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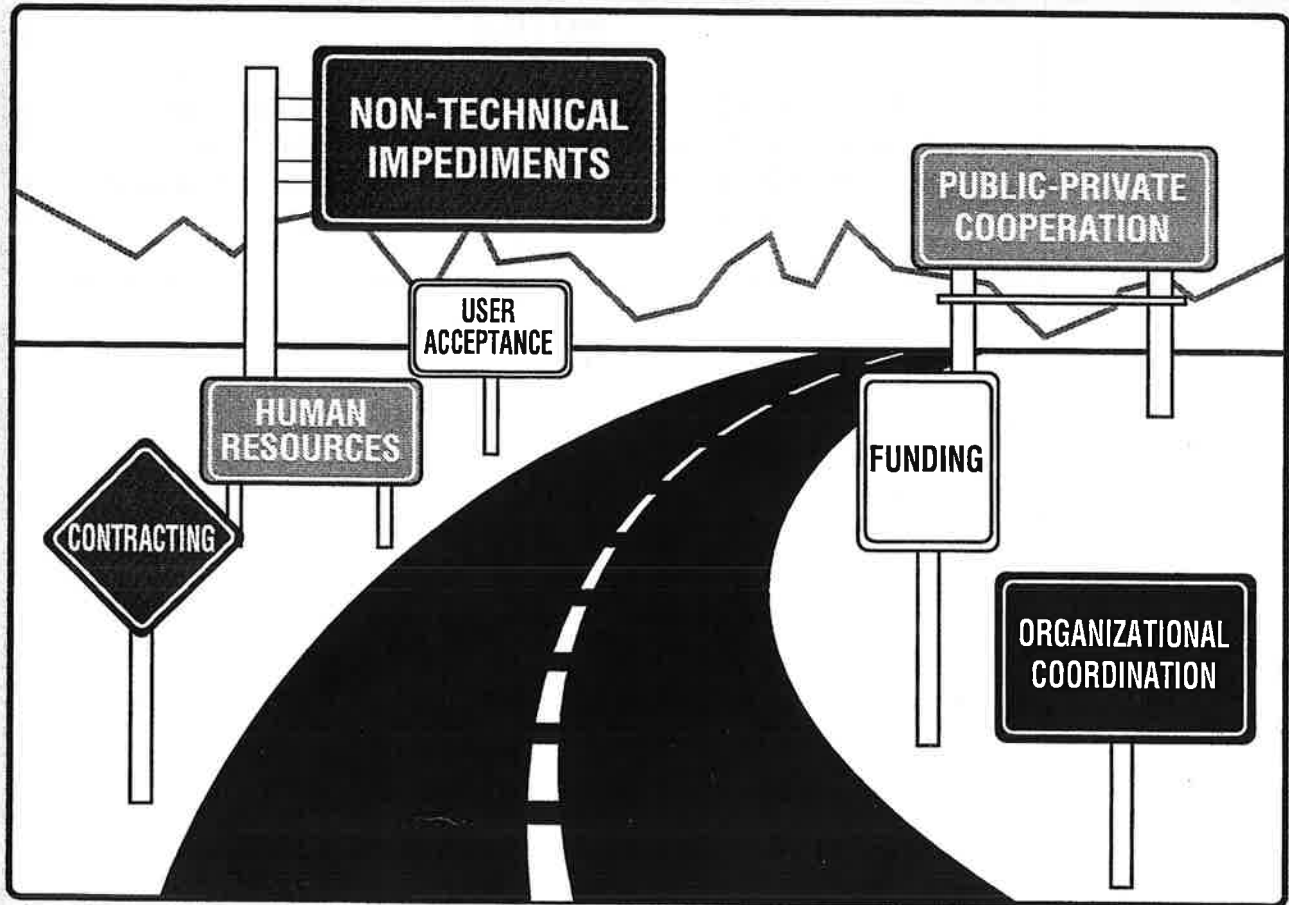
U. S. Department
of Transportation
Federal Highway
Administration

INTELLIGENT TRANSPORTATION SYSTEMS INSTITUTIONAL AND LEGAL ISSUES PROGRAM

FHWA-JPO-95-008
DOT-VNTSC-FHWA-95-3

Final Report
June 1995

REVIEW OF THE SAFIRES OPERATIONAL TEST



Research and
Special Programs
Administration

John A. Volpe National
Transportation Systems Center

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE June 1995	3. REPORT TYPE AND DATES COVERED Final Report July 1994 - June 1995
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4. TITLE AND SUBTITLE ITS Institutional and Legal Issues Program Review of the SaFIRES Operational Test	5. FUNDING NUMBERS HW552/H5003
6. AUTHOR(S) Dawn LaFrance-Linden*, Allan J. DeBlasio**, David W. Jackson***	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Department of Transportation Research and Special Programs Administration Volpe National Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	8. PERFORMING ORGANIZATION REPORT NUMBER DOT-VNTSC-FHWA-95-3
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Department of Transportation Joint Program Office for Intelligent Transportation Systems 400 7th Street, S.W. Washington, D.C. 20590	10. SPONSORING/MONITORING AGENCY REPORT NUMBER FHWA-JPO-95-008
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11. SUPPLEMENTARY NOTES
*EG&G Dynatrend, Inc. (Principal author)
** Volpe National Transportation Systems Center
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12a. DISTRIBUTION/AVAILABILITY STATEMENT This document is available to the public through the National Technical Information Service, Springfield, VA 22161 and ITS America, Washington, D.C.	12b. DISTRIBUTION CODE
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13. ABSTRACT (Maximum 200 words)
The SaFIRES operational test was chosen by the FHWA to be the subject of a case study. Several case studies were performed under the Intelligent Transportation Systems (ITS) Institutional and Legal Issues Program, which was developed in response to the Intermodal Surface Transportation Act of 1991. The objective of each case study was to determine (1) the institutional issues and legal impediments encountered during the establishment of partnerships and deployment of ITS services and products during the operational test, (2) the point in the life cycle of the operational test at which the impediments occurred, (3) how project partners and participants overcame impediments, and (4) lessons that were learned that are applicable to future deployments of ITS products and services. This case study also describes the operational test and documents its history. Interviews for this case study were conducted during the summer of 1994.

14. SUBJECT TERMS Intelligent Transportation Systems (ITS), Intelligent Vehicle Highway Systems (IVHS), Advanced Public Transportation Systems (APTS), Institutional Issues, Legal Issues, Nontechnical Impediments, Operational Test, Lessons Learned, Route Deviation, Demand Responsive, Partnerships, and Transportation	15. NUMBER OF PAGES 60
16. PRICE CODE	

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT
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Final Report

**ITS INSTITUTIONAL AND
LEGAL ISSUES PROGRAM**

**REVIEW OF THE SAFIRES
OPERATIONAL TEST**

Dawn LaFrance-Linden
Allan J. DeBlasio
David W. Jackson

June 1995

Prepared by

U.S. Department of Transportation
Research and Special Programs Administration
Volpe National Transportation Systems Center
Cambridge, Massachusetts

Prepared for

U.S. Department of Transportation
Joint Program Office for Intelligent Transportation Systems
Washington, D.C.

METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
 1 foot (ft) = 30 centimeters (cm)
 1 yard (yd) = 0.9 meter (m)
 1 mile (mi) = 1.6 kilometers (km)

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
 1 centimeter (cm) = 0.4 inch (in)
 1 meter (m) = 3.3 feet (ft)
 1 meter (m) = 1.1 yards (yd)
 1 kilometer (k) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square inch (sq in, in²) = 6.5 square centimeters (cm²)
 1 square foot (sq ft, ft²) = 0.09 square meter (m²)
 1 square yard (sq yd, yd²) = 0.8 square meter (m²)
 1 square mile (sq mi, mi²) = 2.6 square kilometers (km²)
 1 acre = 0.4 hectare (he) = 4,000 square meters (m²)

AREA (APPROXIMATE)

1 square centimeter (cm²) = 0.16 square inch (sq in, in²)
 1 square meter (m²) = 1.2 square yards (sq yd, yd²)
 1 square kilometer (km²) = 0.4 square mile (sq mi, mi²)
 10,000 square meters (m²) = 1 hectare (he) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gm)
 1 pound (lb) = 0.45 kilogram (kg)
 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

MASS - WEIGHT (APPROXIMATE)

1 gram (gm) = 0.036 ounce (oz)
 1 kilogram (kg) = 2.2 pounds (lb)
 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
 1 tablespoon (tbsp) = 15 milliliters (ml)
 1 fluid ounce (fl oz) = 30 milliliters (ml)
 1 cup (c) = 0.24 liter (l)
 1 pint (pt) = 0.47 liter (l)
 1 quart (qt) = 0.96 liter (l)
 1 gallon (gal) = 3.8 liters (l)
 1 cubic foot (cu ft, ft³) = 0.03 cubic meter (m³)
 1 cubic yard (cu yd, yd³) = 0.76 cubic meter (m³)

VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)
 1 liter (l) = 2.1 pints (pt)
 1 liter (l) = 1.06 quarts (qt)
 1 liter (l) = 0.26 gallon (gal)
 1 cubic meter (m³) = 36 cubic feet (cu ft, ft³)
 1 cubic meter (m³) = 1.3 cubic yards (cu yd, yd³)

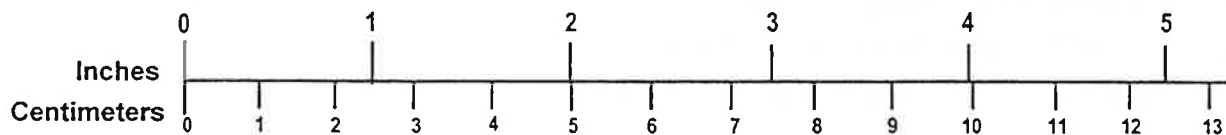
TEMPERATURE (EXACT)

$$[(x-32)(5/9)]^{\circ}\text{F} = y^{\circ}\text{C}$$

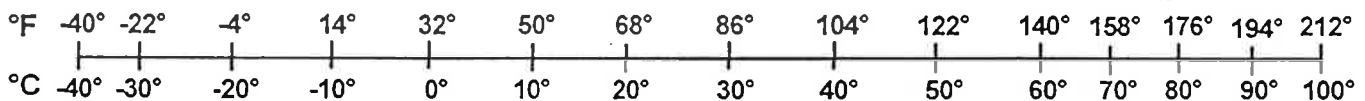
TEMPERATURE (EXACT)

$$[(9/5)y + 32]^{\circ}\text{C} = x^{\circ}\text{F}$$

QUICK INCH - CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSION



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 Price \$2.50 SD Catalog No. C13 10286

Updated 1/23/95

PREFACE

In response to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the United States Department of Transportation (U.S. DOT) developed the *Intelligent Vehicle-Highway Systems (IVHS) Institutional and Legal Issues Program* (now called the *Intelligent Transportation Systems (ITS) Institutional and Legal Issues Program*). This program was designed to identify (1) issues that may constrain the full deployment of ITS products or services, (2) the means to overcome nontechnical barriers to ITS deployment, and (3) the lessons that were learned that might expedite the full deployment of ITS technologies.

This report was prepared by the U.S. DOT's John A. Volpe National Transportation Systems Center (Volpe Center) for the U.S. DOT's ITS Joint Program Office (JPO). The Volpe Center is providing analytical support to the JPO under the Operational Test Case Studies subject area of the *Institutional and Legal Issues Program*. This subject area calls for a national, independent, and cross-cutting evaluation of several operational tests. This evaluation will identify the problems and issues that participants in operational tests encountered when deploying ITS technologies and services and the important lessons that have been learned and may be applied in future deployments of ITS products and services. Other reports produced in the Operational Test Case Studies subject area are listed in Appendix C.

The Volpe Center has assessed twelve federally sponsored operational tests with the **primary purpose** of answering four questions:

1. *What nontechnical impediments were encountered establishing partnerships and deploying ITS services and products during the operational test?*
2. *Where in the life cycle of the operational test did these impediments occur?*
3. *What were the causes of these impediments and how were they overcome?*
4. *What lessons were learned in dealing with these impediments that can be applied to future deployments of ITS products and services?*

In order to place the nontechnical issues in the life cycle of the development and the deployment of the ITS product or service, the **secondary purpose** of the assessments is to describe the operational test and document its history. These assessments are intended to be illustrative and descriptive in nature. They are not intended to be evaluative (i.e., comparing an observed outcome of the operational test to an expected level of performance) or show cause-and-effect (i.e., identifying whether the operational test has contributed to changes to a base condition or event). Also, these assessments are not intended to evaluate the technical components of the operational tests.

During the summer of 1994, a team of analysts, in accordance with the Volpe Center Project Memorandum, *IVHS Institutional Issues - Monitoring Program Framework*, interviewed and sent questionnaires to twelve project participants from the Smart Flexroute Integrated Real-Time Enhancement System (SaFIRES) operational test and reviewed project documentation. The interviewees represented federal, state, and regional governments and private consultants to the test. These individuals were involved in various aspects of the operational test from policy making to program management to technical and administrative support. They included chief executives, agency managers, program administrators, engineers, planners, researchers, and evaluators. Many were involved in the initiation of the project while others were involved in day-to-day project activities. This diverse group of individuals provided the study team with a broad range of views about the SaFIRES operational test and the ITS program in general.

The authors were sensitive to the criticism that project evaluations either seek out negative aspects of the project with little emphasis on positive lessons, are biased, or lay blame. The authors acknowledge that the assessments were oriented toward finding problems, but these assessments were also structured to identify positive lessons that were learned and that could be shared with others.

The authors thank the interviewees for taking time from their busy schedules to answer our questions and for their openness in doing so. The issues, lessons, and insights that they discussed will benefit the entire ITS effort.

Section 1 of this report is a summary of the project and of the issues and lessons learned that were discussed by the interviewees. **Section 2** describes the scope, history, management structure, and participants of the SaFIRES operational test. It also discusses the stated project goals and objectives, the goals and objectives of the project participants, the benefits the interviewees foresee for participating in the project, the risks that they or their organization may be taking, and what they see as the critical success factors of the project. **Section 3** presents a more detailed discussion of the institutional issues and lessons learned.

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1. SUMMARY

This section presents an overview of the Smart Flexroute Integrated Real-Time Enhancement System (SaFIRES) operational test and a summary of the issues and lessons learned that were discussed by the interviewees.

1.1 PROJECT OVERVIEW

The **SaFIRES** operational test, an advanced public transportation system (APTS), has been developed with the goal of providing greater effectiveness and efficiency in serving the public transportation needs of the community through the use of integrated smart vehicle service that includes route-deviation, fixed-route, and demand-responsive service. The test area encompasses a 362 square mile suburban and rural area in and around Northern Virginia's Prince William County, located approximately 25 miles south of Washington, D.C.

SaFIRES, eventually operating with a fleet of up to 50 small, multi-purpose buses and other vehicles, will utilize a variety of intelligent transportation system (ITS) technologies, including global positioning system (GPS), automatic vehicle location (AVL), real-time scheduling software, geographic information system (GIS) mapping, and digital communications via mobile data terminals. Using integrated computerized dispatching software, developed specifically for SaFIRES, project vehicles will be able to switch between service types on an as-needed basis in response to real-time requests. This will enable the effective provision of commuter rail feeder route service and flex-route bus service (comprising route deviations of up to $\frac{3}{4}$ mile), including paratransit transportation.

There are nine major participants in the \$3.2 million SaFIRES operational test, five from the public sector and four from the private sector. The Federal Highway Administration (FHWA) is providing federal operational test funding of approximately \$1.2 million, while the Federal Transit Administration (FTA) is providing overall program management. The Virginia Department of Rail and Public Transportation (VDRPT) is providing federal grant management. The Potomac and Rappahannock Transportation Commission (PRTC) is the grant recipient and the local project managing agency, specifically responsible for the operation of the transit service. The fifth public agency involved in the project is the Northern Virginia Planning District Commission (NVPDC) which assumes the dual responsibilities of technical support and project evaluation.

As the lead partner for this operational test, the PRTC will be assisted in overall project management by Tidewater Consultants, Inc. (TCI), and in operations management by SG Associates (SG). TCI has been assigned the role of technical manager and is responsible for coordinating the technical components of the project. The private firm of SG will assist the PRTC with project management tasks and will provide various transportation consulting services, including transit system configuration and integration services. Two other private sector companies are also heavily involved in this project. GMSI (formerly known as Gandalf

Mobile Systems, Inc.) is responsible for providing computer hardware for the mobile data communication system and the Computerized Vehicle Information System. UMA Engineering, Ltd. (UMA) is responsible for developing the software for the route deviation and scheduling components of the system. All but one of the private and local public participants involved have contributed their own funding to the project.

The SaFIRES project was first proposed to the FHWA during their first national solicitation for operational tests in 1992. The proposal, then known as the Advanced Ridesharing and Traveler Information Systems (ARTIS) project, was not selected as one of the first 16 operational tests. After several proposal refinements and resubmittal to the FHWA and the FTA, SaFIRES was approved for federal funding in January 1994. During 1994, the request for proposals (RFPs) for the technical manager was issued. All scope of work agreements for the hardware, software, and support services, as well as all funding agreements between the numerous partners were executed by December 1994.

In mid-fall 1994, the PRTC obtained 20 vehicles for the SaFIRES project, and subsequently began "non-ITS enhanced" local bus service on three commuter rail feeder routes on December 19, 1994. An additional commuter rail feeder route was added in March 1995 and three bus flex-routes were added in April 1995. By the end of the summer, the SaFIRES project is scheduled to have 22 vehicles operating on five flex-routes and five commuter rail feeder routes. Installation of the mobile data terminals into the existing SaFIRES fleet began in the spring of 1995. This corresponded with the delivery of the software prototype by UMA and the delivery of the computer hardware by GMSI. November 1995 is the scheduled date for all ITS enhancements, including the GPS component, to be installed, integrated, tested, and ready for deployment. The ITS-enhanced project is scheduled to run for 30 months.

1.2 ISSUES ENCOUNTERED BY PROJECT PARTICIPANTS AND LESSONS LEARNED

This subsection outlines the non-technical impediments and the lessons learned discussed during face-to-face interviews with project participants, or in response to the questionnaire. These current or past issues and lessons are divided into four categories:

- New Business Relationships
- Project Definition
- Organizational Coordination
- Human Resources

1.2.1 New Business Relationships

The interviewees expressed ten issues related to new business relationships. The issues are divided into three groupings: (1) issues related to developing the partnership, (2) issues related to defining roles and responsibilities, and (3) issues related to administering the project.

1.2.1.1 Developing The Partnership

Three issues were encountered by the participants while developing the partnership. The first issue involved the difficulty the principal partners faced in working with a partnership. The last two issues concerned competition within the private sector. There was competition regarding product development between some of the private sector partners, and the contracted technical manager (TM) competed directly with one of the original project partners.

The participants felt that the newness of public-private partnerships, especially in the context of an ITS project, created to the greatest extent the partnership difficulties. A number of circumstances were provided that all contributed to the difficulties encountered in working with a partnership. There was an extensive amount of unfunded and non-reimbursable pre-contract start-up work (this especially concerned the public partners). There were distinct differences between the public sectors' slow and cautious operating style versus the private sectors' willingness to accept risk, support innovation, and necessity to show profits. There were intellectual property concerns. Agencies wanted to receive proper credit for project work they performed. Another contributing factor was the early large turnover rate of original private partners. Although delays in the formation of the partnership did occur, the respondents did agree that this issue was resolved, even though trust between the public and private sectors remains a potential subsurface issue that may create consequences for either later stages of this project or could be a future issue for other ITS projects.

The issues concerning private sector competition among the partners, and between partners and the TM have also been resolved, but also have potential to re-emerge. Prior to the elimination of the ridesharing component during the redesign of the project, two private sector participants were both developing ridesharing products and were competitors, leading to their disagreement over who should be responsible for product development. After seven months of delay, resulting in increased costs and partner confusion, the rideshare component was dropped and some private partners left the project. They were replaced by non-competitors from the private sector.

The issue regarding the TM began in the summer of 1994, when a firm that was a direct competitor to one of the partners was contracted as the TM. Both companies develop software for transit applications and public information systems. Conflict arose because the partner, who had no input into the selection process, would have to provide proprietary technical information to the TM. The partner has not contested the decision, but has required the development of non-disclosure agreements between all parties. One respondent noted that proprietary information concerns could be expected in any test using software. Participants raised concern that this issue

may likewise re-appear and affect deployment of the system if arbitration or other legal action is required.

The interviewees related a variety of **lessons** that they learned in addressing partnership development issues. Advice was provided regarding the beginning of the project which was deemed the most difficult: **a new program can be initiated when agencies work together; however, expect some delays in the difficult process of forming a partnership. Recognize the partnership might change and accept these changes as part of the process.** The respondents highlighted how cooperative efforts among the partnership could be increased. **Both the public and private partners should recognize the fundamental differences in each others' business styles and operating requirements, and each should appreciate and benefit from the strengths that the other offers. Communication among the partners is important; keep everyone informed of project status and what to expect.** Points were further made regarding the public sectors concerns over innovation and project costs. **Innovation is possible and is central to improving transit operations. State and federal laws should permit ITS project participants to be reimbursed for all project efforts expended prior to the signing of contracts and funding agreements.**

The participants also provided many lessons that could be applied to reduce competition within the partnerships. **Pick the team carefully, paying particular concern to the parties' compatibility and expertise. Identify areas of competition and conflict early on to reduce stumbling blocks, and address conflicts as they arise, including adding criteria in all RFPs to address this concern.** One such requirement that **may be necessary to include is non-disclosure statements to protect data and products developed during ITS projects.** It was also stressed the need for an open and sensitive partnership development process that protects the interest of all partners and is sensitive to each partner's position and concerns. **An interactive team building process is needed in which all partners are consulted on decisions to hire contractors and all partners are encouraged to express their concerns.**

1.2.1.2 Roles And Responsibilities

Three issues involving roles and responsibilities were discussed by the participants. These issues focus on roles and responsibilities at the federal, state, and local project levels.

Public and private sector representatives felt that the roles and responsibilities for the project were unclear between the FHWA and FTA on the federal level, and between the Virginia Department of Transportation (VDOT) and the VDRPT on the state level. On the federal level, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) had created the new partnership for ITS projects between the FHWA and the FTA without providing a clear administrative structure of the various projects. One participant noted that, "this is a transit project being funded with highway money." Many of the partners were uncertain where the federal decision making authority was vested. Conflicting responses resulted from this confusion and some project delay, especially regarding whether or not to continue the ridesharing component.

The confusion at the state level existed because the FHWA was the principal funding agency and usually works with the VDOT. SaFIRES is predominately a transit project, which is overseen by the VDRPT. Resolution was obtained on the federal and state issues when it was determined that the FTA would administer the project and the VDRPT would be the responsible state agency. Some participants still feel that the federal roles are only partially resolved.

The other role and responsibility issue arose because a project manager was not identified in the original project proposal. This created both a lack of direction for the project and a lack of clarity regarding the flow of funds. The project partners were given tasks with vague responsibilities and without clear completion deadlines, leading to some overlapping roles. This issue was resolved after much administrative confusion, when the partners agreed to an administrative process which appointed a project manager, not originally identified in the project proposal. Many partners also felt that an equally positive impact occurred when the TM was hired to assist project management. Concern was still noted by one participant because of the uncertainty whether all partners will be willing to maintain the project roles they were assigned.

The respondents highlighted the importance of carefully prepared and thorough proposals in their lessons related to role and responsibility issues. **It is expensive in both time and money to prepare proposals, but they are still necessary to defining roles and responsibilities. For consistency, keep the original writers involved when revising the proposal.** The interviewees conveyed that project developers must **identify and assemble the key players early, including a strong, consistent leader and program manager.** The lessons outlined the need for detail regarding roles and responsibilities. **Confusion results from the nature of contracting; roles and responsibilities need to be explicitly defined and identified to each party within the partnership as soon as possible, preferably spelled out in the contracts.** It was suggested that ways to avoid further conflict regarding federal roles is to **allow the FTA more autonomy in transit-related ITS projects and provide only one point of federal contact.**

1.2.1.3 Project Administration

Four issues regarding project administration were discussed. The participants raised the issue that federal administrative procedures do not adequately address how to develop partnerships for ITS products and systems. The interviewees remarked that communication among the eight partners was both difficult to establish and difficult to maintain. Parties mentioned that the VDRPT was unaware of the FHWA's contracting requirements. The fourth project administration issue concerned the difficulties that the partners had in understanding and meeting federal matching requirements.

The parties citing inadequate federal administrative procedures attributed the cause to the newness of the ITS program and the uncertainty of what existing regulations would apply to ITS projects, especially to either fixed-route or route-deviation services. The ITS program created the development of projects, such as SaFIRES, which were transit projects that must be operated under highway rules and procedures. This presented great confusion and difficulty because the

FTA and the FHWA had no established administrative procedures to handle a SaFIRES-type project.

On the local level, existing procurement processes proved burdensome to the SaFIRES project. In addition, the limited trust between private sector, with its competitive nature and profit motive, and the public sector, as the controller of public funds, often exacerbated the administrative process. Some participants saw the inclusion of VDRPT as the grant recipient as adding an unnecessary level of bureaucracy to the funding procedure. However, although the VDRPT staff was initially unfamiliar with the FHWA requirements, they learned quickly and only caused minor delays. Likewise, the issue of inadequate project procedures was also resolved, but required a great deal of staff time and paperwork to develop an internal administrative procedure and build trusting relationships. Two participants felt that the lack of appropriate procedures and the existing regulations' limitations on mixing project funds and riders from other programs (i.e., ADA-eligible paratransit) could slow the project's full deployment or create the need to once again revise the project.

Another administrative issue discussed was the difficulty in communicating. A major reason for this issue was that there were too many independent organizations not brought together by a single leader that would emphatically state the purposes of partner meetings, the level of preparation that each attendee would be expected to attain for each meeting, summarize what exactly was said at each meeting, and what was agreed to by the partners. Without this leadership, parties attended meetings unprepared and left meetings with different recollections as to what was discussed and what agreements were reached. This issue has been resolved, but did cause delays in shaping the initial proposal and the completion of interagency contracts.

The final administrative issue cited concerned meeting federal matching requirements by the local partners. A majority of interviewees noted that this issue arose because of the partners' lack of experience with federal contracting procedures and the general lack of understanding about what constitutes matching. The project partners agreed to a very high matching ratio of 50% federal/50% local. This high local match not only locked in the federal expectations but also effectively fixed the total funding available for the operational test. Much of the local match is a combination of time or services, rather than material or cash. While all the partners agreed to the matching requirements and levels, some participants felt that this issue can potentially create future conflict because of the complexity of accounting for the soft matches, especially when the participants begin billing the project and the deployment begins. Deployment may also be affected because funding for the project may prove inadequate, requiring project revisions to stay within the existing, inflexible budget.

The respondents listed a variety of **lessons** related to the issues involving project administration. The lessons dealt with the development of the administrative process, federal contacts, meeting objectives, leadership and assistance in understanding funding and requirements, advance planning, and matching funds. The participants began by discussing lessons for the initial project stages. **Advance planning should be done to ensure that realistic estimates for schedules, funding, and non-federal matches are obtained.** As part of the advanced planning, the respondents conveyed that project partners should **expect to devote significant resources to**

the development of administrative processes, including the development of appropriate standards if the project proposes something new, and development of a process for selecting private partners which is consistent with local procurement processes.

Regarding communication, the participants stressed that **a strong, consistent leader who is responsible and has chairmanship skills is needed.** It was emphasized that **direct on-site communications among the partners are necessary.** The direct communication included meetings in which **partners must know the content and importance of the meetings to which they are invited and a recorder to keep good minutes of meetings is needed.** Communication improvements also included the thought that **only one central point of contact at the federal level is necessary** and that **it would be better to work through the FTA for transit-related projects.** One party highlighted the importance of going over requirements ahead of time, especially with a new agency or one with which the federal or other managing agencies have not worked previously. **Don't assume agencies are aware of project requirements.**

This thought of making sure the partners understand all requirements was expanded by other individuals to include the need for knowledgeable partners to assist with all project procedures, especially project and funding development. **The project team should be identified early, especially at the state and federal levels, so the knowledgeable partners can provide assistance in developing the project and in understanding the federal funding and operational requirements, including the explanation of government mandates and highlight the changes in the requirements.** The interviewees admitted that there was great confusion in the organizational commitments of the matching funds and they provided lessons to assist with this process. **It is difficult to cut back on promised matches, but matches may always be increased at a later date. The project team should pool the matches, allowing the stronger partners to provide the larger shares and to avoid burdening the weaker partners.** Finally, the parties warned that **a good accounting system is required to track matching funds.**

1.2.2 Project Definition

The interviewees introduced four issues related to defining the SaFIRES project. The issues dealt with the initial lack of direction, the lack of definition for the ridesharing component, the difficulty in coordinating the operational test with the inter-county bus system, and the problems associated with tailoring the proposal to receive federal funding. Two related **potential** issues resulting from unclear proposals and uncertain funding for the SaFIRES project were also suggested.

The lack of guidance in the development of the new project resulted in no clear objectives and no firm direction established for the SaFIRES project. One participant felt that the FHWA was unclear as to what they wanted tested, what technologies should be used, and what the local transportation needs were. Coupled with this was local party problems such as differing objectives, no full understanding of the project or the technology being discussed for inclusion, and the inexperience of some private partners in working with the public sector. These problems led to the development of a project that was too large and complex and had to be refined and

refocused in order to be operational. Through additional time, hard work, and extensive partner discussions, the project was redesigned and the rideshare component was dropped.

Discussion about the single-trip ridesharing component was very contentious during the early stages of the project. Representatives from the federal level desired to see the ridesharing segment implemented; but the local partners, skeptical that the ridesharing component was suitable to the SaFIRES service area, espoused that the concept was inadequately defined, with neither the technical nor the marketing issues explained to the satisfaction of the partners. Discussion and conflict regarding this part of the project threatened to halt SaFIRES. Finally, with the input from the new TM, the majority of the parties decided to eliminate the ridesharing component. One of the original partners left the project as a result of this decision.

Also problematic was the effort to coordinate the deployment of the SaFIRES project with the start-up of the new inter-county bus service. Conflicting time frames and local approval of funding for system operations created much of the problems. This issue was eventually resolved to the point that coordination will not be an obstacle during the deployment of the SaFIRES project.

In the desire for federal funds, some of the partners attempted to tailor the project to ensure federal approval. This resulted in the financial commitment by some partners of more than they could realistically handle and the promise to develop services and use technologies that they did not understand. The project was eventually scaled down to a level that is less innovative than originally envisioned but has greater feasibility for success.

The participants citing issues involving the project definition provided related **lessons** that dealt with the assistance needed in developing a project, guidelines to use in determining the nature of a project, and project timing and scheduling. The respondents noted that **expert guidance and education are needed for the state and local transportation planning agencies in the areas of ITS technologies and federal policies as early in the process as possible**. The TM can play a significant role as an expert, external to the partners' abilities. **Acquire a technical manager early in the project to help shape the technical components, balance the interests of the partners, and ensure that project requirements are met.**

The participants stressed that the nature of the project should be established very early in the project development planning process. A variety of guidelines as to how to best define the project scope were included in the lessons. **The operational test proposals need to be clearly understandable and each partner must have realistic project goals. The partners should be pinned down to the specifics of their concepts as early as possible. The system proposed to be developed should be flexible and adaptable.** The guidelines also dealt with inclusion or elimination of each component of the project. **Each piece of the project should be judged on technical merit. No part of the project should be approved without rigorous examination; or, as a few respondents believed, no part eliminated after having received approval.** Along with these guidelines, the interviewees added that **the project must budget for early customer education.**

Cooperative efforts were stressed during the project definition process. **Review the project's vision and the proposal among all the partners early in the project, possibly in a pre-award meeting. Establish with all the private sector partners what the project requirements are and what the partners are expected to do.** However, the interviewees also warned the project can be affected by the difficulty in developing partnerships and the political process impacts during the project definition phase and beyond. **Partners need to understand that there is no guarantee that an initial investment will result in a contract. This needs to be balanced against the problem of attracting and keeping partners. Likewise, if elected officials or board members change, the proposal may change as well.** Because of all of these potential difficulties, partners should **expect the project development and implementation process to take a long time.**

1.2.3 Organizational Coordination

Two issues regarding organizational coordination were discussed by the participants. The first issue concerned uncertainty at the FHWA as to which office would administer the project. After negotiations within the FHWA, the FHWA HQ delegated the project management to its Regional Office, which assigned the project to the Division, consistent with the normal federal aid process. The confusion was created because of the new business relationships that were required to operate this project.

The second organizational coordination concerned the early opposition to the project by some of the transportation operators in the region. Perceived competition and territoriality were reasons cited for this lack of initial cooperation. This issue has been resolved and cooperation was developed between the local transportation agencies. A participant provided the **lesson** that in order to build local agency support **the project partners need to portray the project as a complement to currently existing systems.**

1.2.4 Human Resources

Two human resource issues were raised by the interviewees. One issue concerned the lack of technical expertise within the local project management agencies. The second issue dealt with the uncertainty as to who was staffing this project within the VDRPT.

Many local agencies do not have the technical experts on staff that is necessary to examine all aspects of technical innovations required by the development and implementation of ITS projects. Tight local budgets impede the acquisition of these experts. Some participants felt that the SaFIRES project was affected by a lack of knowledgeable communication during the development of the technical components and the final draft of the operational test. Resolution of this issue was achieved when additional expertise was acquired from the private sector, including the TM.

Another concern was the staffing at the VDRPT. When it assumed the grant management role for the SaFIRES project, the VDRPT was a new organization with an uncertain internal structure. The VDRPT, oriented to implement transit programs rather than specific projects was slow to assign a single individual to this project. Although staffing continuity was affected, the VDRPT did eventually settle on a SaFIRES representative. One party believed that the startup by the VDRPT and its cooperative efforts with both the FTA and the FHWA was less troublesome than was first envisioned.

The participants offered four lessons learned from confronting human resource issues. First, **get information on project participants and their organizational structure at the start of the project.** Within each organization **it is important to identify staff who will be assigned to a project as early as possible.** After the staff has been identified, gaps in the expertise required for the project can be ascertained. At that point it is important to **develop a procedure to add expertise to a project.** Regarding the need for technical and administrative assistance it was strongly suggested that all lead partners should, **most importantly, do not go it alone; get help as early as possible.**

1.3 ISSUES THAT MAY BE ENCOUNTERED BY THE PROJECT PARTICIPANTS IN THE SAFIRES OPERATIONAL TEST

This subsection outlines the non-technical impediments that the project participants said *may* occur in the SaFIRES operational test and related lessons contributed from thinking about the **potential** issues. In addition to potential issues, this subsection reviews how issues may affect the full deployment of the SaFIRES operational test, or the full deployment of other ITS projects.

The participants mentioned eight issues that may potentially affect the SaFIRES project. These issues fall into the following categories:

- New Business Relations
- Project Definition
- Organizational Coordination
- Human Resources
- Technology
- User Acceptance
- Evaluation.

1.3.1 New Business Relationships

The participants noted that there existed a difference between the SaFIRES operational objectives of the public sector partners and of private partners, which created a lack of trust

among the partners. Although the parties have worked out their differences and a partnership has been developed, some of the respondents felt that *a lack of trust between the public and private partners, as well as among the individual private sector firms*, remains as a potential issue that *may arise as the project progresses*. This lack of trust is a potential issue in many ITS projects. Trust and privacy issues were of particular concern in the SaFIRES project. Even though non-disclosure statements were signed by the partners, deployment of the system can be affected if any arbitration or other legal action is required as a result of the breakdown of the partnership trust and agreements.

The interviewees expressed other concerns regarding new business relationship problems that could affect project deployment. Funding and regulatory limitations could create the need to either revise the project or slow full deployment to accommodate the existing, inflexible budget or federal procedural requirements. The sheer complexity of accounting for the local matches could likewise slow the funding available for deployment.

1.3.2 Project Definition

Two potential issues regarding project definition were suggested. The first dealt with the issue of an unclear proposal: *newly elected public officials may not continue to support a project that has a difficult concept to grasp and whose benefits are not readily recognizable*. Respondents citing this issue provided a lesson on the power and influence of politics on ITS projects. **Changes in the public officials and the political process will effect the proposal.** The second potential issue dealt with uncertain funding for the SaFIRES project: *the project budget is not adequate enough to meet the scope of the SaFIRES project*.

1.3.3 Organizational Coordination

The five public agencies and four private firms that comprise the SaFIRES partnership have many overlapping responsibilities and operational directives. A number of these roles can easily create conflict if any of the agencies or firms involved seek to exercise their jurisdictional authority or claim proprietary interest. A number of participants raised the concern that *the underlying "turfism" and territoriality could be exhibited and may potentially damage the cooperation between the numerous agencies involved in this project*.

1.3.4 Human Resources

A single potential issue regarding human resources was introduced. It was warned that *the inability to locate or develop a work force that encompasses both transit skills and computer skills may severely hinder the operation of this project*. Skill levels will be demonstrated during the on-going operation of the project and project deployment could be directly affected by staff inadequacies. Staff skill levels may also have the potential to affect similar APTS operational tests.

1.3.5 Technology

A potential issue was cited by the majority of the interviewees relating to problems with the technology and product selection. The concern was that the *technology would not be ready for the application for which it was developed or that the product would be inadequate to accomplish the project's vision*. It was remarked that the public decision makers have been hesitant to support technological innovations, which may result in the development of a system that is not advanced enough to meet the project's needs. It was also pointed out that the partners are specifying untested technology, especially with route deviation applications. A final cause that may lead to the realization of this issue enough time may not have been scheduled for the test phase, in which pre-operational trouble-shooting could be conducted.

The many respondents to this issue raised **lessons** concerning the flexibility of the specifications and the possibility that changes may be necessary. **Detail work, including the development of "tight" specifications, should be emphasized at the beginning of the project, thereby eliminating uncertainty in following stages of the project.** However, the project and products may change as a result of changes in scope or the need to protect specific product technology. **The use of contingency funds or other means should be investigated as ways to increase funding as the scope of the project and product specifications change. Project participants must be aware that protections may have to be applied to the development and use of software and data.**

1.3.6 User Acceptance

The concern regarding the difficulties in gaining public support and use of the project lead to the identification of the potential *lack of user acceptance of the SaFIRES system* as a possible issue. Inadequate marketing to the public; the public's reluctance to accept new technologies or services, especially those that are transit-oriented; and the lack of understanding, acceptance, and use of the system by the local transit operators could all lead to the public not understanding and not utilizing the system to the level foreseen by the project planners.

Lessons were cited by the participants on how to accommodate the general public and interest the consumers in the services provided in the project. Even before product specifications are completed, the partners must verify if their concepts are rational. **ITS applications need to be practically oriented. People are not going to accept commuting alternatives which are perceived as complicated or likely to encounter difficulties or delays. User acceptance is necessary, which makes marketing very essential.** Finally, not only do the consumers and commuters have to accept the project, but the transit operators must also accept the project for it to be successful.

1.3.7 Evaluation

A single potential issue was conveyed about the project evaluation. The concern was that *the NVPDC was conducting both the project evaluation and the GIS mapping requirements using the same resources* (i.e., funds, staff, technical equipment). To fulfill both responsibilities may be very difficult because of the limited project resources provided to the NVPDC. In addition, the NVPDC's performance of two roles may create interpersonal relationship conflicts among the partners because the NVPDC is directly evaluating agencies it is working with daily.

2. PROJECT OVERVIEW

This section describes the scope, history, participants, and management structure of the SaFIRES operational test. It also discusses the stated project goals and objectives, the goals and objectives of the project participants, the benefits the interviewees foresee for participating in the project, the risks that they or their organization might be taking, and what they see as the critical success factors of the project.

2.1 PROJECT DESCRIPTION

The **SaFIRES** (Smart Flexible Integrated Real-Time Enhancement System) operational test will evaluate an integrated smart vehicle service that includes route-deviation, fixed-route, and demand-response service types. The test site is a suburban-to-rural environment in the Prince William area of Northern Virginia, located twenty-five miles south of Washington, D.C. This advanced public transportation system (APTS) project was originally called the Advanced Ridesharing and Traveler Information System (ARTIS) and included an advanced traveler information system (ATIS).

Using intelligent transportation system (ITS) technologies, including global positioning system (GPS) based automated vehicle location (AVL), real-time scheduling software, geographic information system (GIS) mapping and digital communication through mobile data terminals, the test will integrate route deviation, commuter bus and rail, feeder bus, and human service transportation in a low population density environment.

Small, multi-purpose vehicles will switch between service types on an as-needed basis, allowing the best vehicle to respond to each request in real time using the integrated computerized dispatching software developed for the operational test. The use of ITS technologies will also greatly simplify Section 15 reporting and tracking human service ridership and agency charges. It is hypothesized that this system will provide greater effectiveness and efficiency in serving the public transportation needs of the community than would be the case in a non-ITS enhanced environment.

Route deviation (up to 3/4 mile) will enable the service to reach a far larger market and negate the need for complementary paratransit services required of fixed route systems. The test is expected to involve up to fifty ITS enhanced vehicles and a dispatching center and is scheduled to last thirty months.

2.2 PROJECT PARTICIPANTS

The major project participants are the Federal Transit Administration (FTA); the Federal Highway Administration (FHWA); the Virginia Department of Rail and Public Transportation (VDRPT); the Potomac and Rappahannock Transportation Commission (PRTC); GMSI

(formerly known as Gandalf Mobile Systems, Inc.); UMA Engineering, Ltd. (UMA); SG Associates (SG); Tidewater Consultants, Inc. (TCI); and the Northern Virginia Planning District Commission (NVPDC).

The **FHWA** is providing approximately \$1.2 million in federal funds to the project for the operational test and the **FTA** is the overall program manager. Both agencies provide technical guidance and project evaluation. The **VDRPT** is the funding conduit between the FHWA and the PRTC, and provides grant management and project oversight. The VDRPT will also identify and suggest sites throughout Virginia which could benefit from similar technology application.

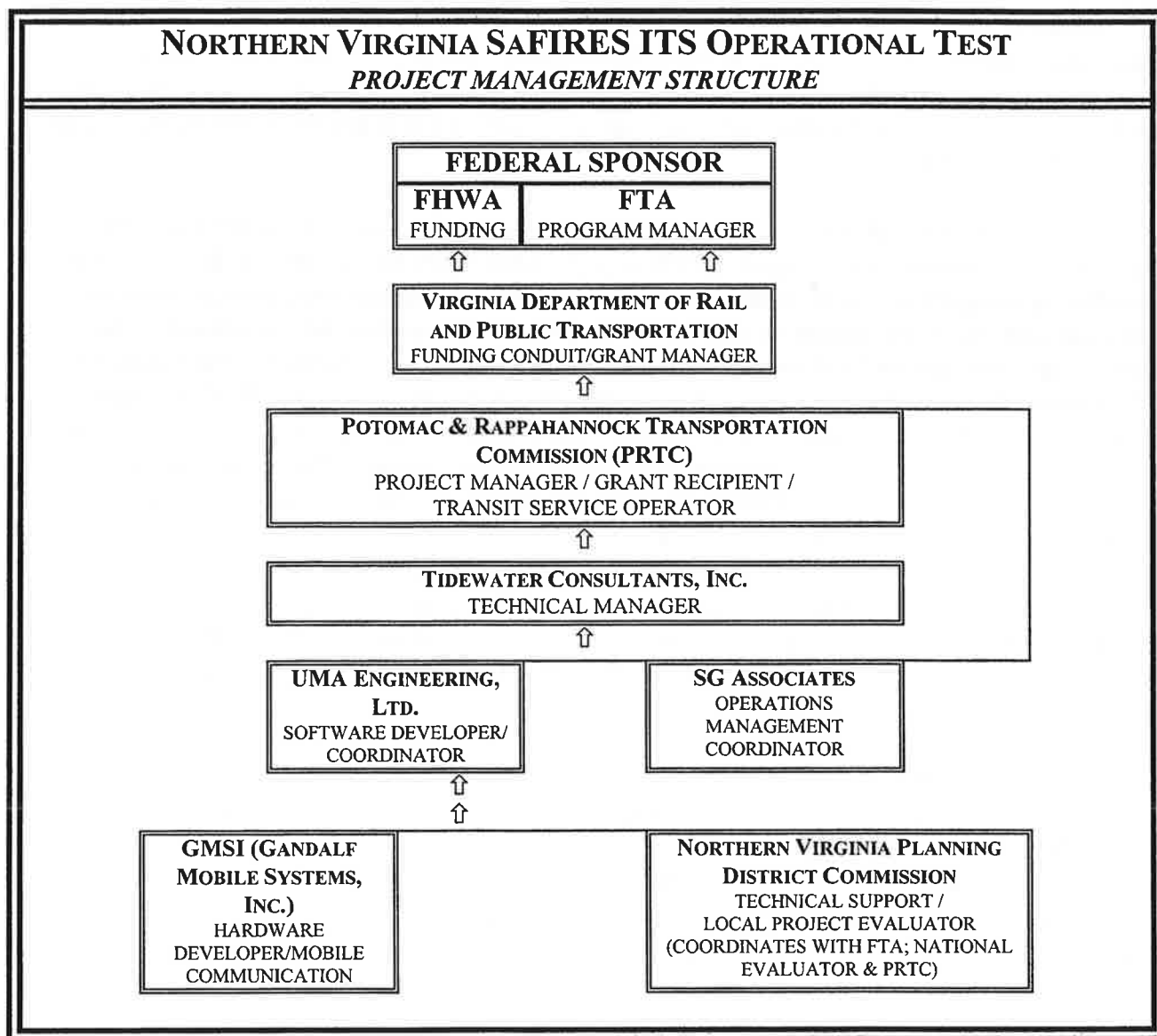
The **PRTC** is the grant recipient and overall project manager, responsible for systems integration and project oversight. The PRTC will also be the operator of the transit service. **GMSI** is responsible for providing hardware to the project. GMSI will provide the mobile data communications system, the Computerized Vehicle Information System and mobile data terminal hardware and software for the installation of the GPS-based AVL and GIS. Also, GMSI is responsible for the technical interface to modify the systems. As a vendor, GMSI sells hardware to the project; as a partner, it also fulfills a local match requirement.

UMA is responsible for developing the software for the route deviation and scheduling components of the system. In addition, UMA serves as software coordinator for the project as a whole. As a vendor, UMA sells software to the project; as a partner, it fulfills a local match requirement. **SG** assists the PRTC with project management tasks and provides transportation consulting services. SG advises the PRTC with respect to transit system configuration, operations applications and integration services. **TCI** serves as the technical manager and is responsible for ensuring that the envisioned products are delivered and responsible for mediating potential disputes.

The **NVPDC** has the dual role of technical support and project evaluation. As part of technical support, the NVPDC is responsible for the local GIS mapping and travel time identification support required by the UMA software and demographic profile locations for use in marketing. In addition, the NVPDC will monitor, document, and provide evaluative information on the test to the PRTC to enable the PRTC to use the data to conduct comparisons to program objectives and for modification of the test, if appropriate. As part of its task, the NVPDC will develop evaluation processes and parameters designed to provide feedback to the PRTC for real time adjustments.

2.3 MANAGEMENT STRUCTURE

The PRTC is the lead partner for this operational test, the grant recipient, overall project manager, and eventual operator of the system. The PRTC will be assisted in overall project management by TCI and in operations management by SG. At the federal level, the FHWA is primarily providing funding while the FTA is the actual program manager. The partnership also includes TCI as a technical manager. TCI reports to the PRTC.



2.4 PROJECT HISTORY

In response to the FHWA's first solicitation in 1992 for operational test candidates, the PRTC established a team of participants who developed and submitted a project proposal to the FHWA. The FHWA did not select the ARTIS project as one of the first 16 operational tests.

The PRTC and several other public and private partners resubmitted an ITS operational test concept outline to the FHWA and the FTA. A series of iterative refinements to the proposed scope of work followed. A revised proposal was submitted on July 14, 1993. Budget and schedule revisions to the proposal were made on August 11, 1993.

A partnership agreement was executed between the FHWA and the VDRPT on January 20, 1994 and a letter of funding approval followed on January 24, 1994. After the funding conduit was established, the partners completed additional agreements: SG, July 1, 1994; UMA, November 28, 1994; GMSI, December 1, 1994; and NVPDC, December 19, 1994. All private participants and all but one of the local public participants involved have contributed their own funding to the \$3.2 million SaFIRES project.

A request for proposal (RFP) soliciting technical manager services was released in May 1994 and the contract was awarded on August 5, 1994 to TCI. After much internal debate, the single trip ridesharing component was eliminated in the summer of 1994 because some partners were not satisfied with the specifications for that part of the project. One partner left the project at that time. Final contracts for hardware and software, initially scheduled for award in the summer of 1994, were all awarded by December. UMA was scheduled to present to the PRTC prototype software for the project in March 1995. Also in March, GMSI delivered the computer hardware, mobile data terminals, and GPS components. Installation and testing of the system components was initiated during the spring of 1995. By November 1995, the entire system is scheduled to be installed, integrated, tested, and ready for deployment.

Delivery of 20 vehicles to PRTC occurred in mid-fall 1994. "Non-ITS enhanced" local bus service under the SaFIRES project was begun using the PRTC vehicles. Three commuter rail feeder routes were initiated on December 19, 1994. In March 1995, an additional commuter rail feeder route was scheduled to begin. On April 3, flex-route bus service began on three routes. During the summer, two more flex-routes and one more feeder route will begin service. During the spring, the installation of the mobile data terminals into the existing fleet began. By the end of the fall of 1995, most of the vehicles anticipated for project use will be dedicated to the SaFIRES project. As more vehicles are added to the project, additional routes will be added. Fifty enhanced vehicles are the ultimate deployment objective of the project. November 1995 is the scheduled date for an ITS-enhanced project. The test phase is scheduled to run for 30 months.

2.5 PROJECT GOALS

The project goals were taken from the revised project proposal, "Advanced Ridesharing and Traveller Information System (ARTIS): A Public-Private IVHS Test of National Significance" (PRTC, 1994). The four goals listed in this report slightly revised the original stated goals:

- To create new types of public transportation, including route-deviation minibus services.
- To integrate these new services into existing transit and paratransit modes.
- To reduce congestion and pollution by offering an innovative, integrated network of attractive alternative services.
- To evaluate the cost effectiveness of the integrated service in reducing vehicle trips per capita, vehicle miles traveled per capita, vehicle ownership per capita, etc.

The project goals were compared to the goals and objectives stated by the participants in the case study interviews. No conflicts were found, although most participants expressed goals beyond those put forth in the project proposal. Of the goals and objectives discussed in the interviews, six were mentioned three or more times:

(The numbers in parentheses in the following sections represent the number of times an item was mentioned and the number of individuals who mentioned it.)

- To improve the organization's business prospects or staff experience. (7-5)

This goal was mentioned by both the private and public sectors, including representatives from both the federal and local levels of the public sector. One private sector participant focused on new product development, while the other focused on entering a new market. The public sector participants cited improved skills, involvement in ITS, improvement of system productivity and job satisfaction as their objectives.

- To improve the transportation options in the region. (6-4)

This goal was expressed by three public level participants, from the local and federal levels, as well as one private sector individual. A public sector participant at the federal level spoke of enhancing both the quality of on-street service and the contribution of public transportation systems to overall community goals. Another federal level participant stated that the advancement of the ITS program, leading to the enhancement of mobility and the improvement in efficiency of freight transportation, was an objective. A local level public sector participant discussed building upon the planned inter-county bus system. The private sector participant declared a goal to be to contribute to the improvement of transit systems.

One individual presented an obstacle to this goal. The technology may not work.

- To make a positive contribution either specifically to the project or to ITS in general. (5-4)

Three public sector participants, from the federal and local levels, and one private sector participant stated this as a goal. The private sector participant and two of the public sector participants emphasized that they wished to perform their project roles in an effective manner. One of the public sector individuals at the federal level stressed the importance of expanding the knowledge base of professionals in the field. Another participant from the local public sector said that assisting in the development of a multimodal system in the region was an organizational objective.

One participant stated two obstacles to this goal which dealt specifically with that participant's ability to execute his organization's role effectively.

- To improve access to public transportation in the region. (4-3)

Two local level public sector participants and a private sector participant mentioned this goal. The private sector participant focused on finding a solution to the problem of providing public transportation in areas of low-population density. Solving this problem was also mentioned by one of the public sector participants, who focused on the application of ITS technology as an innovative solution. The other public sector participant discussed providing a local service for the transit-dependent population which could reach the majority of the citizenry and, in the bigger picture, providing the service area with an integrated network of transportation options.

Two obstacles to this goal were presented by one of the participants. This interviewee felt that budgetary or other resource limitations might affect the achievement of this goal and that the integration of transportation options may not prove operationally feasible.

- To network with other organizations or agencies. (3-2)

This was a goal for two public sector participants. One of the participants was from the federal level, the other from the local level. Both of the participants mentioned involvement in public-private partnerships as an objective in their involvement with the operational test. One of the participants focused on co-ordination with agencies responsible for different modes of transportation. The other specifically mentioned the testing of promising ITS technologies.

The participants cited three obstacles to this goal. Anticipated obstacles included the tendency of agencies to focus on their own goals and objectives, lack of communication among agencies, and the possibility that the development of future partnerships could be jeopardized if the technology used in this project fails.

- To apply new ITS technologies, especially route deviation, in a practical way. (3-2)

Two public sector participants, one at the local level and one at the federal level, cited this goal. Both of the participants specifically mentioned the success of the route deviation application as an objective. Each participant also stressed the practical application of the technology from the operational test to other locations.

The participants related five obstacles to this goal. One concern was in the compatibility of the system from region to region. Another was poor marketing, or the lack of markets. A third was a lack of coordination in the public sector leading to the possibility of two agencies advocating the same product. Both participants noted technical failure as a possibility.

Additional obstacles to achieving individual goals and objectives were cited by four participants, three from the private sector and one from the public sector. These obstacles were mentioned without reference to a specific goal:

- ♦ Lack of cooperation among the partners
- ♦ Lack of a process to ensure that work is completed

- ◆ Public reluctance to accept a dynamic system
- ◆ Lack of a good user interface in the system
- ◆ Lack of adequate marketing for the system
- ◆ Potential for liability issues
- ◆ Competition against larger companies
- ◆ Doing business with the public sector rather than the private sector
- ◆ Lack of product acceptance by the public
- ◆ Lack of technical skills in the work force
- ◆ Potential resistance to innovation from both decision makers and the general public
- ◆ Preference of the general public for traveling in single occupancy vehicles (SOVs)
- ◆ Tension inherent between desires for thorough testing and quick implementation.

Private sector participants mentioned the first eight obstacles and the public sector partners discussed the last five.

2.6 BENEFITS

Eight benefits were mentioned by the interviewees three or more times. These benefits significantly mirrored the goals and objectives that the interviewees presented:

- Improvement of the skills of the organization's staff. (6-4)

This benefit was mentioned primarily by private sector participants looking to develop or enhance skills related to ITS. All of the participants referred to the exposure to innovative technologies or applications used in this operational test as a benefit in this regard.

- Improvement in service for the region. (5-5)

This benefit was discussed by participants from both the public and the private sectors. The public sector participants represented all levels of government and both policy making and administrative functions. Two participants mentioned improved quality and cost effectiveness in the delivery of service. One participant described coordination with existing transportation, such as the commuter rail to Washington, D.C. and connecting the highway network to transit, carpools, and commuter lots. Another cited the creation of a service which would require fewer vehicles and operators than a more traditional system providing a similar level of service. Finally, one participant submitted the application of flexible routing systems in other communities leading to improved ridership as a benefit.

- Implementation of new service for the region. (4-4)

Three public sector administrators, one federal and two local, and one private sector participant asserted that providing a new transportation service to the region would be beneficial. One public participant identified the provision of on-demand transportation, including route deviation. Another cited the creation of an efficient, market driven service, which would be tailored to meet the needs of a variety of different traveling groups. Providing a multimodal transit option to the citizens of the region was offered by one of the local participants. The private sector participant emphasized making the system available to the public.

- Creation of new business opportunities for the organization. (4-3)

This benefit was offered by both public and private sector participants. Two participants mentioned the opening of a new business area. One participant mentioned improved product offerings. Another mentioned increased revenue.

- Achievement of goals and objectives for participating in the operational test. (3-3)

Three public sector participants, at both the local and federal levels, discussed this benefit. These participants were either policy makers or administrators and were speaking of the goals and objectives set by their own organizations for participation in the operational test.

- Establishment of new business relationships between organizations and agencies. (3-3)

One private and two public sector participants discussed this benefit. The private sector participant said establishing credibility with the federal agencies was important. A federal participant discussed coordination with other agencies, and a local public sector representative mentioned becoming part of the ITS community as benefits.

- Development of a transferable model. (3-3)

This benefit was cited by public sector participants, two at the federal level and one at the local level. These participants were policy makers and administrators. One participant focused on having an operational model of fixed route, route deviation, and demand response service. Another put forth the ability to transfer the technology to additional locations. The other participant regarded the data and reports generated by the operational test as a benefit which would facilitate the replication of the project.

- Visibility for the organization. (3-3)

Two public sector participants at the local level and one private sector participant said that the exposure gained by demonstrating their abilities on a national, high profile project would benefit their organizations.

2.7 RISKS

This section presents the risks that the interviewees or their organizations have encountered, or may yet encounter, because of their participation in the SaFIRES operational test. Five risks were mentioned three or more times.

- The system may fail, leaving the participants with little to show for their effort and investment. (7-7)

Six public sector participants, from all levels of government and with policy making and administrative duties, cited this risk. One private sector individual joined them. The private sector participant focused on the amount of work put into the project without being sure of the outcome. Participants at the federal level described the risk in terms of money spent and the lack of results.

- Conflict within the partnership or with other regional transportation agencies may develop. (5-3)

Three local public sector participants discussed potential conflict as a risk. One said the risk was conflict among team members, while another said it was conflict with other regional transportation agencies. The third was concerned that the failure of the project might result in team members trying to assign blame to each other.

- The reputations of participants may be effected by the outcome or the distribution of credit. (4-4)

Three public sector participants and one private sector participant had this concern. The public sector participants represented all levels of government and included participants with policy making as well as administrative functions. One of the public sector participants and the private sector participant expressed concern about being associated with a failed project. The participant from the federal level said the risk was political embarrassment. The local level participant cited the potential lack of recognition or credit should the project be completed successfully.

- The project may require more resources than expected. (4-3)

This risk was discussed by two private sector participants and a local public sector administrator. All of the participants asserted that having the project require more resources, either taking longer than estimated or requiring more funds, is a risk. The private sector participants focused on the initial investments made to get the project off the ground.

- Public response to the project may be negative. (3-3)

The risk of negative public response to the project was submitted by three public sector participants who represented the federal and state levels of government. Two were policy makers, and one was an administrator. One participant was concerned about being

accused of using public funds poorly. Another felt that either publicity or public response to the project might be negative. The third focused on the possibility of negative public perception of the project.

2.8 CRITICAL SUCCESS FACTORS

The interviewees discussed areas they regard as critical success factors (CSFs). For the purpose of this report, a CSF is defined as a key area that must be completed successfully in order for the interviewee to consider the project a success. Six CSFs were mentioned three or more times.

- The system must provide a high level of service to the public. (6-4)

One private sector participant and three public sector participants identified this CSF. The public sector participants came from both the local and federal levels and included administrative and policy making personnel. Most of the participants focused on meeting the needs of users. One participant noted that the system needed to be user friendly. Another mentioned that the project must provide the needed services for local residents. A third discussed the need for the system to provide users with information allowing them to make real-time decisions. One public sector participant stated simply that the services based on the new technology must work. Another declared that the system must have dynamic response capability and be expandable.

The participants offered measurements to identify if this CSF had been achieved:

- ◆ Effects of changes in routing and schedules on ridership
- ◆ Percentage of routes which become fixed
- ◆ Assessment of the system's performance in response to calls for service
- ◆ Appearance of vehicles
- ◆ Degree to which the customers understood the service
- ◆ Degree of flexibility, accessibility, and reliability of the service
- ◆ Results from surveying users regarding their level of satisfaction with the service
- ◆ Passenger and operator complaints
- ◆ Number of missed trips
- ◆ Driver adherence to schedules
- ◆ Accuracy of reports and ridership levels
- ◆ Results of the project evaluation
- ◆ Adherence of system performance to specifications and service parameters.

Participants also identified possible impediments:

- ◆ Failure to identify the appropriate services to provide
- ◆ Improperly defined service areas and corridors

- ◆ Limited resources
- ◆ Lack of focus on customer service
- ◆ Poor system maintenance
- ◆ Unreliable service
- ◆ Inadequate technology for the application
- ◆ Lack of technical skills in the work force
- ◆ Loss of flexibility due to too many routes becoming fixed.

- The users must accept and use the service. (5-4)

Four public sector participants offered this CSF. The participants represented all levels of government. Three of the participants focused directly on the acceptance and use of the system by the public. One participant asserted that the service must reduce the number of SOVs on the road. Increasing the ridership of existing commuter systems through feeder service was also mentioned.

Participants offered various measures of success for this CSF:

- ◆ Ridership levels
- ◆ Utilization of the available technology by the ridership
- ◆ Results from surveying the riders concerning their traveling habits
- ◆ Calculations of actual levels of ridership versus projected levels
- ◆ Frequency of demands for service
- ◆ Breakdown of ridership (commuter vs. occasional)
- ◆ Type and duration of trips
- ◆ Ridership levels of existing commuter services fed by the system.

Potential impediments to achieving this CSF were also discussed by the interviewees:

- ◆ Drivers have difficulty adhering to published schedules.
- ◆ Fares are set too high.
- ◆ The system is not marketed adequately.
- ◆ Public is reluctant to accept a new technology.
- ◆ Public is reluctant to use public transportation.
- ◆ The system may have a poor human factors design or implementation.
- ◆ The system may not be easy to understand.
- ◆ The system might not be explained well to the public.
- ◆ The system might not be user friendly or might be inaccessible.
- ◆ The service might be perceived as too costly.

- ♦ The public response to the system could be negative.
- ♦ The market driven routing might lead to questions regarding the reliability of the system.
- ♦ The service might not be attractive enough.
- The system must be transferable. (4-4)

Four public sector participants contributed this CSF. These participants represented all levels of government. One participant went so far as to call the successful operation, marketing and packaging of the system a key factor to the ITS program. Others put it more simply that the project must serve as an operating model for emulation, the system must be exportable to other parts of the state and country, or that the technology must be transferred.

Six measures of success were discussed by the interviewees:

- ♦ Adaptability of the hardware and software
- ♦ Cost of the system
- ♦ Ridership levels and revenues generated by the system
- ♦ Increase in ridership on existing buses after ITS deployment
- ♦ Number of future installations of the system
- ♦ Use of the technology in other applications

Eight potential impediments were mentioned by the interviewees:

- ♦ The system relies on an existing commuter network.
- ♦ The operational test may not be functionally or financially successful.
- ♦ Industry does not become aware of the system.
- ♦ The system is not marketed properly.
- ♦ The system does not meet expectations.
- ♦ The system is too regionally specific, costly, or complicated.
- ♦ The system requires too many resources for transit systems.
- ♦ Implementors fail to identify the correct markets for the system.
- Successful coordination among the different players must occur. (3-3)

One public sector participant and two private sector participants mentioned this CSF. Cooperation and flexibility among the partners were stressed. Holding meetings as necessary was also suggested by a participant. As one participant noted, this CSF can be difficult to measure quantitatively, although some qualitative assessments can be made, such as agency response time and the attitudes of the partners. The progress of the project is also a good indication of cooperation.

Interviewees mentioned that bureaucratic red tape is a prime impediment. Red tape, which is inherent to the working environment, may make timely response difficult. They also cited that competing priorities within agencies might make it uncertain whether or not a given agency will maintain a high level of interest in the project. Other impediments mentioned were the diverse views of the participants, including the possibility of one or more partners having grandiose views; not dealing directly with people at the transit properties; and potential funding overruns.

- The operational test must lead to full deployment. (3-3)

Three public sector participants, one from each of the levels of government, offered this CSF. These participants held administrative or policy making positions. A successful operational test leading to the deployment of an integrated system was important to these interviewees.

The existence of a permanent system, or at least the decision to build one, will indicate whether or not this CSF has been met. The possible impediments mentioned by the participants include the system being too expensive or not accepted by users, a lack of local marketing, the system not being accepted by local politicians, and an unsuccessful operational test.

- The new technologies must work together to enhance operations. (3-3)

This CSF was identified by three public sector participants representing all levels of government. These participant had either administrative or policy making functions. For the operational test to be considered a success, the technology must be successfully demonstrated, and the new technologies must work together to enhance operations.

The evaluation of the operational test will provide a measure of the success in achieving this CSF. One participant suggested additional measures, such as a comparison with similar systems that do not have ITS technology or route deviation capability and comparison with estimates for a non-ITS replacement service within the area.

Impediments discussed by the participants included the failure of the technology, a poor implementation, inadequate budgeting or marketing, and a lack of the necessary expertise among the partners.

2.9 MILESTONES

The interviewees discussed those events they regard as project milestones. The milestones are not necessarily events as set out in the project schedule, but are the set of important activities which have either already occurred or need to occur from the perspective of the project participants. Eleven milestones were mentioned three or more times by participants. Although the milestones may overlap, they will occur in the following approximate chronological order:

- Acceptance for funding as an operational test. (5-5)

This milestone was discussed by five participants. Three of the participants represented the local and federal levels of the public sector. The other two participants represented the private sector. Acceptance of the proposal, including FTA support and funding, was an important milestone for these participants.

- Formation of the project team. (4-3)

Three participants spoke of establishing the project team as a milestone. One participant was from the private sector, the others from the local public sector. One participant emphasized the establishment of team membership as a major milestone and went on to discuss the identification of subcontractors as well. The other participants discussed the formation of the team and the stabilization of organizational and business relationships more generally.

- Execution of the contracts. (7-6)

Six participants, four from the public sector and two from the private sector mentioned this milestone. The public sector participants represented the federal and local levels of government. Participants underscored the importance of establishing contractual agreements as a milestone when they referred to the completion of partnership agreements, signing contracts, the development of mechanisms for subcontracts.

- Completion of the modifications to the project scope and budget. (5-4)

Four participants, all from the public sector mentioned this milestone. These participants came from all levels of the public sector and included policy making and administrative functions. The revision of the scope and budget was required because the single trip ridematching component of the original proposal was eliminated. Completion of this process and commencement of the revised project would be significant events in the project's history.

- Selection of a technical manager. (4-4)

Four public sector participants, representing all levels of government, identified this milestone. Participants specified various aspects of the selection process, such as the approval of the proposal to add a technical manager, the selection of the technical manager, and the actual hiring of the technical manager.

- Initiation of the technical work. (8-6)

This milestone was mentioned by six participants, four from the public sector and two from the private sector. The public sector participants represented all levels of government as well as administrative and policy making functions. Some of the participants cited the beginning of their own work on the project, but most referred to the project in general.

- Establishment of the initial feeder service without ITS. (4-2)

Two public sector participants, both from the local level, identified this milestone. Establishing the initial feeder service without the ITS technology was seen by one participant as a necessary step in the project. The other participant did mention that implementation of the ITS technology should occur during the initial operation of the non-ITS system to the greatest extent possible.
- Implementation of the operational test. (6-5)

Five participants, all from the public sector, included this milestone in their interviews. These participants represent all levels of government and encompass administrative and policy making functions. These participants agreed that the initiation of the testing phase was an important event.
- Deployment of the full service with ITS technology. (6-6)

This milestone was cited by six participants. Four of the participants were from the public sector, spanning all levels of government and exercising administrative or policy making responsibilities. The other two participants represented the private sector. These participants included the successful completion of the operational test leading to full deployment of service as a milestone of this project.
- Completion of the technical work. (3-3)

Three participants identified the completion of the functional requirements and the technical work for the system as a milestone.
- Evaluation of the operational test. (5-3)

This milestone was discussed by three public sector participants. These participants came from the federal and local levels. One participant discussed the development of an evaluation framework, strategy, and plan before the actual evaluation of the test. Another participant included the monitoring of financial, political, and operational goals.

3. ISSUES AND LESSONS LEARNED

This section presents the institutional issues or non-technical impediments that the interviewees discussed. It also includes the lessons they learned addressing these issues. All of the issues discussed are issues related to the start-up phase of a project since the SaFIRES operational test is just getting underway. The issues are divided into seven categories:

- New Business Relations
- Project Definition
- Organizational Coordination
- Human Resources
- Technology
- User Acceptance
- Evaluation

3.1 NEW BUSINESS RELATIONS

In this section, the issues are divided into three groupings: (1) issues related to developing the partnership, (2) issues related to defining roles and responsibilities, and (3) issues related to administering the project.

3.1.1 Developing the Partnership

The participants discussed three issues they encountered while developing the partnership:

ISSUE 1: WORKING IN A PARTNERSHIP WAS DIFFICULT FOR THE PRINCIPAL PARTICIPANTS

This issue was cited by two members of the public sector and two private sector participants. They stated that the principal reason for this difficulty was the newness of the public-private partnership. This issue caused a large turnover rate of participants while forming the partnership which was attributed to the amount of unfunded and non-reimbursable work required from partners before a contract was executed; the different mandates among the partners, including the private sector's need to show a profit; and concerns regarding both intellectual property and credit for work performed.

One participant characterized the public transportation agencies as being not generally accepting of innovation and asserted that the styles of the public and private sectors in doing business are different to the point of clashing. The same participant went on to note that this is a new business arrangement for everyone and a significant change in the relationship between the

public and private sectors. Another participant discussed the differences in the styles of the public and private sectors in more detail, asserting that the private sector pushes harder while the public sector tends to move more slowly and cautiously. In addition, the private sector partners had some difficulty adjusting to the requirements of the public sector. Difficulties were heightened when one public agency's request for local funding was delayed due to a budget cycle.

These difficulties led to delays in the formation of the partnership. Interviewees felt the departure of some partners left others demoralized and lessened the project's image in the eyes of the funding agencies. At times, the commitment of the public sector to this project was questioned by representatives of the private sector. The partners found it difficult to build trust between the public and private sectors. While there is frustration among the partners, one participant chose to look on the bright side and noted that new ideas are constantly emerging as the partners work out their differences.

All the participants agreed that the issue has been resolved. The partnership was established incorporating the private sector's greater willingness to support risk, the local funding was approved, and funding matches were made. One participant did caution, however, that care must be taken regarding potential future implications of this issue as applied to all ITS projects.

The individual noted that Virginia contract law allows a "letter of no prejudice," which permits the accumulation of billable hours, at the private contractor's own risk, prior to the contract. Often, public sector partners are expected to work on ITS projects before there is a contract. Because public sector hours are not reimbursed until after the funding agreement has been signed, public participants may give the initial work on any ITS project a lower organizational priority and the amount of staff time spent on the projects is less than what should be to properly move the project along. An equivalent "no prejudice" reimbursable allowance granted to the private sector should be granted to the public sector who will receive federal funds.

The participants offered these **lessons** learned:

- A new program can be initiated when agencies work together; it just takes time.
- Both the public and private partners should recognize the fundamental differences in each others' business styles and operating requirements, and each should appreciate and benefit from the strengths that the other offers.
- Communication among the partners is important; keep everyone informed of project status and what to expect.
- The beginning of the project is the hardest time for any ITS project.
- Forming a partnership is difficult; expect some delays and move on.
- State and federal laws should permit ITS project participants to be reimbursed for all project efforts expended prior to the signing of contracts and funding agreements.
- Recognize the partnership might change and accept these changes as part of the process.

- Innovation is possible and is central to improving transit operations.

ISSUE 2: SOME OF THE PRIVATE SECTOR PARTNERS WERE COMPETITORS

Interviewees from both the public and the private sector expressed concern about competitors within the partnership and the potential as well as the actual conflicts arising from that situation. The participants represented both administrative and policy making positions. Competition among private sector partners arose on two main occasions. This issue surfaced during the early stages of the partnership, when the ridesharing component was still part of the project.

The original team included three private sector firms. Two of these private sector participants were competitors and had differing opinions concerning who should be responsible for product development. Interviewees noted that some team members were unwilling to share information with partners they perceived as competitors. After seven months of delay, which resulted in increased costs and confusion among the partners regarding the project status, some private sector partners left the project and were replaced with new participants who were not competitors. Before the ridesharing component was eliminated, there was some concern regarding potential competition among two private sector partners who were both developing ridesharing products.

The participants related four **lessons** learned:

- Pick the team carefully, paying particular concern to the parties' compatibility and expertise.
- Identify areas of competition and conflict early on to reduce stumbling blocks, and address conflicts as they arise.
- There is always the potential for conflict when putting together a partnership.
- The nature of development projects may foster similar issues in the future.

ISSUE 3: THE TECHNICAL MANAGER COMPETES DIRECTLY WITH ONE OF THE ORIGINAL PARTNERS

This issue was discussed by interviewees from both the public and private sectors. The newly selected technical manager (TM) is a competitor of one of the partners. Both companies develop software for transit applications and public information systems.

There was no provision for a TM in the original proposal and the participants selecting the TM overlooked the possibility that TM might be a competitor to a partner. The partner had no input into the decision even though the TM would be privy to the partner's technical information. As a result, the partner is concerned about the arrangement, and now the partners must determine how much proprietary information will be exchanged. This has created a need for non-disclosure agreements, especially regarding software. Representatives of the partner and the TM will need to put effort into developing a strong working relationship.

The participants saw this issue as mostly resolved since the partner will not contest the decision, although future problems may still arise. In the long term, one participant expressed some concern regarding the **deployment** of the system if additional issues arose between the competitors and required arbitration. Another participant noted that proprietary information concerns could be expected in any test using software.

The partners listed **lessons** they learned from addressing this situation:

- Recognize the possibility that project participants may be competitors and include criteria in all RFPs to address this.
- An interactive team building process is needed in which all partners are consulted on decisions to hire contractors and all partners are encouraged to express their concerns.
- Partners should have been more proactive about being included in the TM selection process.
- The contracting agency should have been more sensitive to the partner's position and concerns.
- The interests of all the partners need to be protected appropriately.
- Non-disclosure statements may be necessary to protect data and products developed during ITS projects.

3.1.2 Roles And Responsibilities

Three issues involving roles and responsibilities were discussed by the participants. These issues focus on roles and responsibilities at the federal, state, and local project levels, respectively. Since these issues are very closely related, the lessons learned offered by the participants are grouped together at the end of this subsection.

ISSUE 4: THE ROLES AND RESPONSIBILITIES OF THE FEDERAL PARTICIPANTS WERE UNCLEAR

Representatives from both the public and private sectors at the policy and administration levels discussed this issue. The participants stated a major cause of this issue was the new partnership created through the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) between the FTA and FHWA. The ITS program is brand new and has not been clearly structured at the federal level. In this project, the operational test is being funded by the FHWA but administered by the FTA. As one participant said, "This is a transit project being funded with highway money." In addition, the FHWA is the lead agency and usually only deals with the state DOTs, not with smaller public sector agencies or the private sector. These factors left many of the partners uncertain where decision making authority was vested and lead to conflicting responses from the federal level regarding the elimination of the ridesharing component. The project was slightly delayed as a result.

Some participants felt that the issue was only partially resolved or not at all. One participant asserted that the FTA needs more autonomy in transit-related ITS projects and also that it is necessary to have a single point of federal contact for such projects. Another individual believed that the federal agencies have a strong interest in seeing this project implemented, and so they have made great effort to resolve obstacles occurring at the federal level.

ISSUE 5: THE RESPONSIBILITIES OF THE VIRGINIA DEPARTMENT OF TRANSPORTATION AND THE VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION WERE UNCLEAR

Not only was there confusion at the federal level concerning the roles and responsibilities of the partners, but at the state level as well. The responsibilities of the Virginia Department of Transportation (VDOT) and the VDRPT were also unclear. Because the FHWA was the principal funding agency and usually works with the VDOT, several participants expected the VDOT to assume the lead state role. Others assumed that VDRPT would be the lead state agency because they are responsible for transit programs within the Commonwealth. After some discussion, this issue was resolved when it was decided that the VDRPT would be the responsible state agency. One of the respondents stated that problems were anticipated in the execution of the cooperative agreement between the FHWA and the VDRPT because of the new and unique relationship; however, no problems developed.

ISSUE 6: PROJECT MANAGEMENT ROLES WERE UNCLEAR

There was no full-time project manager identified in the original project proposal. This lack of oversight management left the participants confused regarding the definition of roles and responsibilities for all the partners. The parties responsible for a given task and the deadline for that task were not clearly established. There were also apparent overlapping roles in specific areas, such as conducting the evaluation. This raised the additional concern that if something were to go wrong, there might be conflict over who is responsible and who must fix it. The confusion was compounded by the number of agencies involved and the correspondingly large number of people at meetings. Partners complained of a lack of direction within the project and the lack of clarity regarding the flow of funds. Private sector partners were not sure to whom they should report. The confusion at the federal level also exacerbated the problem of who was managing the project and, thus, responsible for standards and regulations.

The roles of the partners were clarified when the partners agreed to administrative processes, although the process remained cumbersome. An RFP for a TM was issued, and a TM was selected to address the concerns regarding project management. One interviewee, however, was unconvinced that the problems with the project management structure had been sufficiently addressed, although hope was expressed regarding the potential positive impact of the TM. Another respondent remains wary that some of the many jurisdictions involved may not be willing to maintain the project role they were assigned.

The interviewees offered some **lessons** they learned while addressing issues related to defining roles and responsibilities:

- A strong, consistent leader is needed; get a program manager on board early.
- Assemble the key players early, as soon as they are identified.
- There is a need to define limits and roles of partners.
 - ◆ Identify roles and responsibilities within the partnership as soon as possible.
 - ◆ The roles of the participants need to be spelled out in the contracts.
 - ◆ Confusion results from the nature of contracting; roles and responsibilities need to be explicitly defined.
- The FTA needs more autonomy in transit-related ITS projects.
- It is necessary to have only one point of federal contact.
- It is expensive in both time and money to prepare proposals, but they are still necessary to defining roles and responsibilities.
- For consistency, keep the original writers involved when revising the proposal.

3.1.3 Project Administration

The participants discussed four issues that fall in the category of project administration:

ISSUE 7: EXISTING PROCEDURES DO NOT ADEQUATELY ADDRESS ITS PRODUCTS AND SYSTEMS

Four participants, three from the public sector and one from the private sector, expressed concern regarding this issue. Public sector interviewees represented both administrative and policy making levels. They stated that much of the difficulty partners found with administrative procedures was attributed to the newness of the ITS program. This newness put everyone on completely new ground as the partnership tried to manage the large amount of administration required by the project. In general it was unclear what, if any, existing regulations would apply to an ITS project and how such regulations might be more suited for fixed route, rather than route deviation applications.

There were no previously established administrative processes in place, including none between the FTA and the FHWA. This was of particular difficulty since the FHWA is the lead agency for the project, which puts a transit project under highway rules and procedures. It was thought by one participant that the FHWA was better staffed and, thus, better able to administer the project.

According to one participant, additional problems arose regarding local procurement processes not being amenable to the new ITS relationships, in part because of the existing legal and contractual structure. The same participant asserted that the public sector's distrust of the private sector and the private sector's instincts for competition and profit combined with the need to pass federal funds to the partners interacted to exacerbate the situation.

The primary effect this issue had on the project was delay. Establish trusting relationships among the partners and the completing procurements and contracts took longer than initially anticipated. One interviewee expressed uneasiness among the partners regarding the understanding and completion of project requirements. In addition, the VDRPT was brought on-board as the grant recipient, which, in one interviewee's opinion, added an unnecessary layer of bureaucracy to the funding procedure. This interviewee preferred project funds be passed directly from the FHWA to the local project partners. More paperwork and staff time than originally expected was required to set up the administration of the project. However, two participants submitted that bureaucracy is a fact of life in ITS and federal projects and the partners should add contingency periods to the time they believe it would take to move a project from the initial concept to the funding agreements and beyond.

The participants generally agreed that the issue had been resolved primarily through the application of sufficient resources, although it was mentioned that legal consultation had been necessary. One participant disagreed regarding the issue's resolution, asserting that standards needed to be developed as part of the project.

The partners cited several **lessons** when discussing this issue:

- Expect to devote significant resources to the development of administrative processes, even before the project actually starts.
- Regulations are written for what already exists. If a project proposes something new, the issue of developing appropriate standards should be addressed.
- Develop a process for selecting private partners which is consistent with local procurement processes.
- It would be better to work through the FTA for transit-related projects.
- Be in close contact with federal and state transit agencies.
- Only one central point of contact at the federal level is necessary.

Two participants expressed concerns regarding potential effects on full **deployment**. One considered the lack of appropriate procedures to be a potential show stopper, while the other emphasized that existing regulations might limit the participants' ability to mix funds from different sources or to mix groups of riders, thus impacting the potential for a paratransit function.

ISSUE 8: IT WAS DIFFICULT TO ESTABLISH AND MAINTAIN ACCURATE COMMUNICATION AMONG THE EIGHT PARTNERS

One private sector participant and one public sector participant cited this issue. They declared that accurate understanding and clear communication were difficult to establish and maintain among the eight partners. As a result, the importance of some public meetings was not clear to some participants. Part of the difficulty with communication within the partnership was attributed by one participant to human nature. This participant discussed the tendency of people

to leave meetings thinking they heard what they wanted to hear, the desire of the participants to shape an unknown payoff to fit their own needs and expectations, and the difficulty in making judgments regarding the accuracy and dependability of information or commitments offered by those with whom they have had no prior interactions. These issues caused delays in shaping the final proposal as well as interagency contracts.

In at least one case, according to an interviewee, the poor communication within the partnership led to some partners attending an important meeting inadequately prepared to make the expected presentations. Fortunately, there were no long-term difficulties stemming from this incident. Both participants agreed that this issue had been resolved.

The participants offered these **lessons** learned:

- A strong, consistent leader who is responsible and has chairmanship skills is needed.
- A recorder to keep good minutes of meetings is needed.
- Partners must know the content and importance of the meetings to which they are invited.
- Direct on-site communications among the partners are necessary.

ISSUE 9: THE VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION STAFF WAS UNAWARE OF FEDERAL HIGHWAY ADMINISTRATION CONTRACTING REQUIREMENTS

One participant mentioned that the VDRPT was used to working with FTA grant programs and had not worked extensively with the FHWA in the past. Thus, the VDRPT staff was unfamiliar with FHWA requirements. Fortunately, this led to only minor delays as VDRPT personnel learned the requirements quickly.

This interviewee offered one **lesson**: "**Don't assume agencies are aware of project requirements.**" Go over requirements ahead of time, especially with a new agency or one with which you have not worked previously.

ISSUE 10: PARTNERS HAVE HAD DIFFICULTY IN UNDERSTANDING AND MEETING FEDERAL MATCHING REQUIREMENTS

Seven interviewees, five public sector and two private sector representatives, discussed this issue. They stressed that the partners' lack of experience with federal contracting procedures and lack of familiarity with the concept of matching are two main causes for this issue involving matching requirements. Although all partners are required to provide some type of match, the requirement for a match may vary for each participant. The fact that the amount and type of match to be provided by the partners was not clearly defined and the difficulty in matching with time or service rather than material or cash, added to the problems some partners faced in providing a match. This issue caused confusion and stress among the partners as contracts were being developed.

Four participants, representing all government levels and a private company, expressed concern that some partners may have overestimated their ability to provide matches at the originally proposed ratio of 50% federal/50% local in order to look good and to increase the likelihood that the project would be selected for funding. This had the unfortunate effect of locking in federal expectations regarding the high level of matching and effectively fixing the total funding for the operational test. Another participant complained that the partners were not ensuring that time or services (soft) match requirements were being met. The combination of soft matches being difficult to audit and a feeling on the part of this interviewee that no one was reading the contracts carefully, brought up concern that there would be future problems once the requirements were fully established. The complexity of accounting when dealing with matches, especially soft matches, was cited as an issue for the smaller firms whose accounting departments were not set up to handle such tasks. One individual feared that the complex funding situation may also create problems in the payment process for the consultants.

While the partners agreed to meeting the matching requirements, participants expressed lingering concern regarding the fulfillment of soft matching requirements and the documentation of matches which have been provided, especially after the participants start billing the project. The project team was flexible when it came to the distribution of the matching burden among the participants. The use of local operating funds to meet part of the match was also helpful to the partnership.

Participants expressed **lessons** learned from their experiences with the issue of matching:

- The project team should be identified early, especially at the state and federal levels, so the knowledgeable partners can provide assistance in developing the project and in understanding the federal funding and operational requirements.
- A "guardian angel" is needed; e.g., an active, available grants officer who takes the initiative to explain government mandates and to highlight changes in the requirements.
- The project team should pool the matches, allowing the stronger partners to provide the larger shares and to avoid burdening the weaker partners.
- Advance planning should be done to ensure that realistic estimates for schedules, funding, and non-federal matches are obtained.
- It is difficult to cut back on promised matches, but matches may always be increased at a later date.
- The funding and matching structures for each project must be tailor made.
- A good accounting system is required to track matching funds.

As previously noted, many interviewees had concerns that the funding parameters developed as a result of the high local match could have dire consequences on the deployment of this project. Six respondents said that the immediate issue involving meeting the funding commitment can lead to the potential issue of inadequate funding for the project, requiring project revisions or other corrections to stay within the existing budget.

3.2 PROJECT DEFINITION

The interviewees introduced four issues related to defining the project:

ISSUE 1: INITIALLY, THE PROJECT LACKED DIRECTION

Four participants, one from the private sector and three from the public sector, related concern regarding the direction of the project. Among the difficulties they faced at the beginning of the project was one of establishing clear objectives and a firm direction. Some of the difficulty could be attributed to the new type of project being attempted and the lack of available guidance. Related contributing factors are the differing objectives of the participants, the absence of guidance regarding the appropriate roles for participants, the lack of understanding of the project among the public decision makers, and the inexperience of some private sector participants in working with the public sector. One of the participants asserted that the agencies writing the proposals did not understand the technology involved.

According to one interviewee, at the beginning of the project it was unclear what the FHWA wanted tested, which technologies were to be used in the project, and what the local service needs were. This uncertainty contributed to the temptation to expand the project's scope to a level that was too large and complex for the local agencies to implement. The simultaneous initiation of regular service and exploration of ITS technologies added to the project's complexity. According to one interviewee, the private sector partners did not realize that the operational test had a large developmental component.

The resulting confusion among the partners is an understandable result of this situation, as are the delays involved. As the project scope was refined and focused, the ridesharing component, one of the initial pieces of the project, was abandoned. The issue was resolved mainly through additional time, hard work, and constant discussion among team members. Three parties remarked that the time required to resolve this issue was much longer than expected; however, all agreed that the extra time was necessary, with one conveying that the additional time "relieved" the project from a stressful tight schedule.

The participants described the **lessons** learned from this issue:

- Expert guidance and education are needed for the state and local transportation planning agencies in the areas of ITS technologies, projects, and federal policies as early in the process as possible.
- Establish the nature of the project early on.
- Budget marketing money for early customer education.
- Expect the project development and implementation process to take a long time.

ISSUE 2: THE RIDESHARING COMPONENT COULD NOT BE DEFINED CLEARLY ENOUGH TO BE ACCEPTED BY ALL THE PARTNERS

This issue was cited by five participants. Three of the five represented the public sector, while the other two were from the private sector. Both policy makers and administrators expressed concern regarding the ridesharing component of the project.

The single-trip ridesharing component of the project was a major source of controversy and upheaval during the early stages of the project. One participant characterized the essential conflict within the partnership as a desire at the federal level to see single-trip ridesharing implemented. This emphasis was challenged by other parties who felt that the concept definition for single-trip ridesharing was inadequate. Another participant asserted that neither the technical nor the marketing issues surrounding the proposed ridesharing component were explained to the satisfaction of the partners. Participants also mentioned additional concerns regarding the suitability of the service area for ridesharing and whether or not the proposed ridesharing service was necessary.

This conflict caused confusion among the partners and delays that threatened to halt the project. There was a drain on the participants' time and energy as they grappled with this issue. Ultimately, the ridesharing component was eliminated, thus changing the nature of the project. Also, a technical manager was added to better coordinate the technical aspects of the project. The elimination of the ridesharing component forced one partner to leave the project.

The participants offered **lessons** learned from this issue:

- Acquire a technical manager early in the project to help shape the technical components, balance the interests of the partners, and ensure project requirements are met.
- The project scope should be clearly defined by the partnership:
 - ◆ Operational test proposals need to be packaged so that they are understandable.
 - ◆ Participants must set realistic goals.
 - ◆ The system developed should be flexible and adaptable.
 - ◆ Pin partners down to the specifics of their concepts as early as possible.
 - ◆ Each piece of the project should be judged on technical merit.
 - ◆ No part of the project should be approved without rigorous examination.
 - ◆ No part of the project should be eliminated after having received approval.
- Establish with all the private sector partners what the project requirements are and what they are expected to do.
- Partners need to understand that there is no guarantee that an initial investment will result in a contract. This needs to be balanced against the problem of attracting and keeping partners.

- An impartial mentor is needed for technical and institutional issues in the development of ITS projects.

ISSUE 3: IT WAS DIFFICULT TO COORDINATE THE IMPLEMENTATION OF THE INTER-COUNTY BUS SYSTEM WITH THE OPERATIONAL TEST SYSTEM

One participant brought up the issue regarding the coordination of the implementation of the planned inter-county bus system and the deployment of the operational test. The local government in the service area of the proposed operational test intended to implement fixed route bus service independent of the operational test or actual ITS service deployment. The plan was to integrate these two objectives and to use the combined resources to ensure that the local area at least received fixed route service and, at best, benefited from the additional services made possible by the operational test.

Conflicts with the time frames of the fixed route service and operational test implementations caused difficulty in coordinating these implementations. The interviewee also cited the involvement of two state agencies, the VDOT and the VDRPT; the absence of processes to coordinate such efforts because of the innovative nature of the project; and a question regarding the source of funding for the necessary buses as additional causes.

Ultimately, local officials approved operating funds for the system and funding for the operational test was approved as well. Although the project faced some loss of momentum, confusion over funding matches, delays in ordering buses, finalizing subcontracts, and accepting money, the interviewee considered the issue resolved and does not foresee any long term adverse effects on the project. The participant stressed the **necessity of establishing timelines early and allowing reasonable lead times in scheduling** as the **lesson** learned from addressing this issue.

ISSUE 4: PARTNERS TAILORED THE PROPOSAL IN ORDER TO RECEIVE FEDERAL FUNDS

This issue was brought up by one participant. This participant asserted that the desire for federal funding led some of the partners to the practice of "grantsmanship" and the tailoring of the project proposal in order to receive federal funds. Some of the partners promised more than they could deliver and some of them embraced a service and a technology that they did not understand.

This practice, not surprisingly, led to misunderstandings between public and private partners, bad feelings within the partnership, and, finally, recriminations among the partners. In the end, this issue was resolved by scaling down the project scope to a feasible level. Thus, the project is less innovative than originally envisioned, although the potential for a high payoff still exists. Most importantly, the likelihood of successful implementation was increased.

The participant offered some lessons learned from this issue:

- Develop a clear project proposal.

- Review the project's vision and the proposal among all the partners early on, possibly in a pre-award meeting.
- The political process will effect the proposal. If elected officials or board members change, the proposal may change as well.

Two participants suggested **potential issues** that may arise as a result of problems developing from unclear proposals and uncertain funding. They said that *newly elected public officials may not continue to support a project that has a difficult concept to grasp and whose benefits are not readily recognizable*. One of the individuals added that the grand project scope, delays attributed to local politics, unrealistic financial expectations from the private partners, the lack of additional FTA and FHWA funds, and the technical inexperience by the project partners and staff may all lead to the potential issue of *an inadequate project budget to meet the scope of the SaFIRES project*.

3.3 ORGANIZATIONAL COORDINATION

Two issues regarding organizational coordination were discussed by the participants:

ISSUE 1: THE FEDERAL HIGHWAY ADMINISTRATION WAS UNCERTAIN WHICH OFFICE WOULD ADMINISTER THE PROJECT

Even within agencies, roles and responsibilities were unclear, such as within the FHWA where the role of the Division Office was unclear at the start of the project. The Division Office thought the project was to be monitored by the Washington Office. Under normal federal-aid procedures, the Division works directly with the state DOT. The project required new types of business relationships to be developed at all project levels.

Most of the participants felt that this issue has been resolved. These participants asserted that negotiations at FHWA HQ helped to address the issue surrounding project administration. The FHWA HQ delegated project management to the Region Office which passed it to the Division Office. This aligned project management with the normal Federal aid process.

ISSUE 2: SOME OPERATORS OF EXISTING TRANSPORTATION SYSTEMS OPPOSED THE PROJECT

This issue was only briefly mentioned by one participant. This interviewee asserted that territoriality and the perceived competition of interests had led to opposition of the project by some of the operators of existing transportation systems in the region. This participant emphasized the **lesson that the project partners need to portray the project as a complement to currently existing systems**. A second individual felt that the existing "turfism" could potentially damage the cooperation between the numerous agencies involved in this project.

3.4 HUMAN RESOURCES

Two human resource issues were raised by the interviewees:

ISSUE 1: LOCAL AGENCY STAFFS LACK TECHNICAL EXPERTISE

One interviewee discussed this issue. This participant stated that local agencies are usually concerned with the day-to-day operations of systems and not systems development. Therefore, technical innovation is a new area for many local agencies. Traditionally, tight local budgets impede the acquisition of technical expertise which agencies pursuing technical innovation might need or want.

The lack of technical expertise in local agency staffs has resulted in project delays, primarily due to the lack of communication regarding the vision behind the project and the final design of the operational test. The individual added that a **potential staffing issue** regarding *the inability to locate or develop a work force that encompasses both transit skills and computer skills may severely hinder the operation of this project.*

This issue was resolved by bringing in additional expertise from the private sector. According to the interviewee, the **lesson** learned from this issue was that there is a need to **develop a procedure to add expertise to a project**, while remaining alert to the potential for competition and conflict among the partners. Another party added a related lesson concerning the need for technical and administrative assistance, "**Most importantly, do not go it alone; get help as early as possible.**"

ISSUE 2: IT WAS UNCLEAR WHO FROM THE VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION WOULD BE WORKING ON THE PROJECT

This issue was cited by one of the participants. When the VDRPT was brought onto the project as the lead state agency, it took a while to establish who within that organization would be working on the project. The VDRPT itself was a new organization, with an uncertain internal structure. In addition, the VDRPT is oriented towards implementing transit programs rather than projects. To compound the confusion, the operational test is a new kind of project.

This situation caused minor delays, but had no major impacts, although the breaks in staffing continuity was disconcerting to some participants. The interviewee said that the situation appears resolved when the VDRPT settled on a staffing choice. A second participant felt that the process to establish VDRPT as the lead state agency and working directly with the FTA and the FHWA was carried out with far less difficulties than what was first envisioned.

The participant offered two **lessons** from addressing this issue:

- Get information on participants and their organizational structure at the start of the project.

- It is important to identify staff who will be assigned to a project as early as possible.

3.5 TECHNOLOGY

A number of participants stated their concern that there could be potential problems regarding both the selection of the technology and the product. A **potential issue** was cited that related to this subject:

ISSUE 1: THE TECHNOLOGY IS NOT READY FOR THE APPLICATION OR IS INADEQUATE TO ACCOMPLISH THE PROJECT'S VISION

Six participants, representing four public agencies and one private sector firm, highlighted this potential issue. One individual said that the public decision makers involved have been hesitant to support technological innovations for this project. The party added that this may backfire and cause the project participants to reduce the technical specifications to a level that does not obtain a product advanced enough to meet the project's needs. It was also noted that product and data protection and subsequent problems may limit the effectiveness of the product.

Two parties felt that the use and application of the desired technology was largely untested, especially with route deviations. Another cause cited as to why the technology may not prove adequate is that there has been an on-going conflict over the testing of the product and system and quickly implementing the project, substantially reducing the testing phase and pre-operational trouble-shooting period. One individual relayed the concern that the technology used in this project may not transfer to other projects if the system is not properly administered in the SaFIRES project or if a positive evaluation is not adequately publicized.

The respondents contributed three **lessons** related to product selection processes.

- Detail work, including the development of "tight" specifications, should be emphasized at the beginning of the project, thereby eliminating uncertainty in the following stages of the project.
- The use of contingency funds or other means should be investigated as ways to increase funding as the scope of the project and product specifications change.
- Project participants must be aware that protections may have to be applied to the development and use of software and data.

3.6 USER ACCEPTANCE

Participants remarked that the general public may not want to use the technology developed for this project. A **potential issue** was cited that related to this subject:

ISSUE 1: THE PUBLIC DOES NOT USE THE SYSTEM

All but one interviewee conveyed the potential issue of a lack of user acceptance of the system. Four of the participants remarked that they were concerned that the marketing for the project could prove inadequate, resulting in a lack of customer understanding about the hybrid nature of the service provided in the SaFIRES project. One added that marketing could also assist in determining if the market for the system was too small for the private sector to benefit from.

Three other respondents focused on the cause of the issue as the public's reluctance to accept the new technology or service, especially technology that is transit-oriented. There is general resistance to public transportation in favor of the automobile; thereby, potentially creating an insufficient demand for the project's services. Another group that could be responsible for not assisting with the project's performance and therefore potentially sabotaging its success would be the local transit operators (bus and commuter rail operators for SaFIRES). One individual noted that the project's success and outreach with the public requires local operators' understanding, acceptance, and use of the system.

Four **lessons** learned by the participants were stated concerning the importance of gaining public support and use of the project.

- ITS applications need to be practically oriented. People are not going to accept commuting alternatives which are perceived as complicated or likely to encounter difficulties or delays.
- The private sector needs to appreciate the public sector's need for marketing.
- User acceptance is necessary, which makes marketing important.
- Deployment of innovative services requires the support of the transit staff; therefore, agreements between the local sponsor and effected labor unions must be in place before funding for operations is given to the transit industry.

3.7 EVALUATION

One **potential issue** was provided related to the project evaluation:

ISSUE 1: THE SAME RESOURCE REQUIRED FOR THE PROJECT EVALUATION WILL BE USED FOR THE GIS MAPPING

A single participant mentioned this potential issue. One agency, the NVPDC, is assigned to two concurrent project tasks: (1) technical support for the GIS mapping and (2) conduct of the local project evaluation. The individual noted that it may be difficult for that agency to conduct both tasks with limited project resources provided. The potential for conflict between the agency's joint roles as the evaluator and that of the day-to-day support may also present problems with the interpersonal relationships among the partners.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
APTS	advanced public transportation systems
ARTIS	Advanced Ridesharing and Traveller Information System
AVL	automated vehicle location
CSF	critical success factor
DOT	Department of Transportation
FHWA	U.S. Department of Transportation Federal Highway Administration
FTA	U.S. Department of Transportation Federal Transit Administration
GIS	geographic information system
GMSI	Gandalf Mobile Systems, Inc.
GPS	global positioning system
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITS	intelligent transportation system
IVHS	intelligent vehicle highway system
NVPDC	Northern Virginia Planning District Commission
PRTC	Potomac and Rappahannock Transportation Commission
RFP	request for proposals
SaFIRES	Smart Flexible Integrated Real-Time Enhancement System
SG	SG Associates
SOV	single occupant vehicle
TCI	Tidewater Consultants, Inc.
TM	technical manager
UMA	UMA Engineering Ltd.
U.S. DOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
VDRPT	Virginia Department of Rail and Public Transportation

Volpe Center

U.S. Department of Transportation
John A. Volpe National Transportation Systems Center

APPENDIX B

REFERENCES

Aegis Transportation Information Systems, Inc. "Scope and Cost Estimate for PRTC's Advanced Ridesharing and Traveller Information System (ARTIS)," no date.

Gandalf Mobile Systems, Inc. "Proposal for a Mobile Data Communications Component for the Advanced Ridesharing and Traveller Information System," no date.

Northern Virginia Planning District Commission. "Geographic Information System (GIS) for ARTIS Test Planning and Marketing," no date.

Northern Virginia Planning District Commission. "Local Program Data Collection to Assist in Operations Decision Making," no date.

Potomac and Rappahannock Transportation Commission. "Advanced Ridesharing and Traveller Information System (ARTIS): A Public-Private IVHS Operational Test of National Significance," July 13, 1994.

"Prince William Service Area System Operations Plan," no author, no date.

SG Associates, Inc. "IVHS Operations Test: Phase One," no date.

UMA Engineering Ltd. "Proposal for a Route-Deviation Scheduling Component for the Advanced Ridesharing and Traveller Information System (ARTIS), June 1993.

APPENDIX C

OPERATIONAL TEST CASE STUDY REPORTS

IVHS Institutional Issues and Case Studies - ADVANCE Case Study

FHWA-SA-94-055

DOT-VNTSC-FHWA-94-9

NTIS Number: PB 94-186160

IVHS Institutional Issues and Case Studies - Advantage I-75 Case Study

FHWA-SA-94-056

DOT-VNTSC-FHWA-94-10

NTIS Number: PB 94-186145

IVHS Institutional Issues and Case Studies - HELP/Crescent Case Study

FHWA-SA-94-057

DOT-VNTSC-FHWA-94-11

NTIS Number: PB 94-187101

IVHS Institutional Issues and Case Studies - TRANSCOM/TRANSMIT Case Study

FHWA-SA-94-058

DOT-VNTSC-FHWA-94-13

NTIS Number: PB 94-183514

IVHS Institutional Issues and Case Studies - TravTek Case Study

FHWA-SA-94-059

DOT-VNTSC-FHWA-94-12

NTIS Number: PB 94-186111

IVHS Institutional Issues and Case Studies - Westchester Commuter Central Case Study

FHWA-SA-94-060

DOT-VNTSC-FHWA-94-14

NTIS Number: PB 94-186152

IVHS Institutional Issues and Case Studies - Analysis and Lessons Learned

FHWA-SA-94-061

DOT-VNTSC-FHWA-94-15

NTIS Number: PB 94-184322

IVHS Institutional and Legal Issues Program - Review of the FAST-TRAC Operational Test

FHWA-SA-94-067

DOT-VNTSC-FHWA-94-17

NTIS Number: PB 94-186103

IVHS Institutional and Legal Issues Program - Review of the Travlink and Genesis Operational Tests

FHWA-SA-94-071

DOT-VNTSC-FHWA-94-18

NTIS Number: PB 94-203296

ITS Institutional and Legal Issues Program - Review of the SmarTraveler Operational Test

FHWA-JPO-95-002

DOT-VNTSC-FHWA-94-24

NTIS Number: PB 95-179131

ITS Institutional and Legal Issues Program - Review of the TravelAid Operational Test

FHWA-JPO-95-003

DOT-VNTSC-FHWA-95-2

NTIS Number: PB 95-189536

ITS Institutional and Legal Issues Program - Review of the Houston Smart Commuter Operational Test

FHWA-JPO-95-007

DOT-VNTSC-FHWA-95-4

NTIS Number: not assigned yet