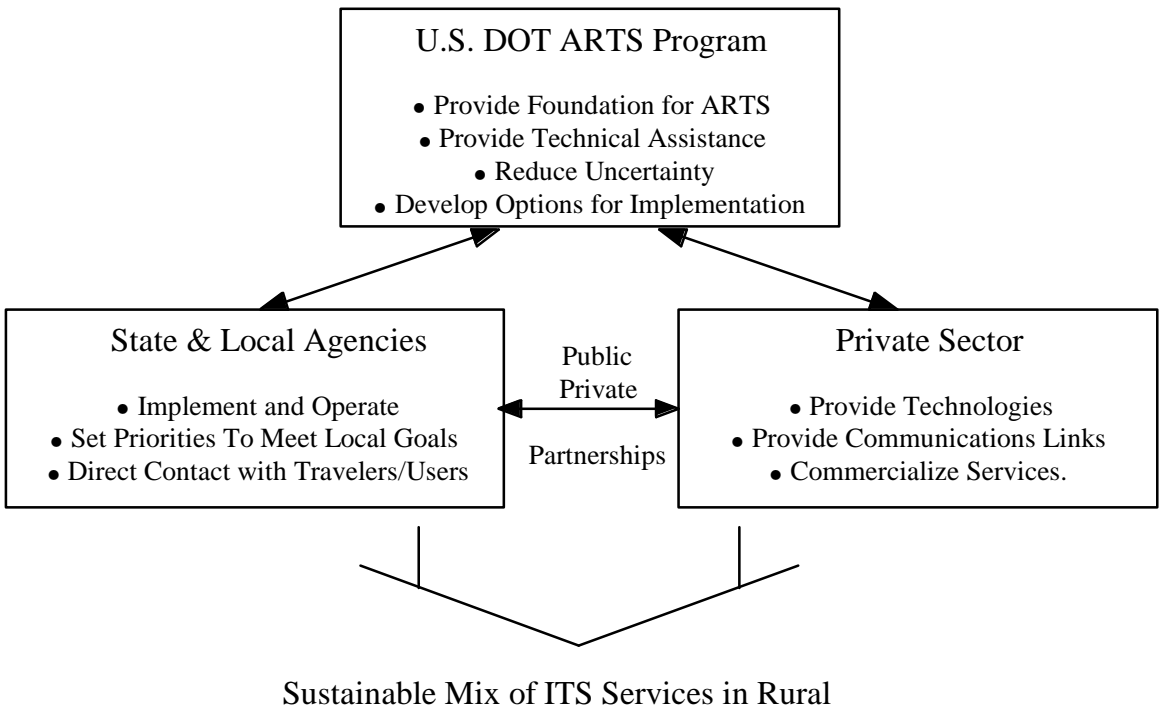
1. Urban
2. Inter-Urban
3. Rural

Each has its own set of needs, priorities and concerns. For example, the major initiative for urban areas focuses on the mitigation of congestion and improvement in traffic flow that ITS technologies can offer.

On the other hand, the ARTS Program is concerned with travel within and through rural America. The conditions found in rural travel (including inter-urban travel through rural areas), the characteristics of the travelers, and the costs of maintaining the rural system all point to the need for a focused program for developing advanced technology solutions for transportation in rural America. Some of the attributes found in rural environments that make this need critical are:

C   Mix of users (rural and urban travelers);
C   Secondary roads with less frequent maintenance, low volume primary and other state highway routes;
C   Steep grades/blind corners/curves/few passing lanes;
C   Large variance in travel speeds (frequent passing);

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[1] These ``Few Good Measures'' include measures to meet goals in the following categories: Time savings; Reductions in crashes; Reductions in fatalities; Increased throughput; Cost savings; and Improved customer satisfaction. (``Implementation of the National Intelligent Transportation System Program: 1996 Report to Congress'').

Figure 1
Primary Roles For Advanced Rural Transportation Systems Implementation

U.S. DOT ARTS Program

- Provide Foundation for ARTS
- Provide Technical Assistance
- Reduce Uncertainty
- Develop Options for Implementation

State & Local Agencies

- Implement and Operate
- Set Priorities To Meet Local Goals
- Direct Contact with Travelers/Users

Public
Private

Partnerships

Private Sector

- Provide Technologies
- Provide Communications Links
- Commercialize Services.

Sustainable Mix of ITS Services in Rural

C	Long distance travel;
C	Fewer convenient detour options;
C	Adverse road surface and weather conditions;
C	Few navigational signs;
C	Less existing infrastructure (per square mile);
C	Light usage/large geographical areas impeding rapid emergency detection and response;
C	More motor vehicle deaths with higher frequency of accidents/vehicle mile traveled and more severe accidents than found in urban areas;
C	Recreational travelers needing traveler information services;
C	Limited or non-existent public transportation services;
C	Many, often uncoordinated, providers of transportation services to meet health and human services needs; and
C	Very dispersed systems with high unit costs for service delivery, maintenance, and operations.

This document is the Strategic Plan for the US ARTS Program. It is important to note that this Strategic Plan represents the US DOT perspective on rural ITS, and the US DOT's roles and responsibilities for improving the rural transportation system through advanced technologies. In this role, the US DOT program will work to bring rural ITS technologies to maturity and examine institutional arrangements for their deployment, providing feasible options to rural areas. In this context, the role of the ARTS Program is not to provide long term operational funding to rural ITS systems (though Federal funds may be available from other programs). Rather, the role of the ARTS Program is to work in partnership with those responsible for the implementation of ITS in rural areas--States and local agencies, and the private sector--to provide appropriate and sustainable (i.e., Can be operated using existing and projected funding and resources) ITS solutions to rural problems and needs (see figure 1). Consequently, others will need to develop their own plans to compliment and coincide with this one.

The latter portion of this document identifies the goals and objectives that are the priority of the ARTS Program. It outlines the Federal role in advanced rural transportation systems and is consistent with the guidelines provided by the GPRA.   The companion ARTS Program Plan is also under development as described in the final section of this document. The program plan includes the setting of strategic priorities, another key follow up element in strategic planning, as well as specifying candidate projects by year to address the uncertainties and ultimately lead to the deployment of rural ITS.

There are three potential barriers to the development and acceptance of the ARTS Strategic Plan. These are:

1. **Acceptance of the role of the US DOT and participation by others critical to the process;**
2. **The focus of the Strategic Plan on the US DOT role in rural ITS in lieu of a ``National'' plan; and**
3. **The degree of variability within the rural transportation system.**

The development and implementation of the Strategic Plan depends upon its acceptance by the key partners required for its implementation. Throughout the strategic planning process, a critical guidance has been provided from the field offices of the US DOT as well as representatives of State and local agencies directly responsible for implementing rural ITS in their areas and independent consultants. However, there may also be some dissatisfaction with the ARTS program's focus on finding the answers to what is not known about rural ITS through research, development, field tests, and targeted deployments at the expense of direct funding of deployment alone. This may become an issue during the comment period prior to the final version of the plan. Given this, it is important to emphasize that reducing the gaps in knowledge is the focus of the ARTS program. Funds for transit operations and other activities may still be provided through traditional Federal funding sources not part of the ARTS program.

The second issue concerns the Strategic Plan's focus on the US DOT's roles and responsibilities, rather than the development of an all encompassing National Plan. As stated in the Introduction, the US DOT is only one partner in the ultimate development and implementation of a sustainable mix of ITS Services in rural America. Other participants include the State and local agencies and other providers of ITS, the private sector, and the public. A concerted effort was made to ensure that the ARTS Program incorporate the interests of all of the participants; however, the Strategic and Program Plans are still designed to reflect the US DOT role and activities in advanced rural transportation systems. Given the diverse nature of the participants and interests across rural America, it was not feasible to develop a ``National'' plan encompassing the views, roles, and responsibilities of each participant. Development of a National rural ITS vision and plan may, however, be a worthy exercise to carry out in the future in coordination with ITS America's ARTS Committee and other organizations.

The last issue is a more difficult problem to solve. The wide variety of needs found in rural settings across the US has made it difficult for participants to recognize similarities and agree to program goals, objectives, or program elements. For example, at first glance, people often perceive few similarities between the very disparate rural areas of Death Valley, The Upper Peninsula in Michigan, Jackson Hole, Wyoming, or Cape Cod. It was found, however, that many of the perceived differences are really associated with the differences in the mix of needs within each rural area. Thus, US DOT has spent substantial effort in developing a set of Critical Program Areas, or Clusters, to provide a common identifiable set of views of rural America, its needs, and how ITS can respond. These Critical Programs Areas have become key elements in developing the specific approaches for the rural ITS program described later, and in minimizing the debate and confusion over ``What is Rural?''

VISION AND MISSION

The Vision statement describes a future that management envisions. It provides a description of what rural America will be like when the rural ITS program is fulfilled. The Mission describes the organization's purpose or changes that the organization intends to directly effect. These two statements provide the direction and purpose upon which the ARTS program is based.

Vision

An improved quality of life for rural residents and travelers through safer, more secure, available and efficient movement of people and goods in rural America through the judicious application of advanced ITS technologies.

Rural America accounts for a small and dispersed portion of our nation's population, yet it encompasses a significant portion of the transportation system. Rural areas account for 80 percent of the total US road mileage and 40 percent of the vehicle miles traveled, and they have a unique set of characteristics associated with the travel upon them and their operations and maintenance. Consequently, the rural traveler has a different set of priorities and needs than does his/her urban counterpart. These differences reflect the rural environment of long distances, relatively low traffic volumes, relatively rare traffic congestion, travelers unfamiliar with the surroundings, and rugged terrain in remote areas. Furthermore, rural characteristics that solicit ITS solutions include an over representation of fatal crashes (About 60 percent of traffic fatalities and 55 percent of work zone fatalities occur in rural areas), safety problems related to high speeds on non-interstate rural roads and increased response time for Emergency Medical Services. Many rural communities now have excellent all-weather road systems, but many rural residents remain isolated because of their inability to travel. Presently, 38 percent of the nation's rural residents live in areas without any public transit service and another 28 percent live in areas in which the level of transit service is negligible[2].

The vision aims to improve the safety and security of the rural traveler, especially given the differences with the urban environment. Similarly, isolation is a factor that impacts both the transportation disadvantaged and the economic vitality of the communities in rural America; therefore, reducing isolation is important. Additionally, as resources continue to become more scarce, using advanced technologies to improve the efficiency and productivity of operating and maintaining transportation services is crucial, especially given the high costs associated with rural transportation operations and maintenance.

Mission

[2] Compiled from Various tables in Highway Statistics 1994. Federal Highway Administration, October 1995.

To facilitate the development and application of Advanced Rural Transportation Systems which address rural transportation needs, through:

Development - Conduct research, operational testing and evaluation where necessary;

Deployment - Promote applications through demonstrations and deployment incentives of cost-effective technologies ready for implementation; and

Delivery - Facilitating training and technical assistance to transportation providers planning or implementing ITS technologies.

The US DOT will work with a wide range of constituents to identify cost effective, system-based solutions to rural problems. Being system based means examining technological, as well as political and institutional issues that must be addressed in order to deploy. This effort will result in a collection of rural ITS options for practitioners, reducing the uncertainty surrounding their implementation. To achieve this end, the program will consist of research, operational tests, and targeted model deployments designed to reduce this uncertainty. The specific elements in the program will be described in the companion ARTS Program Plan.

Initially the implementation may be stand-alone subsystems, however in later years, these subsystems may be coordinated and integrated as necessary to improve or broaden services or reduce costs. Once these systems and subsystems are defined, the US DOT will assist others in the implementation of these solutions through a variety of outreach activities. Ultimately, these systems will be mainstreamed into participating agencies' long-range plans and capital improvement programs.

The Values describe things that are important to an organization that will impact how the Vision and Mission are fulfilled, and yet may not be directly addressed in their statements. These are the underlying principles of the organization. The Philosophy Statements either describe the underlying philosophy that governs the organization, or state management commitments describing the promises management may make to its customers, employees, or other stakeholders. It is the values and philosophies that provide the underlying assumptions upon which the program is built to meet the vision and mission.

Values

Equity   The improvements made via this program will be distributed in a fair and non-discriminatory manner;

Decision making   Balanced and appropriate decisions should be made reflecting the issues and concerns of those impacted and considering all feasible alternatives (their costs, benefits, and outcomes);

Collaboration   Achieving the vision requires many people from a variety of disciplines to work together. This value is at the heart of the US DOT activities, and has been clearly demonstrated through the cross-cutting Rural Action Team; and

Leadership   USDOT will provide strong and enthusiastic leadership to support strategic planning, research, standards development and seed deployment.

Philosophies

The following philosophies, or guiding principles, underlie the Strategic Plan for Advanced Rural Transportation Systems. Collectively, they provide the assumptions and foundation for the goals, objectives, and program elements.

The Federal role for rural ITS is one of support and fostering the implementation of advanced ITS technologies in rural America by others. It is an enabling program designed to bring rural ITS technologies to maturity and explore institutional arrangements that provide feasible options to rural areas wanting to implement ITS.

The ARTS must be sustainable.   They must be developed through public/public and public/private partnering initiatives involving both the highway community and the public transportation community, business interests, etc. They must be seamlessly connected to the rest of ITS (i.e., urban-suburban-rural connectivity, and highway-transit-ridesharing connectivity) and also compatible with non-ITS facilities and systems, and should employ innovative financing principles.

The Goals describe the general results or outcomes the organization intends to achieve. They are measurable but usually not measured. For each goal, strategic objectives are defined. Strategic Objectives are written statements that describe an intended outcome. Strategic Objectives clearly describe measurable targets of achievement.

As opposed to the abstract nature of the vision and mission, the goals and strategic objectives are definable in real and measurable terms. The six characteristics of Strategic Objectives include: (1) An external focus, (2) measurable, (3) achievable, (4) clear, (5) comprehensive, and (6) supporting the mission and goal statements. Strategic objectives can also be defined for both outputs of the program and outcomes of the program. Outputs are the services and products that the program provides. Outcomes are measures of their impact in the rural environments.

There are three types of objectives: Administrative outputs, program outputs and outcomes. The administrative output objectives describe measurable internal or administrative actions that the US DOT will take, hence they are not externally focused. Program output objectives measure the extent to which the US DOT has achieved its role as facilitator--including the extent to which others have been made aware of the solutions, and the extent to which these systems have been deployed. Outcome objectives are measures of the impact that the implementation of the rural ITS systems has on rural America. Outcomes capture the achievement of the overall goals. For example, developing and providing rural ITS awareness seminars would meet an administrative objective. Deploying a safety information system would be an achievement of a program output objective, and reducing the rate and frequency of crashes due to the implementation of this system would be an achievement of an outcome objective.   The long-term outcome objectives are shown as part of this Strategic Plan. The administrative and program objectives are by necessity tied to the specific elements of the companion Program Plan. Therefore, they will be specified as part of that document.

Goals

The goals of the ARTS Program are closely tied to those of the overall ITS program. The five goals of the program are: (1) Safety and security; (2) mobility, convenience and comfort; (3) efficiency, (4) economic vitality and productivity; and (5)environmental conservation. Priority is given to those goals that will meet the more critical needs of travelers and transporters of goods in rural areas. Consequently, the primary goals of the ARTS program are safety and efficient mobility, versus those of urban systems which are congestion relief and increased throughput.

1. **SAFETY AND SECURITY -** IMPROVE THE SAFETY AND SECURITY OF USERS OF THE RURAL TRANSPORTATION SYSTEM.

Improving safety and security is continually identified as a critical goal for rural transportation and ITS. Rural crashes tend to be more severe, and have longer response times due to the long distances and isolated settings. The characteristics of rural crashes mirror the diverse nature of the system, having a wide variety of causal factors. In some cases, trip fatigue takes its toll, while in other cases poor visibility or unsafe road conditions lead to crashes. ITS can play a major role in reducing the rate and frequency of crashes through a wide variety of safety advisory systems. ITS can also help reduce the consequences of the crashes once they occur by enabling emergency responders to reduce response time and provide improved care. Automatic vehicle location systems can expedite the response to emergency situations on board transit vehicles. ITS can also create a more secure rural transportation system by reducing the exposure to unsafe situations. This consists of advanced technologies that 1) provide immediate assistance to travelers in rural areas that experience problems, such as getting lost or having a car breakdown, 2) provide better traveler information which will contribute to prudent trip planning - reducing the exposure to potentially hazardous risk; and 3) law enforcement agencies can apply advanced technologies to meet their needs, including enhanced officer safety, improved dispatching, and simplified reporting.

Safety and Security Strategic Objectives.

1. Reduce the frequency of crashes (via pre-crash warning systems);

2. Reduce the rate of crashes (via pre-crash warning and advisory systems);

3. Reduce the severity and fatality level per incident from current levels (via improved response time and care); and

4. Reduce exposure to unsafe situations (e.g., getting lost, car breaking down, etc.) (via emergency notification system).

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2.   MOBILITY AND CONVENIENCE -- ENHANCE PERSONAL MOBILITY AND ACCESSIBILITY TO SERVICES, AND ENHANCE THE CONVENIENCE AND COMFORT OF ALL USERS OF THE TRANSPORTATION SYSTEM.

One of the major characteristics across all of rural America is isolation and the relatively low number of available transportation options. People should have access to transportation, especially to enable them to meet basic life needs such as getting health care or buying staples. This goal consists of reducing isolation by increasing accessibility to services. This is especially true given the aging of America, and the increasing likelihood that rural Americans will be older with additional transportation needs in the years ahead. In some cases, there may be opportunities to implement technologies that enable older drivers to extend the period that they are able to drive. For those unable to drive, this increase in accessibility consists of advanced rural transit systems. Another important aspect of this goal includes providing alternative means of transportation to tourists in areas that cannot accommodate a large number of vehicles. It also addresses the need for convenient and comfortable travel through the development of information systems that help people get the services they need (gas stations, lodging, restaurants, hospitals, etc.).

The advances in communications and computing have created an alternative to transportation. Improving the ability of rural America to carry out their desired activities through telecommuting and remote computing is also an important aspect of enhancing mobility. Therefore, this goal must also address the evaluation and advancement of communications options for rural America as substitutes for desired travel. Examples of how transportation and ITS may help improve the connectivity of rural areas include: providing connectivity through sharing communications trunk lines used for ITS services; and making public rights of way available for communications link installation.

Mobility and Convenience Strategic Objectives

1.   Increase the percentage of population with available and convenient transportation services to meet its mobility needs;

2.   Improve access to services and tourist areas, and expand the availability of information about services; and

3.   Improve the communications connectivity of rural areas and the ability replace the need for travel with communication alternatives.

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3. **EFFICIENCY --** INCREASE OPERATIONAL EFFICIENCY AND PRODUCTIVITY OF THE TRANSPORTATION SYSTEM, FOCUSING ON SYSTEM PROVIDERS.

In rural America this goal addresses the needs of rural transportation system providers, enabling them to carry out their services in a safe, efficient and productive manner. To some extent, this is a shift from the metropolitan ITS program whose primary goal is to reduce congestion. The long distances and sparse network often make operations and maintenance very expensive on a cost per unit basis, and the seasonally harsh nature of the rural environment can put providers, such as snow plow and transit operators, at risk. Also, the manpower and equipment per road mile, or transit vehicle is often much higher than in urban settings. Finally, weekend or seasonal peaks in traffic, severe weather conditions, backups due to crashes, or road construction with limited alternate routing all create congestion problems. Thus, improving the safety, efficiency, and productivity of operations and maintenance activities of the transportation providers, will meet their critical needs, especially through the application of coordinated advanced wide-area traffic management and traffic signal systems.

Efficiency Strategic Objectives

1. Reduce congestion and delay (e.g., in work zones, at events and tourist areas, etc.);

2. Improve incident management and response time;

3. Improve vehicle routing and diversion (e.g. trip coordination, pre-trip route selection, en-route delay and road condition information, and en-route notification of detour options); and

4. Improve operations and maintenance resource management and allocation.

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4. **ECONOMIC VITALITY AND PRODUCTIVITY** -- ENHANCE ECONOMIC PRODUCTIVITY OF INDIVIDUALS, BUSINESSES, AND ORGANIZATIONS.

Many rural areas are economically depressed and their economic viability is limited by their isolation.[3] Rural ITS can improve their ability to compete by reducing their isolation, improving the efficiency of transportation services to businesses in the area, and letting the public know of their attributes. Likewise, tourist areas need to be able to provide information to their visitors and provide mobility if they are to continue to attract visitors. The focus of rural ITS in meeting this goal is therefore, to keep rural areas viable and helping to provide the services needed to function competitively. Another aspect of this goal addresses the desires of small communities that want to maintain their communities as they are, and limit the amount of growth (e.g., Aspen, CO). The rural ITS program will identify opportunities to address their transportation needs, while also respecting their desire to control growth.

As discussed within the Mobility and Convenience Goal, isolation can also be reduced by improving the communications connectivity of an area. As rural areas become more connected, they become more viable areas for living and working. This goal, therefore, also addresses the evaluation and advancement of telecommuting from rural America as a means of reducing isolation and making the rural environment more livable.

Economic Vitality and Productivity Strategic Objectives

1. Improve access and information to rural communities for travel, goods and services;

2. Improve knowledge of goods, services, and opportunities in rural communities (e.g. en-route information, transportation service information, etc.); and

3. Improve transportation and communication facilities in and around rural communities.

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[3]Understanding Rural America, Economic Research Service, US Department of Agriculture, Agriculture Information Bulletin No. 710, Washington, DC, February 1995.

5. **ENVIRONMENTAL CONSERVATION -- REDUCE ENERGY CONSUMPTION AND ENVIRONMENTAL COSTS AND NEGATIVE IMPACTS.**

The nature of rural air quality concerns may differ from those of urban areas. Particulates, for example, might be of greater concern in some rural areas than other pollutants which have been given higher priority for abatement in urban areas. Additionally, rural areas might be impacted by migratory air pollution generations in some distant metropolitan areas.

Consequently, opportunities to reduce the number of single occupant vehicles, vehicle miles traveled (VMT), and increase public transportation and ridesharing alternatives are essential. Many tourist attractions, such as National Parks, also suffer from the negative environmental impacts of large numbers of visitors. This goal includes opportunities to minimize the effects of large influxes of people into these sensitive areas. In addition, in rural areas there is a need to address the impacts of the transportation infrastructure, operations, and maintenance on the environment, including the reduction of impacts due to hazardous material spills, and the tracking of hazardous materials through the rural transportation system.

Environmental Conservation Strategic Objectives

1. Reduce Single Occupant Vehicles;

2. Reduce Vehicle Miles Traveled;

3. Improve hazardous material response (minimize environmental impacts); and

4. Reduce emissions per trip.

External factors are key outside forces that may influence the success of the rural ITS program in achieving the above mission and goals; or have other impacts on the delivery of the program, and yet are outside the control of the agency.

One set of external factors with a focus on changes in legislation and the environment in Washington, D.C. can have a profound effect on the delivery of a long-term program. Of particular interest are the current hearings concerning Intermodal Surface Transportation Efficiency Act and its re-authorization. If the major priorities or funding mechanisms change as a result of the new legislation, the strategic plan may have to be modified and updated accordingly.

Likewise, shifts in the Federal and State Departments of Transportation roles and responsibilities may impact the fulfillment of the program. However, these shifts may not be due to specific changes in legislation, but can also be caused by changes in administration.   Another important set of external factors are changes in the economy, fuel prices, or concerns of the nation brought about by unique events. Terrorist acts can raise the importance of security throughout the transportation system. Another energy crisis will impact the amount and type of rural travel.

Equally important are watershed changes in technology that can totally change the costs and potential applications within the rural environment. Twenty years ago, no one could have predicted the rapid adoption of facsimile machines throughout the business world, or even the use of cellular phone technology that now makes many ITS applications possible. Significant developments of new communications systems by private industry, such as satellite communications networks, could greatly impact the cost-effectiveness of advanced rural transportation systems. Yet, the USDOT has little control over these types of developments.

The last factor is the ability of local rural communities to adopt new technologies and systems. The rapid infusion of new technologies in rural settings is hampered in a number of ways. First, rural areas are often some of the most fiscally constrained in America. There are large resource requirements for maintaining the current systems, and little additional funds for implementing new systems over the miles of rural network. Likewise, the staff resources are often limited in rural environments with one person taking on the roles and responsibilities typically filled by many specialists in denser areas, or even whole departments. ``Mainstreaming'' the consideration and evaluation of ITS strategies into multimodal transportation planning processes is also important if transportation planners and decision makers are to understand the costs and benefits of implementing certain technologies, particularly in comparison with more traditional or conventional improvements. Staffs must have the time and energy to plan and adopt the new systems to their current environments.

Recognizing these external factors and updating the strategic plan as conditions change over the life of the program will keep it aligned with the overall mission and g oals described above.

A Strategy is an approach, or an implementation methodology, that will lead to achieving a specific objective. It includes a description of how the goals and objectives are to be achieved, including a description of the operational processes, skills and technology, and the human, capital, information, and other resources required to meet those goals and objectives.

Achieving the strategic objectives of the program means recognizing the extremely diverse nature of the rural transportation system. Diversity is exhibited in the system's wide range of motorists, managers, maintenance staff, operators, road types, terrain, climates, jurisdictions, land use, and seasonal characteristics. These diverse characteristics translate into a wide variety of needs, problems, and opportunities for improvement. Consequently, the ARTS solutions, i.e., the application of advanced technologies to meet these disparate needs, problems and opportunities, must be diverse as well. The strategies to identify these solutions must also recognize this diversity.

Given this diversity of the rural transportation system, and the wide breadth of the program (i.e., encompassing a large number of needs of a large number of users), the ARTS program has been organized into seven Critical Program Areas (CPA's). A major effort of the Rural Action Team during the development of the Strategic Plan, was the investigation of different cluster concepts and ways to find common areas of interest across rural America. It was found that while rural settings differ greatly (Jackson Hole, WY, vs. Death Valley, CA, vs. Cape Cod, MA), there was general agreement on the classes of needs that exist within each setting and the principal users of ITS. The clusters were therefore developed around major needs, user groups and service groupings. They are:

Critical Program Areas

1. Traveler Safety and Security;
2. Emergency Services;
3. Tourism and Traveler Information Services;
4. Public Traveler Services and Public Mobility Services;
5. Infrastructure Operations and Maintenance;
6. Fleet Operations and Maintenance; and
7. Commercial Vehicle Operations.

The above division is the primary dimension for this cluster concept and focuses on identifiable needs and services categories. The Tourism and Traveler Information Services CPA, for example,

refers to the needs and services that a visitor (both driver and passenger) unfamiliar with a rural area may require, as well as the Visitors and Tourism Bureaus, transit service providers, information providers, etc., that provide the services to meet their needs. In a tourist resort area, this may be the main focus of the ITS program. In other areas, it may exist but plays a smaller role. Likewise, the Public Traveler and Public Mobility Services focus on reducing the isolation of the transportation disadvantaged and increasing the mobility for all of the public. Its constituents also include both the potential travelers and service providers. The maintenance and operations activities may also form their own divisions because of the costs of the provision of these services in rural areas. As ITS services are shown to reduce their costs, improve their efficiency, etc., these areas and the organizations responsible for them become natural constituents and advocates for the programs.   The clusters are not necessarily mutually exclusive and will overlap in their deployment in a specific region or rural setting. For example, services developed around a ``safety information cluster'' may also exist in the same area with services developed to meet the mobility needs. Similarly, clusters are ``fuzzy'' and the boundary between two related clusters may be difficult to discern at times (e.g., infrastructure versus fleet operations and maintenance).   Figure 2 shows the major conceptual overlaps between the clusters.

Figure 2
Conceptual Cluster Relationships
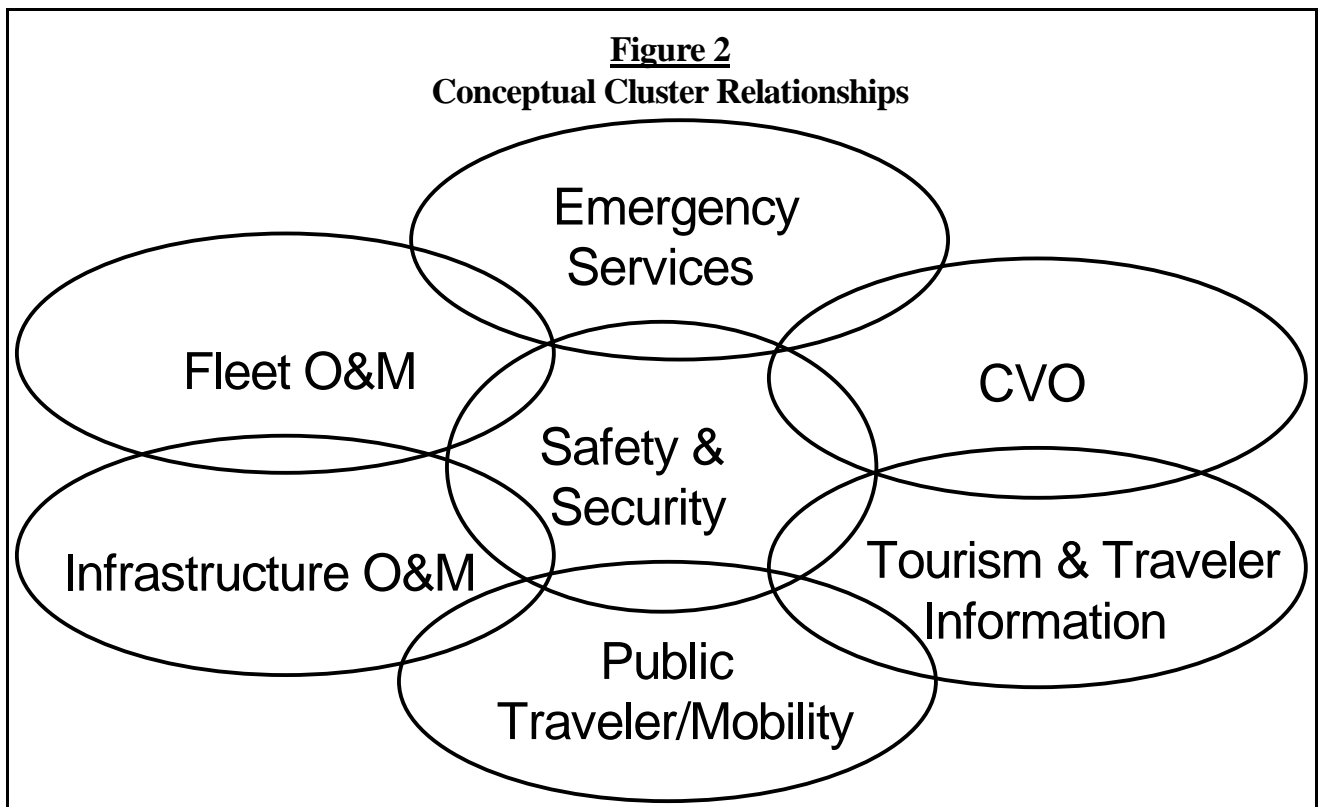
Each rural area will have its own environmental conditions and constraints, frequency of needs, institutional settings, etc. These factors determine the importance and priority placed upon each cluster within an area, and the mix of ITS services that may be considered for implementation.

The clusters provide common areas of understanding and focus and, thus, make the ARTS Plan implementation more manageable. The Program Plan describes the user services, functional requirements, and knowledge gaps that apply to each CPA. Aspects of a program element may address more than one CPA. Consequently, The activities associated with some CPA's may consist of a number of research and field test activities, while activities associated with another will focus on deployment.

Though much needs to be done to determine exactly which projects will be initiated within each CPA, some generalizations can still be made. The research and field testing efforts that take place within this program will be building upon the wealth of knowledge and proven solutions that have been developed under other parts of the ITS program as well as technology applications outside the ITS program.   It is not expected that the rural advanced technologies will be significantly different from their urban counterparts, rather the difference between the two will be characterized through the implementation methods. Consequently, the bulk of the program will probably not consist of basic research, but rather will focus on overcoming the rural barriers that hamper cost-effective implementation. While such a focus will ensure that the seamless connectivity between urban and rural systems is achieved, care must be taken to avoid attempts to fit urban solutions into rural problems.

1. TRAVELER SAFETY AND SECURITY

The rates and severity of accidents have been repeatedly identified as one of the most serious problems associated with rural transportation. Accidents per-vehicle-mile traveled are higher than in urban areas, and tend to be more severe due to higher operating speeds. Once an accident occurs, the times to notify and respond are also on the average longer, and trauma centers are located further away. Consequently, improving safety and security has been identified as a key cluster or critical program area.

The needs in this cluster center around improving the driver's ability to operate the vehicle in a safe and responsible way and in reducing the influence of other factors that may help cause an accident, such as, poor road conditions, visibility, etc. This cluster focuses on the prevention of accidents before they occur and in reducing the severity of the accident if it does take place.

Another aspect of this cluster is increasing the security (both actual and perceived) of the traveler along his/her trip. Providers of transportation services have a responsibility to provide a safe and secure environment in which to travel. A traveler may be injured while traveling even though he/she has not been involved in a vehicular accident (i.e., a transit patron is assaulted while waiting for a vehicle, or someone using a rural rest stop is robbed). Thus, providing a secure environment through remote monitoring, silent alarms, etc., is an important ITS function within this cluster.

TRAVELER SAFETY AND SECURITY -- Some of the advanced systems that may be explored and developed under this cluster are:

1. Wide area information dissemination systems (via radio, computer, TV, etc.) both pre-trip and en-route of safety information, such as weather and road conditions;

2. Site-specific safety advisories and warnings (e.g., the enhanced radar detector for hazard warning, visibility sensors, variable speed limits, collision avoidance, work zone detection/intrusion alarms, rail crossing alerts, shoulder detection, etc.) to alert motorists of imminent problems;

3. Safety surveillance and monitoring (e.g., on transit vehicles (for malcontents and for ill riders), at park-and-ride lots, rest areas, etc.); and

4. In-Vehicle monitoring and detection systems including such items as driver monitoring (alertness, status), vision enhancement, perimeter detection, shoulder detection, etc.

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2. EMERGENCY SERVICES

In this plan emergency services addresses the response to an individual incident such as a traffic collision and to more widespread events such as natural disasters. Once an incident (accident or emergency situation) occurs, there is a need for emergency services. These can be in the form of ambulances and medical care, police, fire, tow trucks, and other vehicle assistance, etc. The isolation of rural areas, extensive time from the incident to detection, and response once the incident is detected all contribute to notifications and response times much longer than found in denser areas, often of an hour or more. This leads to much more severe consequences than would occur with rapid response. Given an incident, the Emergency Management Team must be notified, a decision on how to address the emergency must be made, services dispatched and the location of the incident found and reached. In addition, the care givers are constantly having to make critical decisions about the type and extent of care to provide, whether both on the scene, en-route to a care facility, or and at the hospital or trauma center.

Many rural areas maintain evacuation and disaster response plans for dealing with events such as hurricanes and floods. Timely warning and evacuation are critical to successfully responding to these events. ITS services will provide important tools to support these functions. This cluster focuses on the ITS services required to provide this emergency assistance. It includes both the provision of communications, the management of the emergency services fleets, and the transmission of critical information to better prepare the care givers, both at the scene, en-route or in the hospital or trauma center. Assisting the emergency vehicle in reaching the incident through vehicle routing, identification, and warning systems, is also an important aspect. A large number of this cluster's needs also deals with the coordination of different services and the need to share the critical and appropriate information on the emergency as rapidly as possible in real time.

EMERGENCY SERVICES -- Some of the advanced systems that may be explored and developed under this cluster are:

1. Mayday systems to alert dispatchers of location and nature and extent of a problem (e.g., crash, breakdown, etc.); and

2. Advanced dispatching and vehicle-based response systems (e.g., on emergency medical services & law enforcement vehicles, disaster response vehicles, tow trucks, etc.) to get to the scene quickly, and provide appropriate care (perhaps for the judicious enforcement of traffic laws as well).

3. Emergency communication systems to link critical agencies and to feed information services for en route travelers.

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3. TOURISM AND TRAVELER INFORMATION SERVICES

This cluster focuses on the needs of a visitor or traveler that is unfamiliar with the rural area they are in or traveling through. It includes both information services and the unique aspects of providing mobility services to tourists and resorts, since many times visitors have little choice of mode (no auto) and require special services. It addresses aspects of both the ``Mobility and Convenience'' and ``Economic Vitality and Productivity'' goals for the ARTS program. Knowing where desired destinations are, how to get to them, and conditions along the way adds to the mobility and convenience of an area. Likewise, travelers must be aware of destinations before they can visit them and providing services to tourists and others unfamiliar with the rural surroundings enhances the economic vitality of the area.

The needs and services that may be bundled in this cluster include such activities as electronic yellow pages, weather and condition forecasting, route advisory information, information dissemination in hotels, roadside, wide band radio, etc. Once in a resort area, tourists often are hindered due to lack of a vehicle, or knowledge of the area. Providing mobility through transit, paratransit, and Global Positioning Systems (for rental cars) may also be an important function. This cluster would also be of primary interest to the Tourism and Visitors Centers, Economic Development Bureaus, as well as the local service providers (departments of street and traffic, transit authorities, State Department of Transportation, and Park Agencies).

Tourism may also be a concern in any rural setting during major events and festivals. At these events the traffic, local population, and transportation problems of the participants, local residents, and emergency services swell to many times their average levels. Event logistics, traffic and parking management, provision of emergency communications, etc., are crucial to the success of these events and yet must be temporary in nature, and in most cases understandable to volunteers.

TOURISM AND TRAVELER INFORMATION SERVICES -- Some of the advanced systems that may be explored and developed under this cluster are:

1. Information services (electronic yellow pages, route guidance, etc.) provided at fixed locations (e.g., in hotels, at rest areas, at modal transfer stations, etc.), and en-route;

2. Mobility services (transit, paratransit, parking systems, etc.);

3. Smart card payment/transaction systems for transit and tourist transactions; and

4. Portable event management systems that include such services as traffic management, variable message signs, hotel and service availability and directions on how to reach services when they are available.

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4. Public Traveler Services/Public Mobility Services

Isolation and accessibility to key services are critical concerns to many rural inhabitants. Providing transit, paratransit, rural addressing, and other services associated with ability to make a desired trip fall within the Mobility Services cluster. As the nation ages, and becomes more transportation disadvantaged the need for Mobility Services and the safety net of accessibility will become more extreme. This is especially true for rural areas where neighbors are often miles apart, trip distances are long, and travel to common origins and destinations infrequent. All rural residents, visitors to tourist areas, and human service providers are constituents of this cluster.

The first major need associated with this cluster is finding those who need services and providing the mobility safety net to them. Secondly, determining how to provide the services in an efficient and effective manner, since often those providing the service have very high operating expenses. This includes the sharing of information among providers which can be used to help optimize routing, coordinate delivery, and reduce fraud in claiming subsidies from service providers. Lastly, addressing the need for coordination and communication between the many providers of services that may be involved including transit agencies and social service providers. The cluster includes not only providing mobility to the travelers from their homes and origins and destinations, but also increasing the ability of people to reach them in provision of other services (nursing, meals on wheels, hospital out patient, etc.).

PUBLIC TRAVELER SERVICES/PUBLIC MOBILITY SERVICES -- Some of the advanced systems that may be explored and developed under this cluster are:

1. Advanced transit, paratransit systems, etc., using AVL and improved dispatching (e.g., taking advantage of improved rural addressing (i.e., using Global Positioning Satellites), etc.);
2. Smart card payment/transaction systems for rider payment and tracking (beat fraud); and
3. Advanced ride sharing and ride matching systems.

5. INFRASTRUCTURE OPERATIONS AND MAINTENANCE

Due to the isolation, distances, and sheer amount of rural road miles the provision of infrastructure maintenance and operation services are both costly, and often inefficient. Low volumes on the roads make the detection of problems and conditions a concern. This cluster's focus is on improving the efficiency of the maintenance and operations activities for the transportation systems within rural areas. Improving and automating the highway pavement management systems, providing early detection and deployment of services to meet severe conditions (snow removal, salting, etc.), maintaining, operating, linking local and statewide traffic operations centers, and managing work zones are examples of the ITS elements that would fall in this cluster. It is closely related to the next cluster which focuses on the fleet operations in rural areas.

The maintenance of roads and the road system for safe operation falls under the maintenance organization activities. Because of the nature of rural settings, the cost per mile, and simply knowing the condition of the system that is out there, is very high and often inefficient. This cluster would focus on the provision of services to help maintenance organizations perform their functions more efficiently and safely. Pavement and bridge management, and normal road condition detection to reduce the costs of tracking and planning the system upkeep is critical. Some of the other needs and services that fall within this cluster include: Management of road crews and work zone location; road striping systems; weather information systems, detection of road conditions; coordination of maintenance activities; and flood control and detection.

Also general operations of the physical infrastructure has a set of needs that can be met by rural ITS. These include traffic management, traffic signal systems, tracking of use of the system, assisting in the safety and management of work zone areas, etc. This cluster would also focus on how the needs and desires of the operation managers of the road and other infrastructure systems can be provided for using ITS. Again, the overall focus would be to provide services to help reduce the costs of operations and maintenance activities and improve the performance and efficiency in rural settings.

> **INFRASTRUCTURE OPERATIONS AND MAINTENANCE** - Some of the advanced systems that may be explored and developed under this cluster are:
>
> 1. Appropriate traffic signal and traffic management systems for small urban areas, ultimately linked together (as well as with large metropolitan TMCs) as part of a statewide, distributed information system;
>
> 2. Automated management systems (e.g., bridge, pavement, roadside hardware, etc.); and
>
> 3. Advanced work zone management and traffic control.

6. FLEET OPERATIONS AND MAINTENANCE

The cost of providing services for mobility and managing the fleets used in rural settings is often extremely high for the same reasons as found in the last cluster. The distances are long, and the ability to combine destinations and provide efficient routing often poor. The potential for ITS to improve the coordination of fleets, routing, and communications is especially high in rural areas.

Fleet operations of both transit and other rural fleets has a different focus than infrastructure operations. The vehicles must be scheduled, routed, located, and maintained. Management of rural fleets takes on new significance due to the cost and low use per mile of operations. This cluster would focus on the coordination and provision of services for rural fleet operations and management. It includes services to transit operators and paratransit providers, as well as the fleets of maintenance and other areas. Vehicle location and routing, maintenance scheduling, rural addressing, coordination of services and billing between providers, etc. all would fall within this cluster.

> **FLEET OPERATIONS AND MAINTENANCE** -- Some of the advanced systems that may be explored and developed under this cluster are:
>
> 1. Advanced dispatching and routing systems (e.g., for snow plows, transit operators, etc.) (includes central processing systems and vehicle-based systems such as Automatic Vehicle Location);
>
> 2. Advanced vehicle tracking systems (e.g., guidance for snow plow operators to track through dangerous areas covered in snow); and
>
> 3. Fleet maintenance and management systems.

7. COMMERCIAL VEHICLE OPERATIONS

Commercial Vehicle Operations (CVO) and ITS development and support is carried out through the parallel ITS CVO program under the direction of the FHWA Office of Motor Carriers. The Vision Statement for the ITS CVO program is stated as ``Assisted by technology, trucks and buses will move safely and freely throughout North America.'' It is a voluntary effort consisting of public and private organizations working together to improve highway safety and motor carrier productivity through the development and application of the CVO User Services (Commercial Vehicle Electronic Clearance, Automated Roadside Safety Inspections, On-board Safety Monitoring, Commercial Vehicle Administrative Processes, Hazardous Materials Incident Response, and Freight Mobility).

Since many of the activities associated with commercial vehicle operations take place in rural environments there are a number of topics and services of mutual interest between the Rural and CVO ITS programs. The rural ITS program focuses on the overall ITS services and general users found throughout rural America which may impact, but not be tailored to, CVO operations. Many of these, such as, emergency response and Mayday systems, may fall into other clusters. The Rural CVO cluster's primary function would be to provide a CVO perspective to these other clusters to ensure that CVO needs and requirements are also considered in the development of the overall ITS applications. The Rural CVO cluster may also supplement the main CVO ITS Program in uniquely rural commercial operations such as services to agricultural harvesting and migration operations or small rural commercial activities.

As stated, an important aspect of this cluster would be to ensure that systems designed to meet the other critical program areas also included the elements and perspectives of the commercial vehicle operators (collecting and tracking CVO specific data, monitoring and tracking specific vehicles, meeting unique CVO information needs, etc.). How can CVO operations take advantage of these clusters? Can CVO and general backbone systems be combined? What additional requirements are necessary to meet CVO needs? These are questions that may be addressed in fulfilling this aspect of the CVO cluster.

Another major component of this cluster centers around the agricultural harvesting and roundups found in rural areas. The annual migration of the harvesting combines in the Midwest, the sugar beet harvest in Minnesota, the roundups in ranch and sheep country, etc. all require focused transportation activities in often a very narrow window of opportunity. People need to know the location of the combines. Logistics and the movement of the trucks in and out of the area is critical; The road maintenance organizations may have special requirements before and after the event. All of these concerns point to a unique set of needs possibly overlooked under the provision of normal day-to-day services.

COMMERCIAL VEHICLE OPERATIONS -- Some of the advanced systems that may be explored and developed under this cluster are:

1. CVO-specific requirements/needs within the other critical program areas (e.g., rural addressing, logistics, vehicle and driver monitoring), vehicle location systems for alerts to other travelers as well as for other tracking needs, assistance for agricultural harvesting, collecting and tracking CVO specific information needs (e.g., CVO-enhanced weather advisories);
2. Services to assist Agricultural Harvesting and Migration; and
3. Other services in support of small rural commercial enterprises. On the road communications and paging, low cost vehicle location for employees in the field, etc., to help make rural commercial activities more viable and cost-effective.

8. NEXT STEPS: THE PROGRAM PLAN

This Strategic Plan for the ARTS program has described the vision, mission, objectives, and measures upon which the ARTS program is built. Because of the diversity of needs and settings in rural America, it also developed seven critical program areas, or clusters, which provide areas of common interest and focus within the overall program. The ARTS Program Plan has been defined using the Strategic Plan and its critical program areas as a foundation. Strategic Planning is also a continuing process. As the implementation of the program moves forward, a key element is the ongoing evaluation and adjustment of the plan to account for new knowledge gained by the early research, shifting priorities, etc. This ``Performance Feed Forward'' step of strategic planning will be carried out as part of each budget cycle.

As stated, the ARTS Program Plan will be developed around the clusters, or critical program areas. The tasks associated with the development of the Program Plan are underway and include:

1. Continue assessment and evaluation of current rural ITS projects;
2. Determine what is known and not known for each cluster;
3. Identify potential projects and costs associated with answering the unknowns within each cluster;
4. Set strategic priorities within and between each cluster;
5. Select projects (research, field operational tests, targeted model deployments) to reduce the unknowns within each cluster, meet the goals, objectives and strategic priorities, and stay within budget allocations for each fiscal year; and
6. Evaluate progress and update both the Strategic Plan and Program Plan during each budget cycle (Performance Feed Forward).

APPENDIX B: ACRONYMS

APPENDIX A: PROGRAM PLAN SUMMARY

This Program Plan for the Advanced Rural Transportation Systems (ARTS) implements the goals and objectives established in the U.S. Department of Transportation's (USDOT's) Strategic Plan for the ARTS. This Program Plan proposes five years (FY 97—FY 01) of USDOT projects and activities to advance the ARTS in partnership with other national, state and local public agencies, and with the private sector. Public sector activities will be focused on an ARTS infrastructure that will support various services to transportation providers and users. The ARTS will be fully coordinated with the national ITS through a common national architecture and standards. The ARTS will focus on rural needs and conditions, but will be interoperable with extensions of metropolitan ITS, and will be seamless for travelers and commercial vehicles. The Strategic and Program Plans for the ARTS are being coordinated by the multi-administration Rural Action Team within USDOT.

Program Plan Development

The ARTS Strategic Plan organizes rural needs into seven Critical Program Areas (CPAs):

CPA 1	Traveler Safety and Security
CPA 2	Emergency Services
CPA 3	Tourism and Travel Information Services
CPA 4	Public Traveler/Mobility Services
CPA 5	Infrastructure Operations and Maintenance
CPA 6	Fleet Operations and Maintenance
CPA 7	Commercial Vehicle Operations

The ARTS Strategic Plan sets goals and objectives to meet the needs in each CPA through the ITS adapted to rural conditions. These goals and objectives are translated into measurable outputs and outcomes consistent with Government Performance and Results Act (GPRA) requirements. This ARTS Program Plan proposes the USDOT projects and activities that will promote the outputs (integrated ARTS implementations) intended to produce favorable outcomes (improvements in efficiency, effectiveness and mobility) for rural transportation systems and their users.

This Program Plan links the Strategic Plan to favorable outcomes through analysis of the CPAs within the ITS architecture framework. The CPAs relate to the National ITS Architecture through user services, that were stipulated according to the rural needs and conditions.   Each applicable user service was developed into a set of functions needed to deliver the service under the rural conditions. Based on this analysis, background information on rural transportation systems, and a compendium of existing rural-related research, knowledge areas were defined—what is known or not known as relevant to implementing the ARTS.

The National ITS Architecture defines various organizing concepts for the ARTS as a

system. A layered structure includes *infrastructure* that must be provided in common to support many *applications* that ultimately deliver *services*. Following the tradition in transportation, the infrastructure will be provided largely in the public domain and will follow standards to be open to innovative and competitive applications from the private sector. ARTS activities will define the infrastructure needed to serve the CPAs, and then facilitate deployment of this infrastructure. This layered structure also emphasizes issues common to many CPAs, such as communications in rugged and remote areas, that must be addressed by ARTS activities.

This Program Plan promotes the transformation of the CPAs into the ITS architecture context by proposing support of more active rural participation in the architecture and standards. The intent of the ARTS is not to create a separate rural ITS, but to ensure that rural needs and conditions are represented in what will be an interoperable, national and international system.

The Federal Role

The Program Plan's projects and activities are organized into three budgetary and programming categories that indicate the scope of federal involvement in the ARTS:

- Development
- C Deployment Incentives
- C Delivery

The *development* components of this Program Plan will identify technologies and procedures to enhance the ARTS outcomes, especially where private sector development is inhibited by risks or an inability to capture benefits by pricing. Development includes studies and field tests to resolve effectiveness and feasibility issues. Tests will be evaluated under a unified Test Plan. Development activities include the architecture and standards involvements of the ARTS, and other program support such as Strategic and Program Plan updating and dissemination.

Deployment Incentives include grants to states and localities specifically for early ARTS planning activities or for showcase models of integrated ARTS.

Delivery includes training, procedure development, and support tools that will promote ARTS planning, deployment and operation within transportation agencies. This is aimed at *mainstreaming*, which means raising ARTS knowledge and skills to levels that exist for conventional transportation improvements and operations, and incorporating ARTS in normal deployment planning and programming processes. Subsequently, all approaches to improving transportation services and mobility in rural areas should be treated equitably and expertly.

The ARTS program is coordinated with other federal ITS programs through the ITS Joint Program Office (JPO). The ITS program scope does not include direct deployment of the

ITS by USDOT. However, rural areas include federal domain areas, such as the national parks, where other federal agencies may directly fund ARTS deployment. Such deployments will be coordinated under this Program Plan. Otherwise, states and localities will use their own, and regular federal-aid transportation funding, for deployment. Considerable private investment is also expected, including partnerships with public agencies.

The effectiveness of the ARTS according to the outcomes defined in the Strategic Plan will be evaluated within the ITS by the JPO, and is outside the scope of this Program Plan. These programmatic evaluations, along with project evaluations that are part of the ARTS R&D, will provide valuable feedback to the ARTS program.

Knowledge Area Findings

The ARTS program coordinators in the Rural Action Team have contacted rural field staff and constituencies to formulate the CPAs, define program priorities, and learn what is being done. The ARTS have been taken through preliminary system-development steps to define issues. A compendium of existing ARTS-related research has been compiled. Together, these efforts have defined preliminarily what is known, and what is not known about rural transportation related to the ARTS. These knowledge areas divide into:

> General rural context
> C   Systematic ARTS issues across the CPAs
> C   CPA-specific issues

Some key facts of rural context are:

C   Rural areas account for 83 percent of the nation's land, 21 percent of its population (50 million people), 18 percent of its jobs, and 14 percent of its earnings.

C   There are just over 3 million rural road miles, which is 79% of the national total. Half of the rural mileage is not hard, all-weather, paved. State highway agencies spent about $16 billion on rural highways for capital improvements and maintenance in 1994.

C   The rural highway system represents the extremes of highway utilization: Rural Interstates carry 24% of rural vehicle miles traveled (VMT) on only 1% of the rural route miles. Conversely only 5% of total national VMT is carried on the least used, and almost all rural, 50% of national route miles. The rural challenge is to obtain economical, safe and effective operation of that large "tail" of highways.

C   From the 1990 census data, 7.7% of the households outside of metropolitan areas have no vehicle available, compared to 9.6% in urban areas. However, rural residents have fewer mobility alternatives since 38% percent of the nation's rural residents live in areas without any public transit service and another 28% live in areas with negligible transit service.

C   There are over 1,100 rural transit providers in the U.S.. These vary widely in size, creating problems of efficiency in areas with small and fragmented services. In the rural transit areas of the United States, there are 30 million rural elderly, working poor, and people with disabilities. Rural transit ridership reflects service to the mobility impaired much more than urban transit.

C   Rural motor vehicle accidents are only 28% of the national total, but rural fatalities are 56% of the total fatal accidents and 58% of total persons killed, higher than the rural route mile or VMT proportions. In 1994, there were 20,596 fatal rural highway accidents and 23,693 deaths that resulted.

C   The rural highway safety problem is a combination of highway deficiencies, driver awareness/familiarity, and emergency medical service (EMS) response. For the fatal crashes with time components given, 46.5% of the rural cases take over 50 minutes from crash to hospital arrival, while the comparable urban proportion is 14.2%.

Among the general ARTS findings across CPAs are the following:

I.**We know** that most of the technologies needed for the ARTS exist, or are being developed for general ITS user services. The predominate problems are information dissemination, training, and financial resources for deployment.

We don't know how far an ARTS infrastructure can be extended economically, or how new technologies will affect extent.

II.**We know** that the rural perspective still needs to establish a strong involvement in architecture development and standards.

We don't know which architectural and standards issues will prove most critical to rural distinctions.

III.**We know** that there will be a wide variety of approaches to deployment of ARTS—building from an urban base, starting from a rural base, area-focused, or corridor-focused, etc.

We don't know how different the federal ARTS program approaches have to be in these various cases.

IV.**We know** that rural needs have been a strong federal concern, and that rural areas contain large federal-domains where federal agencies will be ARTS operators.

We don't know the best way to achieve coordination between USDOT and the various federal-domain operating agencies on the ARTS.

V.**We know** that there is a rural highway safety problem, strongly perceived by users.

We don't know how best to direct ARTS efforts since accident causation is a complex issue.

VI.**We know** that the emphasis of the ARTS program will be less on congestion than in the largest urban areas.

We don't know how best to adapt traffic control and its integration with regional systems for tourist peaks, seasonal events, rural places just below urban threshold, or rural areas on metropolitan fringes.

VII.**We know** that many ARTS functions require good radio propagation for communications and positioning information.

We don't know how serious the problems are in mountainous areas, how much cellular communications will spread in sparse rural markets, or how soon low-orbital satellite systems will be affordable.

VIII.**We know** that there are serious economic issues for ARTS, raised by the sparseness and large distances of rural applications.

We don't know exactly how best to focus ARTS solutions to achieve operational efficiencies.

IX.**We know** that provision of rural mobility is constrained by budgets.

We don't know if rural mobility can be guaranteed within budget constraints when ARTS provides service coordination and increased efficiency of operations.

X.**We know** that rural areas are institutionally diffuse for planning and mainstreaming purposes.

We don't know the best approaches for organizing ARTS planning in rural areas.

In addition to the general findings above, many CPA-specific findings have gone into the Program Plan formulation.

A Roadmap to the Plan

The FY 97 projects are already being programmed with authorized funding. The Development projects include tourism and transit demonstrations, and development of a surface transportation weather information system project in concert with the National ITS Architecture development. Program support under the JPO, but not from the ARTS budget specifically, is ongoing. Under Delivery, a set of regional workshops will be conducted through USDOT field offices to initiate state-level ARTS planning.

In FY 98, Development efforts will continue to define the ARTS systematically. Further interaction with ARTS constituencies will refine needs and priorities, to finalize the CPA definition. The CPAs will be developed through the architecture process to define ARTS requirements and general structure for hand-off to the National ITS Architecture and standards activities. One result of this effort will be definition of an ARTS infrastructure as a coherent set of, primarily public-sector, systems that can support all needed services. As issues are better defined and new ARTS subsystems are identified, field tests will be launched. A test plan will subject all ARTS activities to evaluation with programmatic feedback. In Delivery, the capability of states and rural localities to take advantage of deployment funds will be built. Planning procedures for federal aid funding will be drafted, staff training for federal outreach will proceed, and "toolbox" support will be initiated. The architecture work will contribute to a guidance document for rural planners and system operators. FY 98 will see the first Deployment Incentive grants, to help the least advanced areas experience procedures to do initial ARTS planning, and to help more advanced areas develop system integration procedures.

After FY 98, and to the Plan horizon of FY 01, the Roadmap reflects a "waterfall" of ARTS development out of Development. Studies and research identify more problems and likely solutions, at both the architecture level and for subsystems. These move through testing and into readiness for deployment. Deployment Incentive grants will fund the initial efforts to bring ARTS planning to more areas, and to demonstrate higher levels of system integration. Matured planning, through Deployment Incentive experience and disseminated by Delivery, will lead to increasingly mainstreamed deployment from state and local rural planning, with federal-aid funding and public-private partnerships. This deployment will focus on infrastructure that will be increasingly integrated, and private sector activity will add services to those that are already commercialized.

Next Steps

The Strategic Plan has been finalized, but this draft Program Plan will go through further review before being adopted. There will be broad outreach to rural constituencies for comment, and then dissemination.

Each annual element of this plan is subject to internal USDOT review and budget appropriations. The FY 97 and 98 elements will proceed in parallel with Plan adoption. The later years will become better defined through program experience, in time for their annual approvals. The Plan activities will provide the experience for periodic updating of the Strategic Plan.

ARTS PROGRAM PLAN MATRIX

The ARTS Program Plan activities and projects are shown in a table. The rows of the table are the program areas. The columns are the fiscal years 1997-2001, the five year horizon of this Program Plan. Fiscal year 1997 is the spending plan that is already approved.

Within each activity area/year cell, each activity or project is formatted with the following information:

Key to the cells:

> **FY-AA-N**—The project number with the fiscal year, the program category number (matrix row number), then a project sequence number within the cell.
> **!** *Project Title* - **Status** (Completed, in-progress or new start, duration)
> **!** Description of the proposed project
> **!** The Outcome and CPA indexing code in format [M1, M2...:N1, N2...]

In the Outcome and CPA indexing code, M is an Outcome code (possibly more than one) and N is a CPA number (possibly more than one). See number codes below. For the activities that cover all CPA and outcomes, the code will be [all:all].

The CPA numbers are as enumerated in the Strategic Plan:

1. Traveler Safety and Security
2. Emergency Services
3. Tourism and Travel Information Services
4. Public Traveler Services/Public Mobility Services
5. Infrastructure Operating and Maintenance
6. Fleet Operating and Maintenance
7. Commercial Vehicle Operations

The Strategic Plan objectives are coded as follows:

Goal/ Objective
> I. Safety & Security
>> A. Reduce # of crashes
>> B. Reduce freq. of crashes
>> C. Reduce severity/fatalities
>> D. Reduce exposure to unsafe situations
> II. Mobility/Convenience/Comfort
>> A. Increase % of Pop. with available transportation
> III. Efficiency
>> A. Increase throughput, decrease delay
>> B. Improve incident response time
>> C. Reduce travel time
> IV. Economic Vitality/Productivity
>> A. Improve O&M resource mgt. and allocation
>> B. Improve fleet mgt.

C.   Improve economy of rural areas
    V.   Environmental Conservation
        A.   Reduce SOVs
        B.   Reduce VMT
        C.   Improve HAZMAT response
        D.   Reduce emissions/trip

ARTS Program Plan Matrix—FY 97 through FY 01

Program Area	FY 97 (budgeted)
Research and Development	97-1-1 Surface Transportation Weather Information Project, new start. Formulate a program and requirements to promote better decisionmaking with improved weather and road condition information, achieved by integrating the Roadway Weather Information System (RWIS), other weather information sources (e.g., National Weather Service), and ITS-based transportation management activities. Will be used to develop requirements within the National ITS Architecture. Measure the operational cost savings, from better decisionmaking due to improved weather and road condition information, for a rural part of the transportation system and compliant with the National ITS Architecture. [1.all, 4.1:1,5] 97-1-2 Rural APTS Needs Study, ongoing. A needs assessment of rural transit operators and users that was initiated in FY 1996 will be completed. [2.1, 4.2:4, 6] 97-1-3 Rural Applications of ATIS, ongoing. 1. Evaluate the effectiveness of satellite communications, over wide areas and in challenging rural terrains, for transmitting MAYDAY messages. 2. Evaluate the effectiveness of portable work zone changeable message signs (CMS) in reducing work zone accidents and expediting traffic. [1.all, 3.1:1,3,5,7] 97-1-4 APTS Operational Field Tests, ongoing. 1. Evaluate the use and cost savings of using mobile data terminals (MDTs) and automatic vehicle location (AVL) for dispatching rural transit vehicles (Sweetwater County, WY/UT). 2. Demonstrate cost savings and service improvements from a coordinated human services transportation system (Northern FL panhandle). 3. Build upon an intelligent transportation infrastructure, adding MDTs and electronic fare transactions to demonstrate integrated transit service for the public and human service agencies (Cape Cod, MA). [2.1, 4.1:4] 97-1-5 Tourism and Traveler Information Systems Field Test, new start. Test effects of advanced and integrated systems on safety, efficiency, environmental impacts and local economies. Also evaluate opportunities for public/private partnerships and the self-sustainability of systems.

[1, 3, 4, 5:3]

xx-x-x
Evaluation of Operational Tests and CPA Integration—Ongoing
Not separately funded under ARTS. Umbrella evaluation contracts that include rural tests and rural integration projects.

Deployment None
Delivery 97-3-1
ARTS Strategic Plan Coordination Workshops, New Start.
Fund 4-5 regional workshops for headquarters, field and local transportation agency staff, as well as non-governmental interests. Will promote and receive feedback to proposed ARTS program.
[all:all]

97-3-2
ARTS Simple Solutions, Ongoing.
Disseminate to practitioners a collection of case studies that represent tried and generally practicable approaches to applying ITS solutions to rural operational problems.
[all:all]

97-3-x
Develop Deployment Incentive Guidance, new start.
Part of program support, to develop guidelines to be used by applicants for deployment incentive grants.

Program Area <div align="center">**FY 98**</div>
Research and 98-1-1
Development ARTS Critical Program Area (CPA) Definition, new start for 3 year duration.
This project will further define each CPA to derive an ARTS architecture, ARTS infrastructure requirements, research plan and operational test plan. Awards for individual CPA studies as well as integration studies will be made. Task objectives include:
1. Create a component of the ARTS Toolbox that includes the definition of each CPA as the organizing theme, and that will allow local planners to translate their transportation needs into ARTS solutions.
2. Develop a methodology and provide an initial benefit-cost estimate to prioritize deployment of rural ITS components.
3. Define rural user services and translate them for each CPA into functional requirements. Evaluate the National ITS Architecture to determine if the rural functional requirements are properly addressed. Identify standards issues and coordinate them with the existing standards development efforts.
4. Group similar functions across clusters and identify the required public infrastructure. Develop a methodology for tracking the deployment of the rural infrastructure components.
5. Develop a long term research plan based on the identification of unmet requirements for meeting needs in each CPA.
6. Identify and prioritize operational testing issues and create an Operational Test and Evaluation Plan containing recommended projects and evaluation methodology.
[all:all]

98-1-2

Surface Transportation Weather Information Project, ongoing.

98-1-3
Tourism and Traveler Information Systems, ongoing.
Additional technologies and levels of integration will be tested based on further
research and rural infrastructure definition.

98-1-4
Emergency Services, new start.
This project will combine communications technologies, AVL and dispatching
methods with improved institutional arrangements between ISPs, PSAPs and EMS, to
reduce response times, decrease morbidity and fatality, and improve the efficiency of
emergency services in remote and rugged rural areas. Traveler MAYDAY service,
direct emergency calls and calls from patrol agencies will be included.
[1.3, 3.2, 5.3:2]

98-1-5
Traveler Safety and Security, new start.
Rural accident and incident data will be analyzed to define high priority
demonstrations of available technology and methods will be identified and selected for
conduct. An evaluation methodology that considers the need to measure impact on
relatively rare accident events, and where accident data are often scant, will be
developed. Promising developmental or conceptual technologies that can be effective
will be identified for further development.
[1.all:1]

98-1-6
Rural Public Mobility, ongoing.
Methods will be demonstrated to increase the population of the mobility impaired that
is served and to increase overall transit and paratransit ridership of one or more rural
areas, through operational efficiencies from application of APTS technologies,
improved operational procedures, coordination of multiple transportation providers,
and brokerage of client transportation with third party payment. An evaluation of the
increase in service delivery to rural residents in need of non-emergency health and
human service agency treatment will be included.
[2.all, 4.all, 5.1:4,6]

98-1-7
Rural Highway Operations and Maintenance, new start.
Rural highway departments, representing different operating environments, will be
analyzed to identify the operations where improved technologies, procedures and
coordination of resources can reduce costs, and increase effectiveness within budget
constraints. High priority demonstrations of available approaches will be identified,
and selected for evaluated tests. The demonstrations will include a range of capital-
intensity and suitability for operations of different sizes and extent of roadway.
Technologies, procedures and institutional coordination will be tested to improve the
management of traffic in a rural area subject to event-related and seasonal traffic
peaks, and that involves multiple jurisdictions including interfaces with metropolitan
areas.
[3, 4.1, 5:3,5]

98-1-8
Rural Fleet Management, new start.

A rural area with a diversity of public service fleets will be selected to demonstrate technologies, operations and institutional coordination that can reduce fleet operating costs while maintaining or improving fleet readiness and effectiveness of service delivery. Attention will be paid to consolidation of fixed facilities, joint dispatching for efficient vehicle assignment, use of AVL and MDTs for monitoring service progress and vehicle location, and cost allocation for payment by various jurisdictions of joint fleet operation. The demonstration may include partnerships with private fleet operators.
[4.1, 4.2:6]

Deployment	98-2-1

98-2-1
Deployment Incentive Phase 1/Early Starts— Initiate FY98
Evaluated demonstrations of ARTS planning, deployment, integration and sustainment. Pending authorizing legislation.
[various:various]

Delivery 98-3-1
ARTS Toolbox 1 and Expanded Success Stories, ongoing.
Task order contract will continue to identify and disseminate a collection of case studies that represent tried and generally practicable approaches to applying ITS solutions to rural operational problems.
[all:all]

98-3-2
Development of Early Rural Deployment Planning Guidance, new start.
Will support subsequent deployments by establishing initial procedural guidelines for transportation planners to incorporate ARTS projects into transportation improvement plans and programs, especially the statewide long range plan and transportation improvement program. Will establish checklists for federal reviewers for federal-aid grant approval for ARTS projects. Will recommend any changes needed to the appropriate CFRs to incorporate ARTS planning procedures.
[all:all]

98-3-3
Professional Capacity Building, new start.
The federal staff training will be initiated to provide ongoing ARTS deployment and planning technical support to state and local agencies. Curricula will be developed for incorporation into existing training programs. An initial staff cadre will be trained to deliver the curricula.
[all:all]

Program Area   **FY 99**
Research and   99-1-1
Development   Development of Rural ITS Services, ongoing.

99-1-2
Tourism and Traveler Information, ongoing.

99-1-3
Emergency Services, ongoing.

99-1-4
Traveler Safety and Security, ongoing

99-1-5
Rural Public Mobility, ongoing.

99-1-6
Rural O&M and Traffic Management Systems, ongoing.

99-1-7
Rural Fleet Management, ongoing.

99-1-8
Rural CVO, new start.
In coordination with the CVISN program, techniques will be demonstrated in rural areas that address commercial vehicle inspection, clearance and routing issues relevant to non-interstate rural routes, economic competitiveness of rural areas, and agricultural fleets.
[1.1, 3.1, 4.3, 5.3:7]

99-x-x
Incorporation of ARTS Architecture and Standards, new start.
Hand-off of ARTS requirements to existing architecture and standards efforts. Not funded by ARTS program.
[all:all]

Deployment
99-2-1
Deployment Incentive Phase 2, ongoing.
Evaluated demonstrations in rural areas will test increasing levels of integration and sustainment among more advanced deployment areas, and will initiate planning and deployment among less advanced areas. Inclusion of federal domain areas
[various:various]

Delivery
99-3-1
State/local Workshops in ARTS Planning— Initiate FY99
This will provide for a contractor to assist in conducting state and local workshops for ARTS planning agencies. The contractor will provide technical training materials and conduct the workshops in coordination with USDOT and other national ARTS experts. Contractor and agency experience gathered through the workshops will be used to produce a finalized Deployment Planning Guidance.
[all:all]

99-3-2
Toolbox 2 Development , ongoing.
Advanced version of the tool box resulting from additional research. Includes guidance on all ARTS infrastructure and integration of infrastructure components and applications.
[all:all]

99-x-x
Professional Capacity Building, ongoing, off ARTS budget.
The federal staff training will be continued under existing USDOT training mechanisms, to provide ongoing ARTS deployment and planning technical support to state and local agencies.
[all:all]

Program Area	FY 00

Research and Development

00-1-1
Development of Rural ITS Services, ongoing.

00-1-2
Tourism and Traveler Information, ongoing.

00-1-3
Emergency Services, ongoing.

00-1-4
Traveler Safety and Security, ongoing

00-1-5
Rural Public Mobility, ongoing.

00-1-6
Rural O&M and Traffic Management Systems, ongoing.

00-1-7
Rural Fleet Management, ongoing.

00-1-8
Rural CVO, ongoing.

00-x-x
Incorporation of ARTS Architecture and Standards—ongoing.
Not funded by ARTS program.
[all:all]

Deployment

00-2-1
ARTS Deployment Incentive, Phase 3, ongoing.
Progress will be continued in all phases of deployment. Projects will evaluate the effectiveness of component integration and deployments in additional rural environments, and over new coordination areas or corridors.
[various:various]

Delivery

00-3-1
State/local Workshops in ARTS Planning, ongoing.
This will provide for a contractor to assist in conducting state and local workshops for ARTS planning agencies. The contractor will provide technical training materials and conduct the workshops in coordination with USDOT and other national ARTS experts.
[all:all]

00-3-2
Toolbox 3 Development , ongoing.
Continued development of the tool box resulting from additional research.
[all:all]

00-x-x
Professional Capacity Building, ongoing, off ARTS budget.
The federal staff training will be continued under existing USDOT training

mechanisms, to provide ongoing ARTS deployment and planning technical support to state and local agencies.
[all:all]

Program Area	FY 01

Research and Development

01-1-1
Research on Needs in all Critical Program Areas, ongoing.
Ongoing research will respond to, and update, issues in the Rural Research Plan.
[various:various]

01-1-2
Tourism and Traveler Information, ongoing.

01-1-3
Emergency Services, ongoing.

01-1-4
Traveler Safety and Security, ongoing

01-1-5
Rural Public Mobility, ongoing.

01-1-6
Rural O&M and Traffic Management Systems, ongoing.

01-1-7
Rural Fleet Management, ongoing.

01-1-8
Rural CVO, ongoing.

Deployment

01-2-1
ARTS Deployment Incentive, Phase 4, ongoing.
This is the fourth phase of ARTS infrastructure and services integration projects.
States graduating from previous capacity building efforts will be emphasized. This
phase will extend evaluation of the effectiveness of new levels of component
integration in new rural environments, and over new coordination areas or corridors.
[various:various]

Delivery

01-3-1
State/local Workshops in ARTS Planning— Ongoing.
This will provide for a contractor to assist in conducting state and local workshops for
ARTS planning agencies. The contractor will provide technical training materials and
conduct the workshops in coordination with USDOT and other national ARTS experts.
[all:all]

01-3-2
Toolbox 4 Development , ongoing.
Advanced version of the tool box resulting from additional research. Includes
guidance on all ARTS infrastructure and integration of infrastructure components and
applications.
[all:all]

01-x-x
Professional Capacity Building, ongoing, off ARTS budget.
The federal staff training will be continued under existing USDOT training
mechanisms, to provide ongoing ARTS deployment and planning technical support to

state and local agencies.
[all:all]

ARTS	Advanced Rural Transportation System
AVL	Automatic Vehicle Location
CPA	Critical Program Area
CVO	Commercial Vehicle Operations
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GPRA	Government Performance and Reporting Act
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
JPO	Joint Program Office
NHTSA	National Highway Traffic Safety Administration
O&M	Operations and Maintenance
RAT	Rural Action Team
TMC	Traffic Management Center
USDOT	United States Department of Transportation
VMT	Vehicle Miles Traveled