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John A. Volpe
National Transportation
Systems Center

PROJECT MEMORANDUM

**INTELLIGENT TRANSPORTATION SYSTEMS
(ITS) PROGRAM**

**ANALYSIS OF U.S. DOT-SPONSORED
REPORTS ON NON-TECHNICAL ISSUES**

Dawn M. Lafrance-Linden
Anne C. Tallon
Allan J. DeBlasio

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FOREWORD

This project memorandum was prepared by the U.S. Department of Transportation's (U.S. DOT) John A. Volpe National Transportation Systems Center (Volpe Center) under PPA HIV-552 with the U.S. DOT's Joint Program Office for Intelligent Transportation Systems (ITS). Ms. Dawn M. LaFrance-Linden and Ms. Anne C. Tallon of EG&G Dynatrend were the principal authors. Mr. Allan J. DeBlasio of the Volpe Center's Economic Analysis Division is the project leader.

This document contains information subject to change. It is considered an informal technical document for working level communication and dissemination of preliminary information within the cited project. The Volpe Center project leader is responsible for distribution of this report. Mr. DeBlasio should be contacted concerning comments on this report at (617) 494-2032.

EXECUTIVE SUMMARY

Under the Intelligent Transportation Systems (ITS) Program, the U.S. Department of Transportation (U.S. DOT) initiated studies and conducted a variety of conferences and workshops to identify and examine non-technical impediments that could affect the development of ITS products and services. Through these forums, the U.S. DOT reached out to individuals and organizations that would be involved in ITS so their perspectives could be represented in the development of an ITS program.

Through focused research, the U.S. DOT sought solutions to specific problems facing ITS participants and policy makers and reviewed ITS operational tests and other ITS deployments to identify non-technical impediments and lessons learned. As a result of these efforts, several documents were produced that examined non-technical impediments to the deployment of ITS and offered recommendations, observations, and conclusions resulting from these activities. Several of these reports document activities that were conducted from 1992 through 1994 and predated actual ITS deployments. Therefore, the conclusions presented in these reports reflect information from operational tests or the thinking of the authors.

This project memorandum presents summaries of these documents and identifies the significant non-technical impediments examined during the research projects and reviews of ITS activities. It also lists the recommendations forwarded to address those impediments. This paper critically analyzes these recommendations in light of subsequent work and with a perspective gleaned from viewing these efforts individually and as components of a larger set of documents. Further, this document presents a set of its own recommendations in response to those issues.

The reports from which these institutional issues were extracted are listed in chronological order:

Searching for Solutions- Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment, summary of seminar proceedings, Walcoff & Associates, August 1992.

Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States, The University of Michigan, December 1992.

IVHS Public/Private Partnerships: Managing the Legal issues, Workshop Proceedings, sponsored by the IVHS America Legal Issues Committee and the Federal Highway Administration, January 1993.

Institutional Impediments to Metro Traffic Management Coordination, Booz. Allen & Hamilton, Inc., Volpe National Transportation Systems Center, September 1993.

Advanced Vehicle Control Systems Potential Tort Liability for Developers, Nossaman, Guthner, Knox and Elliott, December 1993.

Intellectual Property Rights and the National IVHS Program, Nossaman, Guthner, Knox and Elliott. December 1993.

Workshop on IVHS and Intellectual Property, Federal Highway Administration and IVHS America, January 1994.

IVHS Institutional Issues and Case Studies--Analysis and Lessons Learned, Science Applications International Corporation (SAIC), Volpe National Transportation Systems Center, April 1994.

Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems, A Report to Congress, U.S. Department of Transportation, June 1994.

Overcoming Barriers to IVHS--Lessons from Other Technologies, The Urban Institute, February 1995.

Privacy and Intelligent Transportation Systems--Legal Research Reports, Santa Clara University, March 1995.

ITS Institutional and Legal Issues Program--Analysis of ITS Operational Tests--Findings and Recommendations, Volpe National Transportation Systems Center, September 1995.

Procurement Issues in IVHS Development and Deployment, Procurement Task Force of the Legal Issues Committee of IVHS America, undated.

REVIEW PROCEDURES

The institutional issues addressed in this document were identified as issues in the reports that were reviewed. This document examines each issue individually and places it in a category according to the characteristics of the underlying scenario that created each issue. This document also describes the recommendations put forth by the authors of the various documents that examined non-technical impediments to the deployment of ITS. In essence, this document synthesizes the institutional issues from those documents into one cohesive study, presents the recommendations given in response to the issues, analyzes the status and impact of the issues as well as the recommendations made, and presents further recommendations to deal with the issues.

CATEGORIES OF ISSUES

Nine categories are used to organize the institutional issues identified in the ITS reports discussed in this document:

- Awareness
- Coordination
- Government Requirements
- Intellectual Property Rights
- Liability
- Organizational
- Planning
- Privacy
- Resources

These classifications are also used to arrange those issues into areas of discussion. These categories are not mutually exclusive. In fact, the issues discussed may fit into more than one of the given categories. In the interest of clarity, each issue appears once, in the category to which it most fully applies.

Awareness

Issues in the “Awareness” category include stereotypes and cultural expectations that affect project participants’ attitudes and perceptions toward one another and toward ITS technologies. Most issues in this area center around a lack of awareness of the ITS vision, the motivations of the different participants, and the differences between the public and private sectors.

There are many issues surrounding various facets of ITS awareness. Some of this is natural in a program which, in many ways, is still in its infancy. However, there are still ways in which these issues may be addressed which could speed the development of ITS. Issues in this category have been separated into four groups: motivation, opportunity, outreach, and vision.

Coordination

Issues in the “Coordination” category refer to problems in establishing jurisdictional relationships, obtaining commitments from project participants, and maintaining good communications among the partners. These issues often result from different organizational objectives among the public and private sector agencies and between the public and private sectors.

Three major concerns that occur repeatedly in this category are commitments from ITS participants, public-private interactions, and multi-jurisdictional fragmentation. Other concerns reported were interagency coordination, public sector motivation, private sector needs and

opportunities, the differences in cultures between the partners, poor communication, and poorly defined roles. For the purposes of this analysis, these issues have been grouped under seven topics: centralization, commitment, communication, culture, jurisdictions, public-private, and roles.

Government Requirements

Issues in the “Government Requirements” category encompass those challenges that arise from contract and procurement requirements and procedures as well as any formal requirements that affect ITS technology development. These issues deal with the requirements imposed by federal, state, and local governments to which ITS project participants must adhere and with the differences between public and private sector participants. Government Requirements is the largest category of ITS issues mentioned in the review. To facilitate this analysis the category was further broken down into eight areas: accounting, antitrust, contracts, cost, procurement, regulation, telecommunications, and unspecified.

Intellectual Property Rights

Issues in the “Intellectual Property Rights” category relate to the distribution of rights and proprietary information issues among participants, with regard to both ideas and physical property. In a partnership of public and private sectors, these issues often arise from the uncertainty surrounding the ownership of the intellectual foundations of ITS products and the question of who will have access to these developments.

The most important issue raised in the area of intellectual property rights concerns the distribution of these rights among the partners. Other topics discussed in the documents reviewed were securing intellectual property agreements, the commercialization of ITS technology, the cost of intellectual property negotiations, federal requirements, the needs of the private sector, and proprietary information.

Liability

Issues in the “Liability” category encompass any issue relating to injury or damage that may result from the use of ITS technologies. This category also includes environmental issues and those involving insurance. Liability issues often result from the unclear assignment of responsibility for problems that may arise in ITS projects. In addition, liability concerns often revolve around the potential for torts and product liability litigation.

Organizational

Issues in the “Organizational” category center around building a project team and managing the project, often occurring within partnerships and between partners. These issues often result from the newness of the management structures required by ITS projects because such arrangements have not been tried and established. Organizational issues also encompass challenges defined by the roles of specific team members, such as upper managers and support staffs. The issues discussed in this section have been grouped into five categories: culture, leadership, roles, support, and teaming.

Planning

Issues in the “Planning” category refer to issues in the areas of project planning, the establishment of critical paths, marketing, standards, and specifications. They encompass problems that are encountered as a result of the lack of technical standards in ITS projects as well as challenges that arise during specific phases of ITS projects, such as implementation and evaluation. Issues involving planning for ITS projects have been sorted into nine categories: access, approaches, critical path, evaluation, inclusion, market, standards, technical, and transit.

Privacy

Issues in the “Privacy” category relate to the effects of ITS technologies on personal privacy. These issues include both protections against infringements of privacy rights and the effect that the public’s perception of ITS as intrusive may have on public acceptance. Privacy issues often result from the public’s uncertainty about the far-reaching capabilities of ITS technology. Many ITS applications have given rise to privacy concerns. The protection of computerized data and the use of surveillance technologies have been the prime concerns in this area.

Resources

Issues in the “Resources” category cover the human, financial, and technical support structure that is fundamental to ITS. These issues include cost allocation, present and future funding sources, as well as challenges of training and availability of technical expertise. Resources issues often center around the difficulty of securing both financial and human resources.

Resources, or more specifically, the lack of sufficient resources has been identified as an area of concern among ITS participants. As it is used here the term, “resources” encompasses all types of inputs to ITS projects, including education, funding, information, public support, and staff.

SUMMARY

Through their analysis of the constraints facing the deployment of ITS products and services, the authors of the papers that were reviewed implicitly identified several specific categories in which these issues were most prevalent. They also presented recommendations to address these issues. Volpe Center analysts reviewed these issues, evaluated the recommendations, and identified actions that could be taken by the U.S. DOT to foster the development of ITS products and services. Because similar actions may have been presented in two or more categories, these actions were consolidated into seven areas:

- General ITS Information
- Public-Private Partnerships
- Government Operations
- Intellectual Property Rights
- Liability
- Privacy
- Standards

By implementing these actions, the U.S. DOT would perform three significant roles, that of educator, facilitator, and researcher. The degree to which the U.S. DOT performs these roles within the different issue areas varies considerably. In some areas, these roles overlap. This section discusses ***the most important actions*** available to the U.S. DOT.

General ITS Information

In the area of “General ITS Information,” the major roles are that of researcher and educator. The U.S. DOT should collect and provide information on (1) innovative solutions used to overcome problems deploying ITS, including those used to overcome jurisdictional barriers; (2) the costs to procure and install ITS; (3) the benefits gained from deploying ITS; and (4) foreign ITS activities. Another task would be the education of local elected officials. The U.S. DOT could also be a facilitator by providing some type of on-demand source of ITS information.

Public-Private Partnerships

In the area of “Public-Private Partnerships,” the roles of facilitator and educator predominate. The U.S. DOT should facilitate the development of partnerships by providing team-building support. The Department should provide assistance in developing teaming agreements, which would address the roles and responsibilities of the partners, the appointment of a project manager, the acquisition of appropriate administrative and technical skills, and the assignment of intellectual property rights. This can be done by sponsoring retreats, seminars, or other methods of facilitation.

As an educator, the Department should provide information to help overcome the cultural barriers that exist between the public and private sectors, including providing the public sector

with information on standard business practices used by the private sector. The Department should also provide information on partner selection criteria and other innovative techniques used by public sector agencies to develop partnerships and to alleviate concerns on antitrust violations, organizational conflict of interest, and industry competitors being partners.

Other educational activities include disseminating the results of any facilitation actions taken by the Department, documenting and disseminating information on innovative contracting and procurement techniques, and reaching out specifically to small firms to educate them on ITS and government practices. As a researcher, the U.S. DOT should gather and analyze data to measure the level of public support and willingness to pay for ITS products and services.

Government Operations

In the area of “Government Operations,” the primary role is that of facilitator and the secondary role is educator. The Department should facilitate the deployment of ITS by streamlining administrative procedures and resolving overlapping and conflicting requirements. The Department should evaluate the costs and benefits of government requirements that differ from standard business practices and, where feasible, make changes that would reduce the cost of complying with these regulations. The Department should also consolidate the regulations of the different operating administrations in order to facilitate projects involving multimodal applications.

Other facilitation activities were suggested. The Department should (1) investigate more flexible funding mechanisms; (2) eliminate restrictions that limit or prohibit the sale of traffic data, that limit the use of highway rights of way, and that limit state and local agencies from delegating specific highway operations to private firms; (3) support legislation that expands the Federal Government’s rights to software in order to facilitate commercialization; and (4) emphasize competition over regulation.

The U.S. DOT should educate potential partners, especially those from the private sector, on federal accounting requirements. Specifically, the Department should spell out the requirements to match federal funds, the types of non-cash contributions that will be accepted, and methodologies to establish the value of products offered by project participants.

Intellectual Property Rights

In the area of “Intellectual Property Rights,” the U.S. DOT role should be that of facilitator. The Department must develop and disseminate a clearly articulated policy for the assignment of intellectual property that includes a commitment to retaining the flexibility in current federal law. This policy should serve as guidelines by which the private sector can address the current federal intellectual property requirements. The U.S. DOT should also provide examples of agreements successfully used to assign intellectual property.

Liability

In the area of “Liability,” the principal role for the U.S. DOT is researcher. The Department should investigate the need for the clear assignment of liability for ITS products. As part of this investigation, the U.S. DOT should analyze (1) the historical record of instances of liability litigation, especially in the area of advanced vehicle control systems; (2) whether the invocation of the immunity doctrine for government contractors would unacceptably limit either the ability of consumers to receive compensation if injured or any other course of action currently available to consumers; (3) the potential availability of reasonably priced insurance for ITS applications; (4) the possibility of limiting ITS liability; and (5) possible application of alternative dispute procedures to resolve ITS liability issues. As a result of this research, a guideline which outlines recommended practices for addressing potential ITS-related liability should be developed.

Privacy

In the area of “Privacy,” the U.S. DOT role is one of educator. The Department should educate participants on the need to protect the privacy of the users of ITS products and services. This activity would include disseminating and encouraging the use of the privacy principles developed by the Privacy Task Force of the Legal Issues Committee of ITS America and advising ITS participants to ascertain the applicable privacy laws in the states affected by their projects.

Standards

In the area of “Standards,” the role of facilitator is the most important. The U.S. DOT should develop national standards as quickly as possible. These standards should be as open and flexible as possible so that innovation is not stifled and varied technical approaches can be accommodated. Also, international applications should be taken into account when developing the standards.

TABLE OF CONTENTS

1. INTRODUCTION	1
2. REVIEW PROCEDURES	5
2.1 CATEGORIES OF ISSUES	5
2.2 TABLES	5
3. ANALYSIS OF THE ISSUES	7
3.1 AWARENESS	7
3.1.1 Motivation	8
3.1.2 Opportunity	11
3.1.3 Outreach	11
3.1.4 Vision	12
3.2 COORDINATION	12
3.2.1 Centralization	19
3.2.2 Commitment	19
3.2.3 Communication	21
3.2.4 Culture	21
3.2.5 Jurisdictions	22
3.2.6 Public-Private	23
3.2.7 Roles	24
3.3 GOVERNMENT REQUIREMENTS	25
3.3.1 Accounting	26
3.3.2 Antitrust	35
3.3.3 Contracts	35
3.3.4 cost	36
3.3.5 Procurement	36
3.3.6 Regulation	37
3.3.7 Telecommunications	38
3.3.8 Unspecified	38
3.4 INTELLECTUAL PROPERTY RIGHTS	38
3.4.1 Agreements	44
3.4.2 Commercialization	45
3.4.3 cost	45
3.4.4 Distribution	45
3.4.5 Federal	46
3.4.6 Needs	47
3.4.7 Proprietary Information	47
3.5 LIABILITY	48
3.5.1 Insurance	51
3.5.2 Transportation Improvement Programs (TIPs)	51
3.5.3 Torts	51

3.6 ORGANIZATIONAL	53
3.6.1 Culture	53
3.6.2 Leadership	58
3.6.3 Roles	58
3.6.4 Support	59
3.6.5 Team	59
3.7 PLANNING	60
3.7.1 Access	65
3.7.2 Approaches	65
3.7.3 Critical Path	66
3.7.4 Evaluation	66
3.7.5 Inclusion	66
3.7.6 Market	67
3.7.7 Standards	67
3.7.8 Technical	67
3.7.9 Transit	68
3.8 PRIVACY	68
3.8.1 Awareness	73
3.8.2 Computer	73
3.8.3 Future	74
3.8.4 Information	74
3.8.5 Personal	74
3.8.6 Surveillance	75
3.8.7 Technology	75
3.8.8 Unspecified	75
3.9 RESOURCES	76
3.9.1 Education	76
3.9.2 Funding	81
3.9.3 Information	82
3.9.4 Public Support	82
3.9.5 Staff	82
4. SUMMARY	85
APPENDIX A - ACRONYMS AND ABBREVIATIONS	89
APPENDIX B - DOCUMENT SUMMARIES	91

1. INTRODUCTION

Under the Intelligent Transportation Systems (ITS) Program, the U.S. Department of Transportation (U.S. DOT) initiated studies and conducted a variety of conferences and workshops to identify and examine non-technical impediments that could affect the development of ITS products and services. Through these forums, the U.S. DOT reached out to individuals and organizations that would be involved in ITS so their perspectives could be represented in the development of an ITS program.

Through focused research, the U.S. DOT sought solutions to specific problems facing ITS participants and policy makers and reviewed ITS operational tests and other ITS deployments to identify non-technical impediments and lessons learned. As a result of these efforts, several documents were produced that examined non-technical impediments to the deployment of ITS and offered recommendations, observations, and conclusions resulting from these activities. Several of these reports document activities that were conducted from 1992 through 1994 and predated actual ITS deployments. Therefore, the conclusions presented in these reports reflect information from operational tests or the thinking of the author.

This project memorandum presents summaries of these documents and identifies the significant non-technical impediments examined during the research projects and reviews of ITS activities. It also lists the recommendations forwarded to address those impediments. This paper critically analyzes these recommendations in light of subsequent work and with a perspective gleaned from viewing these efforts individually and as a component of a larger set of documents. Further, this document presents a set of its own recommendations in response to those issues.

The reports from which these institutional issues were extracted are listed in chronological order:

Searching for Solution+ Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment, summary of seminar proceedings, Walcoff & Associates, August 1992.

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Intellectual Property Rights and the National IVHS Program, Nossaman, Guthner, Knox and Elliott, December 1993.

Workshop on IVHS and Intellectual Property, Federal Highway Administration and IVHS America, January 1994.

IVHS Institutional Issues and Case Studies--Analysis and Lessons Learned, Science Applications International Corporation (SAIC), Volpe National Transportation Systems Center, April 1994. This document is based on analysis of six ITS activities, for which case studies have been written:

- ADVANCE
- Advantage I-75
- HELP/Crescent
- TRANSCOM/TRANSMIT
- TravTek
- Westchester Commuter Central.

Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems, A Report to Congress, U.S. Department of Transportation, June 1994.

Overcoming Barriers to IVHS--Lessons from Other Technologies, The Urban Institute, February 1995.

Privacy and Intelligent Transportation Systems--Legal Research Reports, Santa Clara University, March 1995. This document contains the following legal research reports:

- "Examples of How IVHS Architecture Decisions Affect Personal Privacy"
- "IVHS Electronic Communication Service Providers and Application of the Electronic Communications Privacy Act to IVHS"
- "Analysis of State Laws Protecting Computer Systems"
- "ITS and the Fourth Amendment"
- "Private Vehicles: An Oxymoron"
- "Playing Chicken: Would IVHS Consent Requirements Constitute an Unlawfully Coercive Game of Who Blinks First?"
- "Privacy Concerns about IVHS Outside the United States"
- "The Intelligent Vehicle-Highway System and Applicable European Legislation."

ITS Institutional and Legal Issues Program--Analysis of ITS Operational Tests-Findings and Recommendations, Volpe National Transportation Systems Center, September 1995. This document is based on analysis of six ITS activities, for which case studies have been written:

- FAST-TRAC
- Guidestar Program
- Houston Smart Commuter

- Smart Flexroute Integrated Real-Time Enhanced System (SaFIRES)
- SmarTraveler
- TravelAid

Procurement Issues in IVHS Development and Deployment, Procurement Task Force of the Legal Issues Committee of IVHS America, undated.

2. REVIEW PROCEDURES

The institutional issues addressed in this document were identified as issues in the reports that were reviewed. This document examines each issue individually, and places it in a category according to the characteristics of the underlying scenario that created each issue. This document also describes the recommendations put forth by the authors of the various documents that examined non-technical impediments to the deployment of ITS. In essence, this document synthesizes the institutional issues from those documents into one cohesive study, presents the recommendations given in response to the issues, analyzes the status and impact of the issues as well as the recommendations made, and presents further recommendations to deal with the issues.

2.1 CATEGORIES OF ISSUES

Nine categories are used to organize the institutional issues identified in the ITS reports discussed in this document: Awareness, Coordination, Government Requirements, Intellectual Property Rights, Liability, Organizational, Planning, Privacy, and Resources. These classifications are also used to arrange those issues into areas of discussion. These categories are not mutually exclusive. In fact, the issues discussed may fit into more than one of the given categories. In the interest of clarity, each issue appears once, in the category to which it most fully applies.

2.2 TABLES

The nine categories are further employed in tables that identify, describe, and offer recommendations on the institutional issues discussed in the ITS reports analyzed in this document. These tables are intended to present clearly the issues with their corresponding recommendations, as identified by the authors of each report.

The tables are divided into the following six columns: Report, Issue, Experienced, Status, Impact, and Recommendations. The column “Report” presents an abbreviated title of the report in which that issues was identified. Full titles of reports referenced in each table follow the tables. The column “Issue” offers a brief description of the issue itself. From this column the reader can derive a short summary of the issues as well as discern the frequency with which an issue was discussed in the reports.

The column “Experienced*” indicates whether the issue was actually experienced by the authors of the report or by others implementing ITS projects. Possible options for this column are “Y” for “Yes,” to indicate that the issue was indeed experienced; “N” for “No,” to indicate that the issue was not actually experienced; and “P” for “Potential,” indicating that, unless addressed, the situation described will become an institutional issue.

The column “Status” describes the status of the institutional issue at the time the report was written. Possible responses in this field include “0” for “Outstanding,” indicating that the issue has not been resolved; “A” for “Addressable,” indicating that the issue requires attention and can be resolved by ITS project participants; and “P” for “Perceived,” indicating that the situation described is an issue in the author’s perception or by those involved in ITS activities.

The “Impact” column describes the ramifications of each issue in light of the effects of implementing the recommendations proposed by the authors of the reviewed reports. The concept of “impact” refers to the likely consequences of each issue if the given recommendations are adopted. Responses in this field are a numerical range from 0 through 4, with 0 indicating that the issue would have no lasting ramifications, or an impact of “None” if the given recommendations are accepted. The response of 1 designates that the issue would have a “Mild” impact after adoption of recommendations. A response of 2 indicates that the issue would have a “Moderate” effect. The response of 3 reveals that the issue, despite implementation of recommendations, would have a “Significant” impact. A response of 4 in the impact field describes that the issue that would have a “Serious” impact, even in light of implementation of the corresponding recommendations.

The “Recommendations” column presents those sanctions identified by the authors of each report to counter the issues that they identified. In addition to presenting recommendations from all of the reports cohesively, this column exhibits the frequency with which specific recommendations were made by the authors.

3. ANALYSIS OF' THE ISSUES

The most significant issues were extracted from the reports that were reviewed. Each issue was placed in a category and in a group within a category. Each issue is analyzed according to the frequency with which the issue arose, as well as the status and impact of each issue. The recommendations made to combat each issue are then presented. Finally, the recommendations are analyzed and overall recommendations are provided.

3.1 AWARENESS

Issues in the “Awareness” category include stereotypes and cultural expectations that affect project participants’ attitudes and perceptions toward one another and toward ITS technologies. Most issues in this area center around a lack of awareness of the ITS vision, the motivations of the different participants, and the differences between the public and private sectors.

There are many issues surrounding various facets of ITS awareness. Some of this is natural in a program which, in many ways, is still in its infancy. However, there are still ways these issues may be addressed that could speed the development of ITS. Issues in this category have been separated into four groups: motivation, opportunity, outreach, and vision.

Recommendations for Addressing Awareness Issues:

- ***The U.S. DOT should sponsor the development of a brief introduction to standard business practices by a business consultant for distribution to public agency personnel who will be part of public-private partnerships. (Motivation)***
- ***The U.S. DOT should support ITS education for local government officials (Outreach)***
- ***The U.S. DOT should assist in efforts undertaken by ITS America to implement ITS outreach programs. (Outreach)***
- ***The U.S. DOT should provide some type of on-demand source of consistent information on ITS. (Vision)***
- ***The U.S. DOT should collect cost-benefit assessments from prior ITS projects and make them available to potential ITS participants. (Vision)***

3.1.1 Motivation

Issues of motivation focus on the lack of awareness of the incentives and needs of the private sector. Five recommendations were advanced to address this concern. One of the recommendations, "Increase public sector awareness," is straightforward, but vague. The remaining recommendations are offered together as sequential steps focused on increasing awareness of the incentives and needs of the private sector in order to facilitate public-private agreements: (1) establish a national program to identify, clarify, and resolve public-private issues, (2) include all levels of government in the program and divide responsibilities among them; (3) fund the program; and (4) share the results among ITS participants.

These additional recommendations offer more substantive direction, but are still undefined in specifics and scope. Again, the goal is clear, but the implementation may be more complicated than is initially apparent. Unfortunately, the report in which these recommendations were published was a summary of seminar proceedings and, as such, may not completely reflect the actual level of detailed analysis contained within the original presentation.

However, recommendations meant to address the issues of awareness related to public-private interactions need to be reviewed carefully due to the fact that difficulty within the public-private relationship is stated repeatedly and significantly as a major impediment to ITS deployments. While there is no doubt that the ITS community is gaining valuable experience upon which to draw as greater numbers of projects are conceived, built, and deployed, the stature of this impediment is so substantial that prudent steps to improve the public-private relationship should be taken whenever possible. Whether the establishment of such a national program to discover, address, and disseminate information about public-private issues and possible solutions is such a prudent step is hard to say. The issue, however, is so pervasive and tenacious that any possibility of addressing it should be seriously considered. More information on the initial outlay and expected benefits from such a course of action would be necessary before an informed decision could be made. In the interim, perhaps a brief introduction to "standard business practices" developed by a business consultant and distributed to public agency personnel who deal with public-private partnerships would accelerate movement up the learning curve. In addition, all participants should avail themselves of the information and experience available from participants in ITS projects currently deployed or in development. ***The U.S. DOT should sponsor the development of a brief introduction to standard business practices by a business consultant for distribution to public agency personnel who will be part of public-private partnerships.***

AWARENESS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Motivation					
"Solutions"	The incentives and needs of the private sector are not understood, making public-private arrangements difficult.	Y	O	2	1. Establish a national program to identify, clarify and resolve public-private issues. 2. Include all government levels in the program and divide responsibilities among them. 3. Fund the program. 4. Share program results among IVHS participants.
"Solutions"	The public sector is largely unaware of factors that motivate the private sector.	Y	A	0	Increase public sector awareness.
Opportunity					
"Solutions"	There is insufficient awareness regarding public and private opportunity in IVHS development.	Y	A	0	Educate potential participants.
"Solutions"	The public sector has not cultivated relationships with the private sector, so some industries have not been included in IVHS projects.	Y	A	0	The public sector should cultivate new relationships with unfamiliar industries.
"Solutions"	There are insufficient public sector incentives to boost private sector ATIS and ATMS involvement.	Y	A	0	Institute public sector incentives.

AWARENESS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Outreach					
'Metro Traffic'	Too few outreach programs are underway that focus on ITS.	P	O	0	Develop regional ITS America centers that will assume a lead role in advancing the use of ITS technologies.
"Findings'	Funding constraints hinder local government participation in ITS.	Y	A	2	Educate representatives of local governments regarding the benefits of ITS.
Vision					
'Metro Traffic'	With the exception of one, none of the respondents are aware of the benefits of ATMS projects that had been done.	Y	O	2	Perform a benefit/cost analysis that clearly demonstrates the advantages and costs associated with a program
'Metro Traffic'	There is a lack of a common understanding and vision of ATMS.	Y	O	2	Establish a low cost or no-cost hotline to provide an on-demand source of information about IVHS, including ATMS.

Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

'Findings'

"Metro Traffic"

"Solutions"

Review of ITS Operational Tests – Findings and Recommendations.

Institutional Impediments to Metro Traffic Management Coordination.

Searching for Solutions – Public and Private Sector Roles in

Intelligent Vehicle-Highway Systems (IVHS) Deployment.

3.1.2 Opportunity

Awareness of ITS opportunities was the focus of three issues. The unifying theme behind these is a perception that there are ITS opportunities of which the private sector is not aware or taking advantage. Three recommendations are made to address this concern: (1) educate potential participants; (2) cultivate new relationships with unfamiliar industries; and (3) institute public sector incentives.

In light of the previous discussion about the lack of understanding concerning the private sector's needs and incentives, it is unclear what kind of opportunities await private sector participants in ITS projects. The possibility that private sector entities may be aware of the opportunities offered by ITS, but judge them less attractive than some ITS participants do, must be considered. Therefore, it must be established that a lack of awareness is the cause of "missed" opportunities before significant resources could be appropriately committed to recruiting new participants, whether through education, the cultivation of new relationships, or the use of incentives. There should be a gap between the clearly defined, currently available ITS opportunities on the one hand, and participants to take advantage of them on the other before significant resources are committed to attracting new ITS participants. If such a gap is shown to exist, aggressively cultivating ITS participants could bear immediate and important fruit, which would then, assuming the projects were successful, lay the groundwork for future ITS expansion. In contrast, having the potential for opportunity, which appears to be the current state of ITS development, is a more subtle factor and may indicate a need for more upfront resources in order to market ITS to possible participants. Such marketing could consider tactics such as incentives, but may not be the best use of public funds to forward the overall ITS program. It depends, in part, on the level of public sector commitment to ITS and whether the public sector decides to subsidize ITS development. The provision of incentives would cast doubt on the actual attractiveness of ITS opportunities to the private sector. On a related aspect, industries which deal directly with ITS concerns should be cultivated first, whether or not they have traditionally had strong ties to the public sector. ***The U.S. DOT should not use additional resources to recruit additional industries for participation in the ITS program until the currently interested industries have been utilized.***

3.1.3 Outreach

Not all local governments are convinced that the ITS program could benefit them and some may even regard it as a highway program. Thus, they have no sense of project ownership and may believe that there is not enough funding available for ITS implementations. In addition, there are insufficient outreach programs focusing on ITS, especially ATMS (advanced traffic management system).

Education aimed at representatives of local government may positively affect the attitudes and beliefs now hindering ITS development. Outreach from the national level would provide the program objectives and the important ingredients necessary for the success of the program. Local outreach would provide necessary background to implementation personnel (state, county, and city government organizations), supporters (politicians), and users (the general public). ITS America could assume a greater role in the advancement of ITS technologies by developing

regional centers for that purpose. ***The U.S. DOT should support ITS education for local government officials and assist in efforts undertaken by ITS America to implement ITS outreach programs,***

3.1.4 Vision.

There is a lack of clear understanding about the benefits of ITS development among all three shareholder groups: public sector organizations (including politicians); the private sector; and the general public. ATMS in particular is perceived inconsistently among stakeholders, in different metropolitan areas and by individuals within an area.

A low-cost or no cost hotline to provide an on-demand source of ITS information, including ATMS, was suggested to provide a common understanding and vision of ITS. A cost-benefit assessment was also recommended to clearly demonstrate the advantages and costs associated with *the ITS* program. ***The U.S. DOT should provide some type of on-demand source of consistent information on ITS. It should also collect cost-benefit assessments from prior ITS projects and make them available to potential ITS participants.***

3.2 COORDINATION

Issues in the “Coordination”* category refer to problems in establishing jurisdictional relationships, obtaining commitments from project participants, and maintaining good communications among the partners. These issues often result from different organizational objectives among the public and private sector agencies and between the public and private sectors.

Three major concerns which occur repeatedly in this category are commitments from ITS participants, public-private interactions, and multi-jurisdictional fragmentation. Other concerns reported were interagency coordination, public sector motivation, private sector needs and opportunities, the differences in cultures between the partners, poor communication, and poorly defined roles. For the purposes of this analysis, these issues have been grouped under seven topics: centralization, commitment, communication, culture, jurisdictions, public-private, and roles.

Recommendations for Addressing Coordination issues:

- ***The U.S. DOT should assist potential participants in their analyses of ITS implementations. (Commitment)***
- ***The U.S. DOT should act as a coordinator for partnerships having difficulty achieving simultaneous commitments. (Commitment)***
- ***The U.S. DOT should sponsor the development of national ITS standards, taking care to preserve the greatest feasible flexibility within the ITS architecture. (Commitment)***

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
Centralization					
"Overcoming Barriers"	There is a conflict inherent in the split between local, decentralized decision-making and centralized ATMS facilities and functions.	Y	A	1	<ol style="list-style-type: none"> 1. Decentralize control wherever possible. 2. Carefully select functions that would be better centralized. 3. If necessary, use short-term reliance on centralized ATIS management to facilitate deployments.
Commitment					
"Solutions"	The automobile industry is reluctant to bear the costs of incorporating IVHS functions into cars unless there is a guarantee from the telecommunications industry that IVHS services will be provided.	Y	O	2	<ol style="list-style-type: none"> 1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.
"Overcoming Barriers"	Some businesses hesitate to commit resources before receiving commitments from other interested parties.	Y	A	0	After the development of a national architecture, the government should provide financial incentives to the telecommunications industry to provide roadside infrastructure.
"Solutions"	The private sector is motivated by the potential for profit. The private sector needs favorable cost-benefit assessments before committing to IVHS.	Y	A	1	<ol style="list-style-type: none"> 1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Solutions"	Private sector participation hinges on profitability.	Y	A	1	<ol style="list-style-type: none"> 1. Outline private sector opportunities. 2. Incorporate alternate routing estimation methods. 3. Share information and benefits. 4. Develop a private sector outreach program. 5. Investigate the interaction between IVHS and private sector motivation.
"Solutions"	Governments at the state and federal levels require motivation for IVHS deployments.	N	A	0	Use federal and state environmental concerns as motivation for IVHS deployments.
Communication					
"Solutions"	The integrity of information transmissions within public-private arrangements may not be assured.	Y	O	2	<ol style="list-style-type: none"> 1. Establish a national program to identify, clarify, and resolve public/private issues. 2. Include all government levels in the program and divide responsibilities among them. 3. Fund the program. 4. Share program results among IVHS participants.
"Findings"	At the start of most operational tests, a mechanism to foster communication was not in place, affecting coordination between agencies.	Y	A	2	<ol style="list-style-type: none"> 1. Establish a committee structure mechanism. 2. Identify a project manager to facilitate communications.

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Metro Traffic"	Negative stereotypes of cultural differences in public-private partnerships hinder progress of projects. Lack of communication across organizations contributes to a lack of understanding.	Y	A	4	<ol style="list-style-type: none"> 1. Hold frequent meetings, ensuring that the partners spend time together in the planning process. 2. Develop a handbook of public and private partner business terms.
"Analysis"	Poor internal communication can mask differing agendas.	Y	O	3	Select an agency spokesperson to speak for the entire organization at large meetings.
"Analysis"	The lack of protocols in inter-partner communications invite problems.	Y	A	1	Institute a communications protocol to ensure all project partners receive the same information.
Culture					
"Overcoming Barriers"	Differences between work cultures can be one of the most difficult barriers to overcome.	Y	A	2	<ol style="list-style-type: none"> 1. Build upon successes. 2. Develop international standards. 3. Mandate public agency co-operation. 4. Provide expert facilitators. 5. Research solutions to jurisdictional fragmentation.
"Analysis"	Because of cultural differences among partners, partners' goals for their respective IVHS projects differed.	Y	A	3	Meet frequently so partners may check on each other to ensure that progress is going as expected and to minimize the damage caused by miscommunication.

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
Jurisdictions					
"Metro Traffic"	Unclear lines of authority are a root cause of impediments to interjurisdictional cooperation.	Y	A	2	Develop work plan guidelines for implementing ATMS. The plan should be a step-by-step guide for implementing one or more ATMS technologies in the area.
"Deployment"	The coordination of efforts and negotiations among governmental agencies is time-consuming and often requires research in state law and regulation.	Y	O	1	Educate participants and draw on the experiences of other IVHS players regarding the unique procedures and problems of IVHS procurements.
"Solutions"	IVHS implementation is inhibited by multiple jurisdictions.	Y	O	1	1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.
"Solutions"	Junsdictional fragmentation is a barrier to private sector IVHS involvement.	Y	O	2	None.
"Procurement"	It is difficult to coordinate among multiple governmental and jurisdictional entities.	Y	A	3	1. The government should promote efforts to coordinate requirements. 2. The government should seek revisions to ISTEA allowing conflicting regional requirements to be conformed. 3. The government should serve as a clearinghouse for solutions.

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
Public-Private					
"Implementation"	There is not enough cooperation between the public and private sectors.	Y	A	0	1. Eliminate restrictions that limit or prohibit the sale of traffic data. 2. Reduce limits on the use of highway rights of way. 3. Allow state and local agencies to delegate specific highway operations to private firms.
"Solutions"	The U.S. is not applying approaches to IVHS developed by the Japanese and the Europeans that have proven beneficial to fostering public-private cooperation.	Y	A	0	1. Form a large scale consortia of private participants. 2. Use a sliding scale for public funding and retention of IP rights. 3. Solicit ideas from the private sector. 4. Support broad solicitations. 5. Provide public sector infrastructure studies.
Roles					
"Solutions"	There is insufficient willingness on the part of the public sector to share enough responsibility for ATIS to facilitate private sector involvement.	Y	O	2	None.
"Analysis"	The lack of clarity in defining goals, roles, and responsibilities hindered the progress of the project.	Y	A	4	Meet frequently so partners may check on each other to ensure that progress is going as expected and to minimize the damage caused by miscommunication.

COORDINATION					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Metro Traffic"	Due to conflicting objectives, confusion exists about the appropriate public and private sector roles in partnerships.	Y	A	3	Provide guidance on public and private sector roles, defining alternative public and private sector roles throughout the life cycle of an ATMS program.

+ Impact after implementation of recommendations

Key

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies – Analysis and Lessons Learned.
"Deployment"	Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States.
"Findings"	Review of ITS Operational Tests – Findings and Recommendations.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"Metro Traffic"	Institutional Impediments to Metro Traffic Management Coordination.
"Overcoming Barriers"	Overcoming Barriers to IVHS – Lessons from Other Technologies.
"Procurement"	Procurement Issues in IVHS Development and Deployment.
"Solutions"	Searching for Solutions – Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment.

- ***The U.S. DOT should facilitate the initiation of public-private partnerships within a project. (Communication)***
- ***The U.S. DOT should sponsor retreats, seminars, or other methods of facilitation to assist partners in developing the details of the partnership. Any information resulting from such activities should be disseminated throughout the ITS community. (Communication)***
- ***The U.S. DOT should identify and collect research and other information on overcoming cultural differences within partnerships. It should also support similar efforts by organizations such as ITS America. (Culture)***
- ***The U.S. DOT should promote efforts to coordinate competing requirements among multiple jurisdictions and serve as a repository and clearinghouse for methodologies used to successfully overcome jurisdictional issues. (Jurisdictions)***
- ***The U.S. DOT should follow the recommendations that propose eliminating restrictions limiting or prohibiting the sale of traffic data, reducing limits on the use of highway rights of way, and allowing state and local agencies to delegate specific highway operations to private firms. (Public-Private)***

3.2.1 Centralization

One issue focused on the inherent tension between the requirements of local, decentralized decision making and a centralized advanced traffic management system (ATMS). The report made three recommendations for addressing this issue: (1) decentralize control wherever possible; (2) carefully select those functions it might be better to centralize; and (3) use short-term reliance on centralized advanced information management systems (ATIS) to facilitate deployments when necessary. It appears these recommendations can be summarized as, decentralize control unless a compelling reason, such as facilitating deployment, indicates otherwise.

This is a sound strategy because it maximizes the enfranchisement of local ITS participants and makes local decision makers active parts of the ITS community. This way, instead of ITS being perceived as a threat to local autonomy, it can serve the interests and needs of local communities as defined by the local decision makers. Hopefully, this will increase local support of ITS efforts in general and help facilitate a team approach to transportation issues which span more than one locality. ***There is no action recommended to the U.S. DOT in this section.***

3.2.2 Commitment

There is concern in the ITS community regarding the level of commitment of participants, or potential participants, particularly those in the private sector. The lack of commitment which some find troubling is partially due to the newness of ITS technology and its application. There is reluctance, most notably among the private sector, to invest in an area with such an uncertain

future. In many cases, the profitability of ITS cannot be shown to the satisfaction of potential private sector participants; in others there is an “after-you” mentality in which investment is withheld until another party commits to the project. The development of a national architecture and federal financial incentives are suggested remedies. Another recommendation would educate the private sector about ITS opportunities. Finally, other recommendations suggest we look abroad and examine partnerships in other countries for solutions.

The general issue of commitment seems to result from the private sector’s lack of confidence that ITS investment will be profitable. Many of the recommendations address this concern by facilitating the analysis the private sector needs to do before committing to ITS, researching the solutions implemented in foreign countries, and distributing the results of both these efforts. Clearly any information already available should be shared and any information readily obtainable should also be pursued. (The “Awareness” section also discusses the lack of understanding which surrounds the needs of the private sector).

The Federal Government could reasonably put some resources toward facilitating these efforts. In addition, the government could act as a broker between potential ITS participants who cannot otherwise agree to commit to a project. The reassurance of profitability and of other participant commitment will address some of the stated issues. One missing piece, however, seems to be the commitment of the government itself to the implementation of ITS technology. If the private sector cannot prove to itself that ITS is a profitable venture, then they will not pursue it. That does not mean that ITS would not benefit the citizens who use it and should not be pursued at all. If the government is convinced of the profitability or merely the desirability of ITS,’ then it could easily facilitate ITS development by shouldering more of the risks and upfront costs. An obvious difficulty with this conclusion is the current fiscal climate in Washington, which is unlikely to be friendly to the proposal that a significant national investment be made at this time,

The possibility of the government providing direct financial incentives, for instance to the telecommunications industry, is politically unlikely; but unless there are enough inherent incentives to a project, incentives may be necessary if the project is to be implemented at all. The development of a national architecture has strong support throughout the ITS community, although it has opponents as well. The creation of an ITS base through a national ITS architecture would eliminate some of the uncertainties that have caused the private sector to hesitate. Care should be taken, however, in the crafting of such standards in order to permit the greatest possible latitude in implementation. The question of implementing national ITS standards is taken up in greater depth in the category of “Planning.”

In summary, the U.S. DOT should assist potential participants in their analyses of ITS implementations, act as a coordinator for partnerships having difficulty achieving simultaneous commitments, and sponsor the development of national ITS standards, taking care to preserve the greatest feasible flexibility within the ITS architecture.

3.2.3 Communication

Poor interagency communication can affect the progress of an ITS project. At the start of most operational tests, there was no mechanism in place to foster communication, which allowed the distinct agendas and separate functions of the various transportation agencies to impede progress on the projects. In fact, poor internal communication was shown to mask differing agendas. In another case, a lack of inter-partner communication was found to exacerbate the unclear roles within the partnership. A related concern is the preservation of the integrity of communication within the partnership.

Within the project, establishing a committee structure mechanism was recommended, along with the identification of a project manager to facilitate communications. Instituting a communications protocol was also recommended to ensure the consistency of information disseminated to the partners. Such a protocol might include the selection of one agency spokesperson to speak for the entire organization at large meetings. Frequent meetings were recommended to ensure the partners spent time together in the planning process.

On an institutional level, it was recommended that a national program to identify, clarify, and resolve public-private issues be founded. This program would include all levels of government and divide the responsibilities among them. The program would be federally funded and the results would be distributed among all ITS participants.

Two actions are recommended in this section: ***(1) The U.S. DOT should facilitate the initiation of public-private partnerships within a project; and (2) the U.S. DOT should sponsor retreats, seminars, or other methods of facilitation to assist partners in developing the details of the partnership. Any information resulting from such activities should be disseminated throughout the ITS community.***

3.2.4 Culture

Cultural differences were identified twice as an impediment to ITS development. The differences in the work cultures of various ITS participants due to competing interests, organizational fragmentation, and multiple jurisdictions was considered by the authors of that report “most difficult to overcome.” Seven recommendations for overcoming this difficulty were offered.

The first recommendation is to build upon and publicize existing coordination efforts which have been successful, such as ITS America. This action is necessary to further ITS development and an obvious step. One of the other recommendations is more specific and calls for ITS America to provide expert facilitators who have been proven to have the ability to assist in ITS decision making and building bridges between participants with varied interests. Assuming ITS America is able to provide such a resource, involving such individuals in the ITS development process, most likely at the earliest, team-building stage, could facilitate the resolution of concerns arising from cultural differences.

The second recommendation advocates developing international standards, where possible, in order to encourage economies of scale, increase profitability and facilitate system interoperability. This recommendation is sound and its goals are valid. However, international standards should be weighed carefully against the value of retaining flexibility and remaining open to future innovations. There does not seem to be consensus in the ITS community regarding standards, which implies that standardization may be premature. (Additional information on standardization appears in the “Planning” section).

Three recommendations indicate federal action to address the differences in work cultures. One advocates that, when necessary, the Federal Government require the cooperation of public agencies and authorities that manage roads in ATMS and ATIS implementations, and, concurrently, require the agencies and authorities to meet performance goals set at the national level. The reasoning behind this recommendation is unclear. Certainly, imposing top-down requirements eliminates the need to reconcile differences between the partners, but the resulting team would only be as strong as the authority exercised over it. Actually resolving conflict and building ITS project teams which can work successfully together would provide greater return for the ITS program in the long run.

The sixth recommendation provides for federal encouragement directed at other governmental agencies at all levels to overcome institutional fragmentation. This would be accomplished through strategies such as financial incentives for the development of common geographic information system (GIS) platforms and locational reference systems at the local levels which would be compatible with national standards (which do not yet exist). Given the current political climate, it would be difficult to institute financial incentives. This would only be likely to happen if the Federal Government were to make developing ITS a national priority. ***There is no action recommended in this area for the U.S. DOT.***

The final recommendation addressed to the federal level advocates the utilization of on-going research related to overcoming jurisdictional fragmentation as it becomes available. This recommendation is an obvious one and this course of action should be pursued.

Also discussed as a recommendation was the consolidation of decision-making authority at the level which represented the greatest number of interested parties; it was assumed that that would often indicate the level of the metropolitan planning organization (MPO). It is unclear what impact instituting this recommendation would have on the issue at hand.

The U.S. DOT should identify and collect research and other information on overcoming cultural differences within partnerships. It should also support similar efforts by organizations such as ITS America.

3.2.5 Jurisdictions

It has been generally recognized that it is difficult to coordinate ITS implementations across multiple jurisdictions, whether those jurisdictions be different levels of government, various government agencies, geographic regions, etc. One of the reports summarized recommended that

the government promote efforts to coordinate the competing requirements and serve as a clearinghouse for solutions, which, given the central role the public sector is playing in ITS development, is a sound strategy. ***The U.S. DOT should promote efforts to coordinate competing requirements among multiple jurisdictions and serve as a repository and clearinghouse for methodologies used to successfully overcome jurisdictional issues.***

Additional general recommendations, such as educating the participants and drawing on the experiences of prior ITS participants, examining foreign partnerships and holding workshops, are vague and, while based on a logical approach, they require additional refinement. Other recommendations are more specific and are more immediately implementable, such as testing institutional and technical innovations concurrently and including the definition of roles for the private and public sectors in ITS planning. The former recommendation is probably already in practice, since many ITS project involve both technical and institutional innovations and there seems to be no purpose in pursuing them separately. The latter is a helpful suggestion. Defining roles is a necessary and, unfortunately somewhat neglected, part of developing a well-functioning ITS project team. Therefore, this recommendation serves as a good reminder of what needs to be done. ***The U.S. DOT should encourage transportation planning agencies to clearly define the roles of the public and private sectors within a proposed project.***

Finally, the most complicated recommendation suggests that the government should seek revisions to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) allowing conflicting regional requirements to be conformed. The report does not make clear what would be involved in such an action, so unless it would be a very straightforward process with clear advantages as a result, it is probably better left alone. ***No additional action is recommended to the U.S. DOT.***

3.2.6 Public-Private

Clearly related to concerns about the commitment levels of the private sector are concerns related to the general public-private relationship. Addressing the difficulties which have arisen regarding cooperation between the public and private sector has been a central task within ITS projects. Part of the problem relates directly to the different natures of the sectors and their interdependence in ITS projects. For example, the ability of the private sector to commercialize ITS products and services has been underutilized, in part, due to public sector restrictions, such as limits on the sale of traffic data. In these cases, the report summarized specifically recommended eliminating restrictions limiting or prohibiting the sale of traffic data, reducing limits on the use of highway rights of way, and allowing state and local agencies to delegate specific highway operations to private firms. All of these recommendations are direct and sound and appear to address forthrightly the issue at hand. Unless there are significant legal issues in opposition, these recommendations should be followed. ***The U.S. DOT should follow the recommendations that propose eliminating restrictions limiting or prohibiting the sale of traffic data, reducing limits on the use of highway rights of way, and allowing state and local agencies to delegate specific highway operations to private firms.***

In a related discussion of the lack of support available to foster cooperation between the public and private sectors, a report recommends that the U.S. apply approaches developed by the Europeans and the Japanese which have proven beneficial to fostering public-private cooperation abroad. The specific actions recommended are: (1) the formation of a consortia of private participants, (2) use of a sliding scale for public funding and intellectual property rights, (3) solicitation of ideas from the private sector, (4) support for broad solicitations, and (5) the provision of public sector infrastructure studies. Unfortunately, these recommendations were not discussed in detail in the document reviewed, so an evaluation of them should be considered in that light. The question of public infrastructure studies is beginning to be considered already as part of the national ITS commitment. There is also on-going research into the distribution of intellectual property rights. A consortia of private sector participants might be a resource for the ITS community, but perhaps the formation of such a body should be left to the private sector itself. The solicitation of ideas from the private sector is already happening, perhaps not as explicitly as the source of the recommendation would like. As with all successful ITS projects, projects which have been successfully implemented abroad should be examined for potential lessons for future projects. ***No additional action is recommended to the U.S. DOT.***

3.2.7 Roles

The absence of clear roles within ITS partnerships and the impact of the resulting confusion has been identified as an impediment multiple times. Often, these problems result from the absence of clear definitions of partners roles and the confusion that exists around private sector roles in public-private partnerships. Recommendations made to mitigate these impediments include the partners meeting frequently to ensure progress is being made on the project as anticipated and to minimize any damages resulting from prior miscommunications. Another recommendation advocated the provision of guidance to partnerships in defining alternative public and private sector roles throughout the life cycle of an ATMS program. ***As discussed in Section 3.2.3, the U.S. DOT should facilitate the initiation of public-private partnerships within a project.***

3.3 GOVERNMENT REQUIREMENTS

Issues in the “Government Requirements” category encompass those challenges that arise from contract and procurement requirements and procedures as well as any formal requirements that affect ITS technology development. These issues deal with the requirements imposed by federal, state, and local governments to which ITS project participants must adhere and with the differences between public and private sector participants. Government Requirements is the largest category of ITS issues mentioned in the review. To facilitate this analysis the category was further broken down into eight areas: accounting, antitrust, contracts, cost, procurement, regulation, telecommunications, and unspecified.

Recommendations for Addressing Government Requirements Issues:

- ***The U.S. DOT should pursue increased uniformity in cost accounting requirements to assist ITS participants in adequately meeting them. (Accounting)***
- ***The U.S. DOT should provide appropriate training as a realistic, cost-conscious, and readily achievable remedy to some of the difficulties that government accounting requirements have caused ITS participants. (Accounting)***
- ***The U.S. DOT should review the existing administrative requirements and identify ways to consolidate differing requirements of U.S. DOT agencies in order to facilitate inter-agency coordination. (Accounting)***
- ***The U.S. DOT should recommend the use of a third party auditor as one method to assist ITS participants in complying with government requirements. (Accounting)***
- ***U.S. DOT should support the inclusion of a statement of purpose which addresses antitrust concerns in teaming agreements, or in any other applicable contract, as a sound, easily implemented solution which should address the issue and requires no additional action at the federal level. (Antitrust)***
- ***The U.S. DOT should document innovative contracting procedures used in ITS and other types of development projects and make that information available. (Contracts)***
- ***The U.S. DOT should undertake the streamlining of administrative processes and educating small firms about federal procurement policies. (Contracts)***
- ***The U.S. DOT should develop training sessions on administrative requirements. (Contracts)***
- ***The U.S. DOT should collect and circulate information on innovative practices as part of the educational process. (Contracts)***

- ***The U.S. DOT should begin the development of guidelines for the use of public-private partnerships. (Contracts)***
- ***The U.S. DOT should create procurement procedures for public-private partnerships as soon as possible. (Contracts)***
- ***The U.S. DOT should evaluate the costs and benefits of the government requirements which differ from standard practices to determine where it may be possible to reduce the cost of compliance. (Cost)***
- ***The U.S. DOT should conduct an analysis to determine the causes of uncertainties and additional costs in the procurement process in preparation for developing ways to minimize them. This analysis should be made in public. (Procurement)***
- ***The U.S. DOT should distribute information regarding the applicability of organizational conflict of interest rules to institutions involved with ITS development.***
- ***The U.S. DOT should favor competition over regulation, unless a compelling case for regulation can be made. (Regulation)***
- ***The U.S. DOT should study ITS partnerships in other countries as a source of solutions to ITS problems faced in the U.S. and share the findings through workshops or meetings. (Regulation)***
- ***The U.S. DOT should strongly emphasize the need for the roles of the public and private sectors to be spelled out early in the planning stages of any ITS project. (Regulation)***
- ***The U.S. DOT should streamline administrative processes. (Unspecified)***
- ***The U.S. DOT should educate small firms about federal procurement policies. (Unspecified)***

3.3.1 Accounting

Federal cost accounting, cost certification, and auditing requirements can create an expensive burden to ITS participants, increase taxpayer's costs, and inhibit competition to firms willing and able to meet the requirements. To address this, four recommendations were made: (1) apply these requirements only to those procurements which are clearly relevant to the goals of the requirements; (2) increase the uniformity of cost accounting rules which apply to procurements; (3) centralize decision making in the Federal Government regarding the necessity of cost and pricing information; and (4) support training sessions on government requirements for potential ITS participants.

The first recommendation seeks more emphasis on the spirit over the letter of the government requirements in question. There is not enough information given in the document outlining what

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Accounting					
"Procurement"	Federal cost accounting, cost certification, and auditing requirements can create an expensive burden to IVHS participants.	Y	A	2	<ol style="list-style-type: none"> 1. Apply these requirements only when clearly relevant to the goals of the project. 2. Increase the uniformity of cost accounting rules. 3. Centralize decision making concerning cost and pricing information requirements. 4. Provide training.
"Analysis"	Government accounting requirements are unclear to private sector participants.	Y	O	1	<ol style="list-style-type: none"> 1. Develop a course in concert with industry to educate both public and private sector partners about funding issues. 2. Use a third party auditor.
"Analysis"	Administration of funding from multiple sources is awkward.	Y	O	2	Perform an end-to-end review of existing infrastructure for inter-agency coordination.
"Findings"	Private sector partners were reluctant to provide financial information to local, state, and Federal Government auditors because the information could become public.	Y	A	3	<ol style="list-style-type: none"> 1. Address use of proprietary material and assignment of intellectual property rights early in the project. 2. Establish mutually acceptable accounting procedures.
Antitrust					
"Implementation"	Actions of participants in an IVHS joint venture could be found to violate antitrust laws by unfairly interfering with competition.	N	P	0	None.
"Deployment"	Participants entering into a teaming agreement could be vulnerable to charges of antitrust violations which might result in both civil and criminal penalties.	P	A	0	Include a statement of purpose which addresses antitrust concerns in the teaming agreement.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Contracts					
"Deployment"	Contract negotiations are the greatest source of legal barriers experienced by IVHS participants.	Y	O	4	None.
"Implementation"	Some private sector entities are unfamiliar with government contracting requirements.	Y	A	2	1. Streamline administrative processes. 2. Educate small firms about federal procurement policies.
"Solutions"	Public sector procurement and contracting regulations inhibit private sector participation in IVHS.	Y	O	3	None.
"Procurement"	The private sector lacks experience with governmental procedures.	Y	A	2	Training sessions for state and local procurement personnel and for the business community on topics relating to IVHS procurements could be offered and supported by the Federal Government.
"Procurement"	There are no established procurement procedures for carrying out public-private partnerships which have been identified as the basis for IVHS development.	Y	A	3	The government, in consultation with IVHS America should: 1. Develop guidelines for the use of public-private partnerships. 2. Create specific procurement procedures that apply to such entities.
"Partnerships"	The goals and resources of each IVHS project are unique, requiring each agreement to be drafted individually.	Y	A	1	1. Put the agreement in writing. 2. Customize the level of detail to the specific nature of the agreement. 3. Analyze and address the interests of all parties in all agreements.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Solutions"	Legal constraints regarding public rights of way impede public-private agreements.	Y	O	2	None.
"Findings"	Several partners had never worked with other partners before and were unfamiliar with each other's contracting procedures, which created conflicts between the partners.	Y	A	2	Make contracting procedures open and flexible. Most operational test participants identified this lesson as the most significant in working out project details.
"Findings"	Current contracting procedures are not suited to ITS projects.	Y	A	4	Contracting procedures must be open and flexible. Most operational test participants identified this lesson as the most significant in working out project details.
Cost					
"Procurement"	The cost of complying with government requirements can significantly add to the cost of an IVHS project.	Y	O	4	Evaluate the costs and benefits of government requirements which differ from standard business practices to determine where it may be possible to reduce the cost of compliance.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Procurement					
"Deployment"	Procurement issues have been the most time-consuming and irritating legal constraints confronted by IVHS participants.	Y	O	2	Educate participants and draw on the experiences of other IVHS players regarding the unique procedures and problems of IVHS procurements.
"Solutions"	Public sector procurement procedures inhibit private sector IVHS involvement.	Y	O	2	1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.
"Solutions"	Procurement regulations inhibit private sector IVHS involvement.	Y	O	2	None.
"Solutions"	Difficult procurement processes impede public-private arrangements.	Y	O	2	1. Establish a national program to identify, clarify and resolve public-private issues. 2. Include all government levels in the program and divide responsibilities among them. 3. Fund the program. 4. Share program results among IVHS participants.
"Solutions"	Public sector policies, especially procurement policies, do not facilitate public-private partnerships in developing IVHS.	Y	A	0	Adopt and develop new policies.
"Implementation"	Some IVHS vendors may be excluded from certain IVHS procurements due to organizational conflict of interest requirements.	P	A	2	1. Streamline administrative processes. 2. Educate small firms about federal procurement policies.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Procurement"	Organizational conflict of interest rules limit the extent to which the same company can design and build a specified system.	P	A	2	The Federal Government should provide clarification on the applicability of organizational conflict of interest rules to institutions involved in IVHS development.
"Procurement"	The private sector is discouraged from participation in IVHS because of the uncertainties involved in government procurements.	Y	A	2	1. The government should analyze the causes of the uncertainties and additional costs and develop approaches to minimize them. 2. The results of the analysis should be made public.
"Solutions"	Traditional procurement policies do not maximize private sector involvement in IVHS.	Y	A	0	1. Utilize the design-build model and have a contractor complete the work within specified times and costs. 2. Develop national ITS standards.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Regulation					
"Overcoming Barriers"	There is unresolved tension between competitive and regulatory approaches to IVHS deployments.	Y	A	2	Use great caution in determining when to forgo the benefits of competition in favor of a regulatory approach.
"Solutions"	Regulatory policies inhibit private sector IVHS involvement.	Y	O	2	<ol style="list-style-type: none"> 1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.
Telecommunications					
"Findings"	Operational test participants had difficulty with telecommunications regulations.	Y	O	1	Provide partners with the required technical expertise to implement every aspect of ITS projects.

GOVERNMENT REQUIREMENTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Unspecified					
"Implementation"	Governmental requirements cause undue delay.	Y	A	2	1. Streamline administrative processes. 2. Educate small firms about federal procurement policies.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies -- Analysis and Lessons Learned.
"Deployment"	Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States.
"Findings"	Review of ITS Operational Tests -- Findings and Recommendations.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"Overcoming Barriers"	Overcoming Barriers to IVHS -- Lessons from Other Technologies.
"Partnerships"	IVHS Public/Private Partnerships: Managing the Legal Issues.
"Procurement"	Procurement Issues in IVHS Development and Deployment.
"Solutions"	Searching for Solutions -- Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment.

the goals of the requirements are and why the ITS procurements are different. In any case, this recommendations appears easier said than done. If a change in the legal requirements is pursued, the likelihood of success seems small without more information to justify it. This may simply be a case of the private sector participants being new to the way the government does business and needing to come up to speed. ***Unless permitting ITS procurements to be free of federal cost accounting, cost certification and auditing requirements would make an enormous and unique difference to the level of ITS involvement, the U.S. DOT should not pursue such an exemption,***

The next recommendation advocates an increase in the uniformity of cost accounting rules which are applicable to procurements. The report cites the different obligations of ITS participants depending on the nature of the participant (academic institutions, states, etc.) due to the varied federal cost accounting rules. The possibility of state procurement policies differing from or conflicting with the federal requirements was mentioned ***as well. Overlapping and conflicting requirements must be sorted out for each ITS project; increased uniformity in cost accounting requirements would assist ITS participants in adequately meeting them and should be pursued by the U.S. DOT.***

The third recommendation supports centralized federal decision making as a way to obtain certainty and consistency in determination of cost and pricing requirements. It is unclear from the original document what changes from current procedures would be necessary to achieve this. ***Without additional information concerning the specific actions required for centralizing cost and pricing decisions and how this differs from increasing uniformity in cost accounting rules, no action is recommended to the U.S. DOT.***

The fourth recommendation advocates the provision of training sessions for potential ITS vendors. ***The U.S. DOT should provide appropriate training as a realistic, cost-conscious, and readily achievable remedy to some of the difficulties that government accounting requirements have caused ITS participants.***

Some of the administrative requirements, such as the administration of funding from multiple sources, have been a burden to ITS projects. To address this, an end-to-end review of existing structure for inter-agency coordination was recommended. ***The U.S. DOT should review the existing administrative requirements and identify ways to consolidate differing requirements of U.S. DOT agencies in order to facilitate inter-agency coordination.***

Exacerbating the difficulty of compliance with the federal regulations is the private sector's lack of experience with public sector requirements. In addition, some private sector partners were reluctant to provide financial information to local, state, and Federal Government auditors because that information could be made public. Developing a training course, with input from industry, to educate both the public and private sector partners about funding issues was suggested as a possible remedy. Establishing mutually acceptable accounting procedures was recommended as well. Use of a third party auditor was also suggested, as was addressing the use of proprietary material early in the project. Training has already been recommended to the U.S. DOT as an effective countermeasure to difficulties resulting from government requirements.

The U.S. DOT should also recommend the use of a third party auditor as one method to assist ITS participants in complying- with government requirements.

3.3.2 Antitrust

ITS participants entering into joint ventures or teaming agreements may be vulnerable to charges of antitrust violations. If a violation were found, both civil and criminal penalties could apply. Addressing antitrust concerns in a statement of purpose as part of the teaming agreement was offered as a safeguard against violations. ***The U.S. DOT should support the inclusion of a statement of purpose which addresses antitrust concerns in teaming agreements, or in any other applicable contract, as a sound, easily implemented solution which should address the issue and requires no additional action at the federal level.***

3.3.3 Contracts

The complexity of government contracting requirements and the private sector's lack of experience in dealing with them has made contract negotiations between the public and private sectors the greatest source of legal barriers experienced by ITS participants. More specifically, there was concern that public sector procurement and contracting regulations inhibited private sector participation in ITS, although no recommendations were made for addressing this. A related concern maintained that current contracting procedures were not suited to ITS projects because the same contracting procedures used to acquire construction and consulting services were used to recruit partners for development-oriented operational tests. To counter this, open and flexible contracting procedures were strongly recommended and cited as the most significant lesson learned from working out project details. Because open and flexible contracting procedures are desirable in an undertaking as complex as an ITS project, ***the U.S. DOT should document innovative contracting procedures used in ITS and other types of development projects and make that information available.***

In contrast, however, some participants focused on the private sector's unfamiliarity with government contracting requirements and lack of experience with government procurement procedures. Streamlining administrative processes and educating small firms about federal procurement policies were among the recommendations made to address these difficulties. Instituting training sessions for state and local procurement personnel and for the business community on topics related to ITS procurements were also recommendations. The recommendation for open and flexible contracting procedures was also repeated here. Three actions are recommended: (1) ***The U.S. DOT should undertake the streamlining of administrative processes and educating small firms about federal procurement policies;*** (2) ***the U.S. DOT should develop training sessions on administrative requirements;*** and (3) ***the U.S. DOT should collect and circulate information on innovative practices as part of the educational process.***

The cooperation required between the public and private sectors by ITS projects requires extensive negotiations regarding legal rights and responsibilities and there are no established procurement procedures for public-private partnerships, which have been identified as the basis

for ITS development. No recommendation was made by the source of the first issue. In the case of public-private partnerships, it was recommended that the Federal Government, in consultation with ITS America, develop guidelines for the use of public-private partnerships and create procurement procedures that apply to such entities. ***The U.S. DOT should begin the development of guidelines for the use of public-private partnerships and create procurement procedures for these partnerships as soon as possible. This would be an important step forward for the ITS program.***

In a similar issue, one report discussed the lack of a fixed formula for teaming agreements. The recommendations to (1) put the agreement in writing, (2) customize the level of detail to the specific nature of the agreement, and (3) analyze and address the interests of all parties in all agreements, were offered in response. ***No action is recommended on the part of the U.S. DOT.***

It was also asserted by one of the documents that legal constraints regarding public rights of way impeded public-private agreements, although no details were offered and no recommendations made.

3.3.4 cost

One source noted with great concern that the cost of complying with government requirements can significantly add to the cost of an ITS project at a time when the government is very cost-conscious. To remedy this, an evaluation of these requirements in a manner which balances the total cost of the requirements with the value of the requirements was recommended; followed by an aggressive effort to reduce the costs of compliance wherever possible. The cost of complying with government requirements is an important concern for ITS participants. ***The U.S. DOT should evaluating the costs and benefits of the government requirements which differ from standard business practices to determine where it may be possible to reduce the cost of compliance.***

3.3.5 Procurement

Procurement issues have been the most time consuming and irritating legal constraint confronted by ITS participants and have been repeatedly identified as the cause of inhibited private sector involvement in ITS and impediments to public-private arrangements.

Recommendations for addressing procurement issues range from vague, such as develop and adopt new policies, to concrete, such as utilize the design-build model and have a contractor complete the work within specified time and costs and develop ITS standards. (Standardization is addressed in depth in the "Planning" section). ***No action is recommended to the U.S. DOT***

Fortunately, there is much agreement in the center that what is required is more information and the dispersal of that information, although the specifics of the different recommendations vary. One recommends the examination of partnerships in other countries for solutions. Another approach recommends a national program to identify, clarify, and resolve public-private issues be established and funded. This approach stipulated that the program include representatives from

all levels of government with responsibilities divided among them and the results of the program be shared among ITS participants.

Drawing on the experience of prior ITS participants and sharing those findings was recommended both domestically and internationally. In the second case, it was also recommended that technical and institutional innovations be tested concurrently and roles for the public and private sectors be included in ITS planning. Neither of those recommendations strongly applies to this situation. ***Thus, no action is recommended to the U.S. DOT.***

One set of recommendations, which captures much of the intent behind many of the other procurement related recommendations, advocates that the causes of the uncertainties and additional costs be analyzed by the Federal Government in order to develop approaches to minimize them, followed by the analysis being made public. ***The U.S. DOT should conduct an analysis to determine the causes of uncertainties and additional costs in the procurement process in preparation for developing ways to minimize them. This analysis should be made public.***

A specific procurement related concern identified the possibility that some ITS vendors would be excluded from certain ITS procurements due to organizational conflict of interest (OCI) rules that limit the extent to which the same company can design and build a specified system. The recommendations to streamline administrative processes and educate small firms about federal procurement policies do not really address the nature of this issue. The recommendation that the Federal Government provide clarification on the applicability of OCI rules to institutions involved with ITS development addresses this issue. ***The U.S. DOT should distribute information regarding the applicability of OCI rules to institutions involved with ITS development.***

3.3.6 Regulation

The role of regulation was also a concern among the documents summarized. One source described the tension between competitive and regulatory approaches to ITS as an issue. In this instance, great caution in the determination of when to forego the benefits of competition was advised. The U.S. DOT should favor ***competition over regulation, unless a compelling case for regulation can be made.***

An unspecified concern that regulatory policies inhibit the private sector from participating in ITS projects was raised by another source. Some generic recommendations were made to address this issue: (1) examine partnerships in other countries for solutions; (2) hold workshops and meetings; (3) test technical and institutional innovations concurrently; and (4) include definitions for public and private sector roles as part of ITS planning. There are two additional actions recommended: ***(1) The U.S. DOT should study ITS partnerships in other countries as a source of solutions to ITS problems faced in the U.S., and share the findings through workshops or meetings; and (2) the U.S. DOT should strongly emphasize the need for the roles of the public and private sectors to be spelled out early in the planning stages of any ITS project.***

3.3.7 Telecommunications

Operational test participants have had difficulty with telecommunications regulations when the system had to be designed, design parameters had to be set, and Federal Communications Commission (FCC) licensing requirements had to be fulfilled. Providing partners with the required technical expertise to implement every aspect of ITS projects, including adherence to telecommunications requirements, was recommended. This would be ideal, but is not in the purview of the U.S. DOT. ***No action is recommended to the U.S. DOT.***

3.3.8 Unspecified

The requirements of doing business with the public sector is often cited as the cause for delays, especially for private sector participants who may be unfamiliar with public sector practices. The recommendations made to address this issue were to streamline administrative processes and educate small firms regarding government requirements for procurements. Thus, the actions recommended are: (1) ***The U.S. DOT should streamline administrative processes; and (2) the U.S. DOT should educate small firms about federal procurement policies.***

3.4 INTELLECTUAL PROPERTY RIGHTS

Issues in the “Intellectual Property Rights” category relate to the distribution of rights and proprietary information issues among participants, with regard to both ideas and physical property. In a partnership of public and private sectors, these issues often arise from the uncertainty surrounding the ownership of the intellectual foundations of ITS products and the question of who will have access to these developments.

The most important issue raised in the area of intellectual property rights concerns the distribution of these rights among the partners. Other topics discussed in the documents reviewed were securing intellectual property agreements, the commercialization of ITS technology, the cost of intellectual property negotiations, federal requirements, the needs of the private sector, and proprietary information. The issues surrounding these topics are discussed along with the recommendations made by the documents reviewed. The recommendations are evaluated and alternatives are offered when appropriate.

Recommendations for Addressing Intellectual Property Issues:

- ***The U.S. DOT should include a recommendation advocating periodic review of the intellectual property agreements in any guidelines developed for assisting the formation of partnerships. (Agreements)***
- ***The U.S. DOT should develop a clearly articulated national policy which differentiates between widely available technical standards based on an open architecture and the intellectual property rights to such an implementation. (Distribution)***

INTELLECTUAL PROPERTY RIGHTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Agreements					
"Analysis"	Industry and universities are concerned that information will be revealed that will compromise potential benefits or reputational benefits from investments.	Y	O	2	Periodically review aspects of partnership agreements that address intellectual property rights and change them as necessary.
Commercialization					
"Workshop"	The public is not receiving the full benefit of publicly funded IVHS if the private sector is not allowed to commercialize new products and inventions and market them.	Y	A	1	None.
"Workshop"	Federally funded technology is not adequately commercialized.	N	P	0	None.
Cost					
"National IVHS"	The increased costs incurred by the private sector in negotiations aimed at preserving intellectual property rights deters private sector participation.	Y	A	2	None.

INTELLECTUAL PROPERTY RIGHTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Distribution					
"Deployment"	IVHS participants have complained that the FHWA has insisted on retaining intellectual property rights to applications developed partly with federal funds.	Y	O	3	Educate participants and draw on the experiences of other IVHS players regarding the unique procedures and problems of IVHS procurements.
"Implementation"	The private sector is unlikely to participate in IVHS projects if it is uncertain about the distribution of intellectual property rights.	N	P	0	None.
"Overcoming Barriers"	The public and private sectors differ in their approaches to the distribution of intellectual property rights.	Y	A	2	1. Balance rights with costs. 2. Address private sector issues. 3. Avoid creating a monopoly. 4. Develop a national uniform policy. 5. Store federally funded software in escrow.
"Workshop"	Technical data rights are retained by the government when the data is developed using federal funds. This may discourage private sector participation in IVHS.	Y	A	1	Recent procurement reform efforts include a policy which guarantees the government only those rights necessary for obtaining competitive prices on future purchases.
"Workshop"	Federal law lacks guidance regarding the rights to data or inventions developed under jointly funded projects.	Y	A	1	Realize that the ambiguity, while frustrating, is also the flexibility to negotiate based on the specifics of the project.

INTELLECTUAL PROPERTY RIGHTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Procurement"	The private sector fears that the government will retain most, if not all, intellectual property rights associated with IVHS projects without adequate compensation.	y	A	2	1. The government should retain only those IP rights necessary to protect itself from monopoly. 2. The government should create a uniform policy regarding the retention of IP rights. 3. The government should build on experience with past procurements.
"National IVHS"	Public and private sector interests regarding the distribution of intellectual property (IP) rights are in conflict.	Y	A	2	None.
"Findings"	Contracts are often ambiguous about the ownership and future use of products and sector funds.	Y	A	2	Change contract language to specify property rights in detail.

INTELLECTUAL PROPERTY RIGHTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
Federal					
"Workshop"	The Federal Government cannot obtain copyrights to computer programs, precluding commercialization of those programs. This discourages private sector involvement.	Y	A	0	Pending legislation would remove this restraint and enable the government to enjoy expanded rights to technology which could then be commercialized through technology transfer programs.
"Workshop"	The scope of the government's retained license in inventions made with federal assistance is undefined.	N	P	0	None.
"Workshop"	The government retains rights to subject inventions, those either conceived or first reduced to practice during the performance of a federally funded contract, limiting the contractor to commercial, nongovernmental applications.	Y	A	2	Revise applicable regulations, including narrowing the definition of a subject invention.
"National IVHS"	There is fear in the private sector that federal intellectual property regulations are inadequate to protect private sector interests.	N	P	0	1. Define the circumstances under which the government will seek rights. 2. Define the steps a contractor may take to avoid improper attribution of existing technology. 3. Define the range of uses for technology where the government retains any rights.

INTELLECTUAL PROPERTY RIGHTS					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Solutions"	The needs of the private sector for cost-benefit assessments and property rights protections are not being met.	Y	A	0	Include cost-benefit assessments and provisions for property rights protection in IVHS planning.
"Partnerships"	There are unclear limits on the use of proprietary information.	Y	A	1	Include a statement of purpose which addresses intellectual property concerns in the teaming agreement.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies -- Analysis and Lessons Learned.
"Deployment"	Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States.
"Findings"	Review of ITS Operational Tests -- Findings and Recommendations.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"National IVHS"	Intellectual Property Rights and the National IVHS Program.
"Overcoming Barriers"	Overcoming Barriers to IVHS -- Lessons from Other Technologies.
"Partnerships"	IVHS Public/Private Partnerships: Managing the Legal Issues.
"Procurement"	Procurement Issues in IVHS Development and Deployment.
"Solutions"	Searching for Solutions -- Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment.
"Workshop"	Workshop on IVHS and Intellectual Property.

- ***The U.S. DOT should recommend placing software which is under development in escrow as one method to guard against contractor default. (Distribution)***
- ***The U.S. DOT should explicitly state that it is committed to retaining the flexibility present in current federal law as an important tool in negotiating intellectual property agreements. (Distribution)***
- ***The U.S. DOT should recommend that all members of ITS project teams avail themselves of the experiences of their projects.***
- ***The U.S. DOT should provide examples of options for intellectual property distribution. (Distribution)***
- ***The U.S. DOT should focus on developing guidelines to help the private sector negotiate the current federal intellectual property requirements. (Federal)***
- ***The U.S. DOT should consider supporting pending legislation to expand government rights to software for the purpose of facilitating commercialization. (Federal)***
- ***The U.S. DOT should ensure that the needs of the private sector are addressed during ITS planning by incorporating recommendations for the inclusion of property rights protection and cost-benefit assessments in guidelines for forming ITS partnerships. (Needs)***
- ***The U.S. DOT should advocate the incorporation of a statement of purpose to address intellectual property concerns in any teaming agreement. (Proprietary Information)***

3.4.1 Agreements

Securing intellectual property and proprietary rights agreements has been an important concern for participants from industry and academia. The possibility that information would be revealed which could compromise potential benefits, including reputational benefits, from leading edge investments was raised as an issue. Another aspect of this issue is the concern of partners that their investment in the partnership would be subject to federal and/or state requirements that would force them to give up proprietary rights to the products (either intellectual or material) of their investments. To address this, it was recommended that the intellectual property rights components of partnership agreements be reviewed periodically and changed when necessary.

The U.S. DOT should include a recommendation advocating periodic review of the intellectual property agreements in any guidelines developed for assisting the formation of partnerships.

3.4.2 Commercialization

In order for the public to receive the full benefit of funding ITS, new products and inventions must be commercialized and marketed. There are concerns in the ITS community that federally funded technology is not adequately commercialized and that the public is not fully benefiting from publicly funded ITS projects. Both issues arise from a belief that, although the public sector possesses the technology, that sector is incapable of commercialization, yet in possession of the technology and that there is not sufficient technology transfer to adequately commercialize resultant ITS products and inventions. No specific recommendations were offered to address these concerns, but applicable recommendations are included under the “Distribution*” section.

3.4.3 Cost

One of the reports asserted that the increased costs incurred by the private sector in negotiations aimed at preserving intellectual property rights is a deterrent to private sector participation in ITS projects. While it is apparent that the private sector is cost conscious and, thus, sensitive to any costs which it may be possible to avoid, such contractual negotiations are necessary and there is no obvious way around them. There was no recommended action for solving this problem. However, the discussion in the “Distribution” section offers some recommendations which may have the secondary effect of decreasing the amount of negotiations necessary and concurrently the related cost to the private sector.

3.4.4 Distribution

The distribution of intellectual property rights between the Federal Government and the private sector in projects at least partially publicly funded was mentioned repeatedly as an impediment to ITS projects in the documents reviewed for this analysis. The public sector is concerned that the public receive the full benefit of federally funded ITS projects and the private sector is concerned with profitability, specifically receiving adequate compensation for any forfeited intellectual property rights.

The reports offered recommendations to address these concerns. It was recommended that efforts made to address the intellectual property rights concerns of the private sector address the risks taken by the private sector during contract negotiations and balance the distribution of intellectual property rights with the actual costs incurred by the participants. This action would ensure private sector investors a reasonable return on their investment. These are sound principles that generally address private sector concerns. At the same time, it was recommended that the government retain only those intellectual property rights necessary to avoid creating a de facto monopoly with public funds and develop a uniform national policy concerning the retention of intellectual property rights. Certainly, the creation of a monopoly is not in the government’s interest and the Federal Government should guard against such an occurrences Another recommendation emphasizes the importance of differentiating between widely available technical standards based on an open architecture and the intellectual property rights to an implementation of those standards. ***The U.S. DOT should develop a clearly articulated national***

policy which differentiates between widely available technical standards based on an open architecture and the intellectual property rights to such an implementation.

In part, it is feared that uncertainty regarding intellectual property rights could discourage private sector participation. For example, technical data rights are allocated based on the funding used to generate them. Thus, technical data rights are retained by the government when the data is developed using federal funds, which may discourage private sector participation in ITS. The associated recommendation touted recent procurement reform efforts which guaranteed the government only those rights necessary to obtain competitive prices on future purchases. If this effort is successful, it should adequately address this concern. In the case of software being developed in part with public funds, it is recommended that the government guard against the possibility of a private developer defaulting on its contractual obligation to provide the software by requiring that the software be placed in escrow. As a reasonable precaution, ***the U.S. DOT should place software which is under development in escrow as one method to guard against contractor default.***

Some participants object to ambiguity in federal law regarding the ownership of intellectual property. In response to this complaint, one recommendation advised a change in perspective, and advocated focusing on the ambiguity as the source of the flexibility required to negotiate agreements based on the particularities of the project. ***The U.S. DOT should explicitly state that it is committed to retaining the flexibility present in current federal law as an important tool in negotiating intellectual property agreements.***

One recommendation offered the education of ITS participants, in part through the experiences of other ITS participants, concerning the unique procedures and problems related to ITS procurements as a solution to this conflict. Another advocated that the government build on its experience with previous procurements. Two actions are recommended: (1) ***The U.S. DOT should recommend that all members of ITS project teams avail themselves of the experiences of other projects; and (2) the U.S. DOT should provide examples of options for intellectual property distribution.*** (The issues surrounding ITS procurements are discussed in more depth in “Government Requirements.”)

3.4.5 Federal

The Federal Government retains rights to subject inventions, which are inventions either conceived or first reduced to practice during the performance of a federally funded contract. This potentially limits the contractor to commercial, non-governmental applications which may not provide adequate compensation to offset the contractor’s investment. The report recommends revision of the applicable regulations, which should include narrowing the definition of a subject invention. There is disagreement among the reports as to the nature of this issue. Some of the reports clearly focus on the status quo as ambiguous and favoring the Federal Government. Others see the issue as perceptual and, thus, not in need of legislative effort.

There is a perception in the private sector that federal intellectual property policy is complex and ambiguous and that the government retains broad rights to publicly funded inventions which are

undefined in scope. This adds to private sector apprehension in participating in ITS development. According to one of the sources of the issue, this issue is in fact sufficient statutory and policy provisions which limit the government's rights, and there is actually a perceptual problem, not an intellectual property rights problem. The other source also classifies the issue as a perception rather than an experience but also offers recommendations to address the anxiety of the private sector: (1) define the circumstances under which the government will seek rights; (2) define the steps a contractor may take to avoid improper attribution of existing technology; and (3) define the range of uses for technology where the government retains any rights. These steps could be published in the form of guidelines and might be very helpful in addressing the concerns in the private sector. Unless more of a case for the need of legislative reforms could be made, ***the U.S. DOT should focus on developing guidelines to help the private sector negotiate the current federal intellectual property requirements.***

On a different, but related topic, there is a concern that the Federal Government, under current law, cannot obtain copyrights to computer programs. This limits the interest of the private sector in participating in their development because commercialization would not be possible. To address this, the report recommends that pending legislation be supported, which would remove this constraint and enable the government to enjoy expanded rights to technology which could then be commercialized through technology transfer programs. ***The U.S. DOT should consider supporting pending legislation to expand government rights to software for the purpose of facilitating commercialization.***

3.4.6 Needs

There is a concern that the needs of the private sector for property rights protection and for cost-benefit assessments of ITS projects are not being met. It is recommended that provisions for property rights protection and cost-benefit assessments be included in ITS planning. ***The U.S. DOT should ensure that the needs of the private sector are addressed during ITS planning by incorporating recommendations for the inclusion of property rights protection and cost-benefit assessments of ITS projects in guidelines for forming ITS partnerships.***

3.4.7 Proprietary Information

In order to facilitate the flow of information and build trust among the partners even before the start of a teaming agreement, proprietary information must be protected. One report raises a concern that there are unclear limits on the use of proprietary information. The same report goes on to recommend that any teaming agreement include a statement of purpose which addresses intellectual property concerns along with a discussion explaining why the parties are agreeing to team. ***The U.S. DOT should advocate the incorporation of a statement of purpose to address the use of proprietary information in any teaming agreement.***

3.5 LIABILITY

Issues in the “Liability” category encompasses those issues relating to injury or damage that may result from the use of ITS technologies. This category also includes environmental issues and those involving insurance. Liability issues often result from the unclear assignment of responsibility for problems that may arise in ITS projects. In addition, liability concerns often revolve around the potential for torts and product liability litigation.

Recommendations for Addressing Liability Issues:

- ***The U.S. DOT should consider the need for clear assignment of liability for ITS products and services. (Insurance)***
- ***The U.S. DOT should work with MPOs to develop a method for evaluating ITS products and services, including the development of guidelines concerning the environmental requirements to be considered when developing a TIP. (Transportation Improvement Programs)***
- ***The U.S. DOT should analyze the current historical record for instances of advanced vehicle control systems (AVCS) liability litigation. If no litigation occurs, that historical data should be made available to reassure potential ITS participants. This may be sufficient to overcome the concerns of some in the private sector and, in any case, can be done with relative quickness and at low cost. However, if there is a long-term and consistent resistance on the part of the private sector to participate in AVCS development and the Federal Government views AVCS as enough of a priority, then indemnification would be an appropriate and logical step. (Tort)***
- ***The U.S. DOT should develop a non-binding equivalent of “codes of practice,” by publishing guidelines for concerned parties which outline recommended practices for addressing the potential for ITS-related liability. (Tort)***
- ***The U.S. DOT should evaluate whether invocation of the government contractor immunity doctrine would unacceptably limit either the ability of consumers to receive compensation if injured, or any other course of action currently available to consumers. (Tort)***
- ***The U.S. DOT should thoroughly explore the potential availability of reasonably priced insurance for ITS applications. (Tort)***
- ***The U.S. DOT should investigate the possibility of limiting ITS liability. (Tort)***
- ***The U.S. DOT should look into the possible application of alternative dispute resolution to the concern surrounding ITS liability. (Tort)***

LIABILITY					
Report	Issue	Experienced	Status	Impact *	Recommendations
Insurance					
"Analysis"	The responsibility for liability and insurance is not clearly assigned.	Y	O	1	<ol style="list-style-type: none"> 1. Design safety into the system in the first place. 2. Design the system so that the driver cannot manipulate screen data while the vehicle is in motion. 3. Require each partner to provide insurance for their people.
TIPs					
"Overcoming Barriers"	TIPs developed at the state and local levels are vulnerable to legal action with respect to environmental regulations.	P	A	1	<ol style="list-style-type: none"> 1. Encourage states and MPOs to analyze the environmental ramifications of major projects using ATMS and ATIS. 2. Conduct a model value evaluation which could serve as a baseline for state and MPO analysis.
Tort					
"Deployment"	Participants in IVHS may face tort and products liability litigation.	N	P	0	None.
"Deployment"	Participants fear liability related to the development of automated vehicle control systems (AVCS) technology.	Y	A	3	Indemnification by statute may be the only means to achieve significant deployment of AVCS in the U.S.
"Implementation"	There is concern that tort liability issues present serious barriers to IVHS development.	N	P	0	None.
"Solutions"	Legal liabilities inhibit private sector IVHS participation.	Y	O	2	<ol style="list-style-type: none"> 1. Examine partnerships in other countries for solutions. 2. Hold workshops and meetings. 3. Test technical and institutional innovations concurrently. 4. Include the definition of roles for the public and private sectors in IVHS planning.

LIABILITY					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Solutions"	The U.S. has not done enough to address private sector liability concerns.	Y	A	1	Implement codes of practice to address liability concerns and encourage product development.
"Procurement"	The risk of liability costs reduces private sector participation in IVHS.	Y	A	2	The Federal Government could: 1. Obtain from Congress the ability to indemnify contractors for liability. 2. Assist contractors in invoking the government contractor immunity doctrine. 3. Explore the possibility of insurance at reasonable rates.
"Tort"	Manufacturers, designers, and vendors of AVCS systems face serious vulnerabilities to potential tort liability.	P	A	0	1. Enact uniform federal laws. 2. Limit strict liability. 3. Disallow private sector suits. 4. Limit awards. 5. Establish one statute of limitations.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies -- Analysis and Lessons Learned.
"Deployment"	Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"Overcoming Barriers"	Overcoming Barriers to IVHS -- Lessons from Other Technologies.
"Procurement"	Procurement Issues in IVHS Development and Deployment.
"Solutions"	Searching for Solutions -- Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment.
"Tort"	Advanced Vehicle Control Systems Potential Tort Liability for Developers.

3.5.1 Insurance

The responsibility for liability and insurance of ITS systems is unclear. All of the concerns raised in interviews were from those involved in ATIS systems. It is these systems that will be presented to the general public, and there is concern that investments in ITS technologies will be lost if a successful lawsuit is levied against an ITS partner for fielding an unsafe system. It was suggested that safety be a design criteria from the beginning and that vehicles which provide data on a view screen be designed so that the driver cannot manipulate screen data while the vehicle is in motion. ***The U.S. DOT should consider the need for clear assignment of liability for ITS products and services.***

3.5.2 Transportation Improvement Programs (TIPS)

TIPS, which are developed at the state and local levels, are vulnerable to legal action with respect to environmental regulations. Two recommendations were made to address this concern. The first would have the Federal Government encourage states and MPOs to analyze the environmental impacts of major projects which use ATMS and ATIS. This is certainly sound advice; all applicable federal requirements should be addressed when developing TIPS. The second advises that the government conduct a model evaluation for the states and MPOs to follow in their own analysis. This appears to be more than is needed to guide the states and MPOs. ***The U.S. DOT should work with MPOs to develop a method for evaluating ITS products and services, including the development of guidelines concerning the environmental requirements to be considered when developing a TIP.***

3.5.3 Torts

There is a good deal of concern within the private sector regarding the potential for liability involved in participating in ITS projects. In fact, according to one document, this has been the major ITS concern prompting participants to seek legal advice. While there is not consensus on the actual level of risk involved for private sector participants, there is obviously a great deal of concern within the private sector that the possibility of catastrophic liability litigation exists and that not enough has been done to address it. None of the documents reviewed cited the actual occurrence of litigation and subsequent assignment of liability. The main focus of concern is on advanced vehicle control systems (AVCS), because they can include the transfer of vehicle control from the operator to automatic systems. No experience with actual litigation was indicated, however. Many of the documents cited a concern that the uncertainties regarding liability were inhibiting not only private sector participation, but ITS deployments as well.

One of the recommendations, which was made separately by three documents, was to have the Federal Government obtain from Congress the ability to provide indemnification by statute to private sector AVCS developers. Clearly, this would address any concern the private sector would have regarding AVCS liability. The complexities in executing such a step should be weighed against the need for it. ***The U.S. DOT should analyze the current historical record for instances of AVCS liability litigation. If no litigation occurs, that historical data should be made available to reassure potential ITS participants. This may be sufficient to overcome the concerns***

of some in the private sector and, in any case, can be done with relative quickness and at low cost. However, if there is a long-term and consistent resistance on the part of the private sector to participate in AVCS development and the Federal Government views AVCS as enough of a priority, then indemnification would be an appropriate and logical step.

One recommendation advocated that the Federal Government draw on the experiences of other countries in ITS development. A subsequent recommendation took this a step further and specified that the government should learn from the experiences of the Japanese and the Europeans and take action by instituting codes of practice to address liability concerns and to encourage product development. In its general case, this recommendation is simple and straightforward. Such action should be taken as a matter of course during the planning stages of ITS projects. In the stated particular, implementing codes of practice might entail a good deal of legal and political effort, depending on the level at which they are instituted. ***The U.S. DOT should develop a non-binding equivalent of "codes of practice," by publishing guidelines for concerned parties which outline recommended practices for addressing the potential for ITS-related liability.***

Another action recommended to the Federal Government would disallow suits against the private sector, possibly by assisting contractors in invoking the government contractor immunity doctrine. Once more, this would completely address the concerns of the private sector, if there is enough government support to take action. ***The U.S. DOT should evaluate whether invocation of the government contractor immunity doctrine would unacceptably limit either the ability of consumers to receive compensation if injured, or any other course of action currently available to consumers.***

One recommendation which should be completely explored before any significant effort is put into enacting legislation is the potential availability of reasonably priced insurance. This would adequately address private sector concerns and also ensure that large-scale legal efforts are not made on behalf of a concern that never manifests as an actual problem. ***The U.S. DOT should thoroughly explore the potential availability of reasonably priced insurance for ITS applications.***

Other recommendations limit the impact of liability litigation of the private sector. The distribution of liability could be examined and possibly changed to distribute it more equitably. Enacting limitations to liability, possibly through modifying strict liability, and the instituting a uniform statute of limitations, and pre-empting the varied state tort laws with uniform federal laws are other alternatives. ***The U.S. DOT should investigate the possibility of limiting ITS liability.***

Limiting the amount and nature of compensatory damages and punitive damages would certainly address private sector concerns, but must also be weighed against the protection of the consumers. ***No additional action is recommended to the U.S. DOT at this time.***

As an alternative to litigation, alternative dispute resolution could be mandated. This may reduce the cost of addressing potential law suits, but does not otherwise address private sector concerns. It is, however, certainly a relatively simple solution and a reasonable step to try, especially if the

actual liability costs from AVCS prove to be low. ***The U.S. DOT should look into the possible application of alternative dispute resolution to the concern surrounding ITS liability.***

3.6 ORGANIZATIONAL

Issues in the “Organizational” category center around building a project team and managing the project, often occurring within partnerships and between partners. These issues often result from the newness of the management structures required by ITS projects because such arrangements have not been tried and established. Organizational issues also encompass challenges defined by the roles of specific team members, such as upper managers and support staffs. The issues discussed in this section have been grouped into five categories: culture, leadership, roles, support, and teaming.

Recommendations for Addressing Organizational Issues:

- ***The U.S. DOT should provide partnerships, especially public-private partnerships, with assistance, possibly through guidelines or mentors. (Culture)***
- ***The U.S. DOT should mandate the inclusion of a project manager in any proposal for an ITS project.***
- ***The U.S. DOT should also require that the project and the roles and responsibilities within it be clearly defined in the project proposal. (Leadership)***
- ***The U.S. DOT should provide ITS participants with team-building support which should include advice on team formation, guidance on the definition of roles and responsibilities and examples of innovative solutions from successful ITS projects. (Leadership)***
- ***The U.S. DOT should encourage the development of appropriate partner selection criteria. The criteria should include review of the potential for competition between partners, adequate representation of all partners, appropriate contracting procedures, and a requirement for a project manager. The U.S. DOT should also collect and disseminate information of successful uses of such criteria. (Team)***

3.6.1 Culture

Cultural differences among partners can cause difficulties in the partnership. The different ways in which the public and private sectors do business was one case cited by the reports. These differences in ways of doing business are due in large part to the different measures of success used by the different types of partners. In addition, the organizational culture of the academic sector is different from both the public and private sectors, which complicates the partnership with different goals and priorities and can result in a lack of cooperation between the project implementors. To address these issues, the reports suggest that monthly meetings between project managers from the public sector and principal investigators from the academic sector be

ORGANIZATIONAL					
Report	Issue	Experienced	Status	Impact *	Recommendations
Culture					
"Findings"	Different goals and priorities between the academic and public and private sectors resulted in a lack of cooperation between the project implementors.	Y	A	1	Hold monthly meetings between project managers from the public sector and the principal investigators from the academic sector.
"Analysis"	Cultural differences impede public-private partnerships.	Y	A	3	Provide public-private partnerships special assistance as required.
Leadership					
"Analysis"	Lack of an on-site technical manager creates problems in the implementation and test phases.	Y	A	4	Designate an operational test manager with sufficient authority to reduce response time when problems arise.
"Analysis"	The FHWA needs to be convinced that the other partners have appropriate management and leadership in place.	Y	A	3	Identify a good operational field test project manager. This may be the single greatest factor for success.
"Analysis"	The program manager has a major impact on the resolution of institutional impediments; this role is not sufficiently understood.	Y	A	4	Assign a full-time program manager for the life of the test.
"Findings"	When several agencies share responsibilities for funding, project support, and evaluation, the task of managing the project becomes difficult.	Y	A	2	Clearly define the project and more clearly define the roles and responsibilities of those involved.

ORGANIZATIONAL					
Report	Issue	Experienced	Status	Impact *	Recommendations
Roles					
"Findings"	The newness of the situation brought issues of partnerships in the early stages of operational tests. Participants had to overcome biases toward each other.	Y	A	4	1. Develop a team of participants that are compatible and work closely together. 2. Consider the concerns of both sectors. 3. Ensure each sector educates the other as to how it operates.
"Findings"	The partnership was strained when one partner became a vendor to another.	Y	A	2	Clearly define partner roles and responsibilities at the beginning of the project.
"Findings"	The traditional customer-vendor relationship has been replaced with an engineering-development one, meaning that now operational test managers must deal with private sector partners as equals, not contractors.	Y	A	3	1. Involve partners in the early stages of the operational test. 2. Recognize that innovative methods are required to develop public-private relationships. 3. Obtain outside support.
"Findings"	Confusion over the roles of the participants and their diverse perspectives grew from the newness of the partnership.	Y	A	3	Improve the administrative process and train participants in the role and purpose of partnerships.

ORGANIZATIONAL					
Report	Issue	Experienced	Status	Impact *	Recommendations
Support					
"Findings"	The potential lack of upper management support hinders project progress.	P	O	1	Demonstrate results in order to maintain upper management support.
Team					
"Findings"	Lack of competition in frequent use of sole-source contracting at the federal, state, and local levels concerned some public sector participants.	Y	A	1	1. In the short term, write sole source agreements. 2. In the long term, establish partner selection criteria.
"Partnerships"	Teammates are not selected with due care.	Y	A	1	1. Select teammate with organizational and technical compatibilities in mind. 2. Consider the potential for future competition between teammates in developing a teaming agreement.
"Analysis"	Insufficient criteria exist regarding partner selection.	Y	A	1	Have more organizations represented as partners who are signatories on the partnership agreement.

ORGANIZATIONAL					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Analysis"	Partners who joined the team late received less input into the project and were required to work with limited resources.	Y	A	2	Build the team at the beginning of the project and initiate higher level review of contracts to ensure their clarity of scope.
"Findings"	Some partners were competitors to other participants.	Y	A	2	Identify a full-time project manager who will facilitate communication and coordination between partners, assist in defining roles and responsibilities, and provide organization. This is the most important recommendation made.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis" IVHS Institutional Issues and Case Studies - Analysis and Lessons Learned.

"Findings" Review of ITS Operational Tests -- Findings and Recommendations.

"Partnerships" IVHS/Public/Private Partnerships: Managing the Legal Issues.

held and special assistance for public-private partnerships be provided. U.S. *DOT should provide partnerships with assistance, possibly through guidelines or mentors*

3.6.2 Leadership

Appropriate leadership in key places facilitates the success of ITS projects. In some cases, that leadership has not been present. For example, the lack of an on-site technical manager caused problems in the implementation and test phases of one project. Based on that experience, the source of that issue asserted that a knowledgeable technical manager willing to oversee the day-to-day management of the project is essential. Toward that end, the source recommended designating a project manager with sufficient authority to reduce response time when problems arise.

Another leadership issue concerns the management and leadership within the various partners on a project. The support of upper management was a positive indicator of a successful project. Further, it was again suggested that a good manager be identified. This, the report asserted, may be the single greatest factor for success.

While it was stated that the program manager has a major impact on the resolution of institutional impediments, a lack of sufficient understanding about the program manager's role was cited as an issue. Successful fulfillment of this role requires a designated on-site person who is knowledgeable about the project and is responsible for overseeing the day-to-day management of the operational test. It was recommended that a full-time program manager be assigned for the life of the project.

In some cases, the issue was simply the difficulty in managing projects with multiple partners. When several agencies share responsibilities for funding, project support, and evaluation, the task of managing the project becomes more difficult. To address this, it was recommended that both the project itself and the roles and responsibilities within it be more clearly defined.

To address the leadership issues, two actions are recommended: (1) the U.S. *DOT should mandate the inclusion of a project manager in any proposal for an ITS project: and (2) the U.S. DOT should also require that the project and the roles and responsibilities within it be clearly defined in the project proposal.*

3.6.3 Roles

Defining the roles and responsibilities of the partners in an ITS project has emerged as an important precursor to the successful completion of the project. Poorly defined roles have been a recurrent problem within ITS teams.

Working in a partnership was new to many ITS participants, and the newness of the situation sometimes required partners to overcome biases toward one another. In many cases the roles and responsibilities of the partners were not clearly defined, leading to confusion among the participants. Some recommendations were made to address these problems were to develop a

team of participants that are compatible and work closely together, balance the concerns of both sectors, educate each sector regarding the operations of the other, improve administrative processes, and provide training to the participants about purpose of the partnership and the roles within it.

Traditional management structures are not always appropriate for ITS projects. In some cases the customer vendor relationship has been replaced with an engineering development model. In other cases, multiple roles can complicate the picture. For example, one partner who is administering the project could enter into a procurement contract with another partner, thus creating a customer-vendor relationship between them which could strain the original partnership. The most important step in addressing these concerns is to define partner roles and responsibilities clearly at the beginning of the project. Involving partners in the early stages of the operational test, recognizing that innovative methods are required to develop public-private relationships, and obtaining outside support were additional suggestions to help prevent such difficulties from occurring within the partnership.

The U.S. DOT should provide ITS participants with team-building support which should include advice on team formation, guidance on the definition of roles and responsibilities and examples of innovative solutions from successful ITS projects.

3.6.4 Support

The support of upper management was cited as a concern by one of the reports. However, obtaining upper management support was also found to be time-consuming. Top managers keep busy schedules and their organizations are often involved in many areas, resulting frequently in a physical separation between the top managers and the ITS project. As a result, the possibility that upper management may not support participation in ITS projects hinders project participation. Demonstrating results might be the best strategy for maintaining upper management support. ***There is no recommended action for the U.S. DOT in this category.***

3.6.5 Team

Team formation is a critical part of the development of an ITS project. Many ITS participants encountered difficulty with this important and complicated task.

Partner selection has been a particularly problematic area. Insufficient criteria for the selection of partners is one manifestation of this problem. The use of non-competitive processes, such as sole-source contracts, to bring partners into the relationship has raised concerns in past projects. Sometimes, partners on an ITS team are simply incompatible, or, are not selected with sufficient care. A special case of this situation occurs when some partners are competitors to other participants.

Some recommendations to improve appropriate partner selection advocate the development of partner selection criteria, the choice of teammates with technical and organizational compatibilities in mind, including the potential for competition among teammates, and the

identification of a full-time project manager to facilitate communication and coordination among the partners. An additional recommendation suggested that any organizations who are signatories to the partnership agreement be represented as partners in the project. It was also acknowledged that in the short term, use of sole source agreements made sense, but should be phased out when adequate partner selection criteria is established.

In one case, partners who joined the team late received less input into the project and found available resources limited. This illustrates the importance of building the team at the beginning of the project and reviewing contracts to ensure their clarity of scope.

To assist ITS participants in the successful formation of project teams, ***the U.S. DOT should encourage the development of appropriate partner selection criteria. The criteria should include review of the potential for competition between partners, adequate representation of all partners, appropriate contracting procedures, and a requirement for a project manager. The U.S. DOT should also collect and disseminate information of successful uses of such criteria.***

3.7 PLANNING

Issues in the “Planning” category refer to issues in the areas of project planning, the establishment of critical paths, marketing, standards, and specifications. They encompass problems that are encountered as a result of the lack of technical standards in ITS projects as well as challenges that arise during specific phases of ITS projects, such as implementation and evaluation. Issues involving planning for ITS projects have been sorted into nine categories: access, approaches, critical path, evaluation, inclusion, market, standards, technical, and transit.

Recommendations for Addressing Planning Issues:

- ***The U.S. DOT and ITS America should develop a policy which addresses the issue of universal access which includes, but is not limited to, data from cost-benefit assessments. (Access)***
- ***The U.S. DOT should follow the recommendations which advocate broad, flexible standards for ITS implementations which can accommodate varied technical approaches and a compatible, flexible approach to the financial needs of those projects, either through the provisions of the ISTEA, block grants or other discretionary finding mechanisms. (Approaches)***
- ***The U.S. DOT should require critical path studies be completed for all ITS implementations as part of the project development phase. (Critical Path)***

PLANNING					
Report	Issue	Experienced	Status	Impact	Recommendations
Access					
"Overcoming Barriers"	There may be no IVHS service to low-income or potentially unprofitable areas, which could cause political problems related to public expectations of universal access.	P	A	2	The Federal Government and IVHS America should develop a policy regarding universal access based on cost-benefit assessments.
Approaches					
"Overcoming Barriers"	Top-down and bottom-up approaches to IVHS planning are in conflict and compete with each other.	Y	A	1	<ol style="list-style-type: none"> 1. Avoid mandating one IVHS design. 2. Take advantage of ISTEA flexible funding provisions. 3. Use block grants or other discretionary funding to custom fit IVHS applications.
Critical Path					
"Overcoming Barriers"	The necessary precursors to a functional system may not be in place if the critical path of the deployment is unaccounted for. For example, an ATIS may require information from an ATMS.	P	A	0	The government should perform critical path studies for stand-alone and integrated ATMS and ATIS deployment.

PLANNING					
Report	Issue	Experienced	Status	Impact	Recommendations
Evaluation					
"Solutions"	Methods for evaluating institutional effectiveness are not incorporated into operational tests.	Y	A	0	1. Document the implementation conditions. 2. Conduct in-depth case studies. 3. Expect and learn from failures.
"Solutions"	The lack of an evaluation plan allows for prevailing of different interests of the partners and strained relationships.	Y	A	3	1. Develop an evaluation plan that is acceptable to all project participants. 2. Follow the plan throughout the life of the project.
"Analysis"	Evaluation planning is not considered as important as it is.	Y	A	2	1. Form evaluation working groups and committees. 2. Expand and institutionalize evaluation guidelines and requirements.
Inclusion					
"Overcoming Barriers"	Those who see themselves as not benefiting from IVHS applications are more likely to politically oppose federal expenditures on it.	Y	A	0	1. IVHS America should include Advanced Bicycle Transportation Systems and Advanced Transportation Systems for Pedestrians. 2. IVHS America should include airline, railroad, and waterborne transportation interests in developing intermodal interfaces.
Market					
"Solutions"	Market uncertainties make private sector involvement in ATIS risky.	Y	O	2	None.

PLANNING					
Report	Issue	Experienced	Status	Impact	Recommendations
Standards					
"Implementation"	There are no IVHS design and performance standards.	Y	A	1	1. Establish a consensus on systems architecture. 2. Consider allowing the private sector to establish most standards for goods and services.
"Overcoming Barriers"	There are no IVHS standards.	Y	A	1	1. The Federal Government should support early international standards which remain open, accommodate various implementations, and support multiple vendors.
"Findings"	ITS program standards have not been developed and existing technology standards are constantly being changed.	Y	O	3	Develop national standards.
"Analysis"	IVHS operational field tests are progressing toward deployment without a national architecture and technical standards.	Y	O	4	Employ expedient implementation of a national architecture which will dramatically cut the technology risk and increase potential profits for IVHS.
Technical					
"Findings"	Selecting the most appropriate technology for IVHS implementations is difficult.	P	A	1	Separate the ITS technology causing specification difficulties from its original contract and issue an RFP providing for the modification or rejection of the prototype.
"Analysis"	Taking technical risks without fallback plans could affect ultimate system performance.	P	A	0	Create a back-up plan.

PLANNING					
Report	Issue	Experienced	Status	Impact	Recommendations
Transit					
"Solutions"	Projects that fail to consider public transit in IVHS planning are not as innovative as they could be.	Y	A	0	Include public transit in IVHS planning.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies -- Analysis and Lessons Learned.
"Findings"	Review of ITS Operational Tests – Findings and Recommendations.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"Overcoming Barriers"	Overcoming Barriers to IVHS – Lessons from Other Technologies.
"Solutions"	Searching for Solutions – Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (IVHS) Deployment.

- ***The U.S. DOT should develop and institutionalize evaluation guidelines which detail the requirements each partnership needs to fulfill when conducting an ITS project. These requirements should include the development of an initial evaluation plan agreeable to all the partners and that plan should itself include evaluation of the project's institutional effectiveness. (Evaluation)***
- ***The U.S. DOT should pursue the input of other transportation modes in order to develop intermodal interfaces which met the needs of both the ITS deployments and the other modes to which they are attached. (Inclusion)***
- ***The U.S. DOT must establish national standards for ITS implementations. However, the standards should remain as loose as possible in order not to stifle the innovation of ITS participants. International applications should be taken into account when national standards are developed. (Standards)***
- ***The U.S. DOT should advise ITS participants to use innovative procurement techniques to acquire technological components in ITS applications and should also insist on the development of a back-up plan when an ITS project takes technical risks which could ultimately affect system performance. (Technical)***
- ***The U.S. DOT should encourage ITS partnerships to consider incorporating public transit into ITS project planning when doing so would serve the project's goals and make the project more innovative. (Transit)***

Issues involving planning for ITS projects have been sorted into nine categories: access, approaches, critical path, evaluation, inclusion, market, standards, technical, and transit.

3.7.1 Access

There may be little or no ITS service to low-income or potentially unprofitable areas. This could cause political problems if there are public expectations of universal access. The recommendation that the Federal Government and ITS America should develop a universal access policy based on cost-benefit assessments may not be appropriate due to the difficulty of quantifying the benefits of providing service to such areas. After all, if it were cost effective to do, there would not be concern that it might not happen. ***The U.S. DOT and ITS America should develop a policy which addresses the issue of universal access which includes, but is not limited to, data from cost-benefit assessments.***

3.7.2 Approaches

There is more than one approach to ITS planning and some of the approaches conflict. Top-down and bottom-up approaches to ITS are in conflict and compete with each other. The four recommendations made to address this issue facilitate the mutual coexistence of these approaches: (1) avoid mandating one ITS design; (2) ensure that any standards which are

implemented can accommodate a wide range of technical solutions; (3) utilize the flexible funding provisions of the ISTEA; and (4) use block grants or other discretionary funding mechanisms to custom fit ITS applications. **The U.S. DOT should follow the recommendations which advocate broad, flexible standards for ITS implementations which can accommodate varied technical approaches and a compatible, flexible approach to the financial needs of those projects, either through the provisions of the ISTEA, block grants, or other discretionary finding mechanisms.**

3.7.3 Critical Path

There has been concern that the critical path for ITS projects is not being adequately considered. The necessary precursors to a functional system may not be in place if the critical path of the deployment is unaccounted for, such as when an ATIS requires information from an ATMS in order to function. Recommending that the government perform critical path studies for stand-alone and integrated ATMS and ATIS deployment is a step in the right direction, but puts the emphasis in the wrong place. **The U.S. DOT should require critical path studies be completed for all ITS implementations as part of the project development phase.**

3.7.4 Evaluation

Evaluating ITS projects is a complicated task which has led to some concerns, especially around evaluation planning, from some ITS participants. In some cases the partners lack understanding about the need and importance of evaluation planning, or the scope of an evaluation may have changed during the course of a project. Problems arise because the lack of an evaluation plan allows partners' different interests to prevail, resulting in strained relationships. Further, some partners object to the omission of methods for evaluating institutional effectiveness.

In response to these concerns, recommendations were offered to refine ITS evaluation efforts. First, developing an evaluation plan which is acceptable to all project participants and then following through with the plan would address some of the concerns expressed above. To fill the remaining gap, evaluation working groups or committees might be formed to expand and institutionalize evaluation guidelines and requirements. Methods for evaluating institutional effectiveness could be incorporated into this effort, as well. In evaluating institutional effectiveness, it is recommended that the implementation conditions be documented, in-depth case studies be conducted, and that failures be expected and that partners learn from them. To assist in the resolution of concerns surrounding the evaluation of ITS projects, **the U.S. DOT should develop and institutionalize evaluation guidelines which detail the requirements each partnership needs to fulfill when conducting an ITS project. These requirements should include the development of an initial evaluation plan agreeable to all the partners and that plan should itself include evaluation of the project's institutional effectiveness.**

3.7.5 Inclusion

Those who see themselves as not benefiting from ITS applications are more likely to oppose federal expenditures on them. Two recommendations were offered for addressing this concern:

(1) ITS America should include advanced bicycle transportation systems and advanced transportation systems for pedestrians and (2) ITS America should include airline, railroad, and waterborne transportation interests in developing intermodal interfaces. Pedestrians and bicyclists are unlikely to be won over to the cause of ITS unless they can actually benefit from the deployments. Unless there are specific areas where ITS can sensibly be applied to issues effecting pedestrians and bicyclists, there should be no special action to win over these constituencies. ***The U.S. DOT should pursue the input of other transportation modes in order to develop intermodal interfaces which met the needs of both the ITS deployments and the other modes to which they are attached.***

3.7.6 Market

There is concern that market uncertainties make private sector involvement in ATIS risky. No recommendations were made to address this concern.

3.7.7 Standards

The lack of ITS standards is a growing concern within the ITS community. Some object to the lack of standards because of market or liability concerns, others because they see them as necessary for increased private sector participation. Still others view the continuation of operational tests through the deployment stage before the implementation of national standards as a problem. Finally, some argue that the lack of standards leads to changes which adversely effect systems architecture for the ITS deployments.

All of the recommendations in this section endorse the implementation of standards, although their approaches vary. One set of recommendations advises that a consensus on systems architecture be established and that it be considered to allow the private sector to establish most standards for goods and services. Another source recommends that the Federal Government support early international standards which remain open, accommodate various implementations, and support multiple vendors. In contrast, a different source advocates that an expedient implementation of a national architecture, which will dramatically cut the technology risk and increase potential ITS profits, be employed. Finally, the last recommendation merely advises that national standards be developed quickly.

The U.S. DOT must establish national standards for ITS implementations, However, the standards should remain as open as possible in order not to stifle the innovation of ITS participants. international applications should be taken into account when national standards are developed.

3.7.8 Technical

Selecting the most appropriate technology for an ITS application can be difficult and is complicated by the concern that incorrect selection of a product could affect the evaluation process, the evaluation, and the project results. In addition, taking technical risks without a fall-back plan may result in the system failing to meet some or all of its performance goals.

If an ITS technology is causing specification difficulties, one recommendation advises that it be separated from the original contract and a request for proposals (RFP) be issued which provides for the modification or rejection of the prototype. Another suggestion is to develop a back-up plan that would balance the technical risks taken in an implementation. ***The U.S. DOT should advise ITS participants to use innovative procurement techniques to acquire advanced technological components in ITS applications and should also insist on the development of a back-up plan when an ITS project takes technical risks which could ultimately affect system performance.***

3.7.9 Transit

Public transit is often left out of ITS projects, leading to projects which may be less innovative than they could be. Including public transit in ITS planning would address this issue. ***The U.S. DOT should encourage ITS partnerships to consider incorporating public transit into ITS project planning when doing so would serve the project's goals and make the project more innovative.***

3.8 PRIVACY

Issues in the "Privacy" category relate to the effects of ITS technologies on personal privacy. These issues include both protections against infringements of privacy rights and the effect that the public's perception of ITS as intrusive may have on public acceptance. Privacy issues often result from the public's uncertainty about the far-reaching capabilities of ITS technology. Many ITS applications have given rise to privacy concerns. The protection of computerized data and the use of surveillance technologies have been the prime concerns in this area.

Recommendations for Addressing Privacy Issues:

- ***The U.S. DOT should publicize available information about the social and economic ramifications of ITS technology and consider sponsoring research to fill in the gaps where information is not available. (Awareness)***
- ***The U.S. DOT should advise ITS participants in projects that have potential for implementation abroad to follow the strictest rule of law for the area of that implementation. (Awareness)***
- ***The U.S. DOT should advise all ITS participants to ascertain the applicable privacy laws in the states affected by their ITS projects. (Computer)***
- ***The U.S. DOT should encourage all ITS participants to follow the ITS America privacy principles. (Future)***

PRIVACY					
Report	Issue	Experienced	Status	Impact	Recommendations
Awareness					
"Legal Reports"	IVHS implementations in other countries have illuminated privacy concerns. U.S. participants should derive lessons from these implementations.	P	O	1	Stress the realization that too few countries have researched the social and economic ramifications of IVHS sufficiently, and none have conducted thorough research regarding the effects of IVHS technology on privacy.
"Legal Reports"	No single collection of laws exists that an American corporation could follow to satisfy the requirements of every European country regarding IVHS implementation.	P	O	1	U.S. companies should follow the strictest rules of law for each area of interest in implementing IVHS technologies.
Computer					
"Legal Reports"	Legal protection of computerized data and computer systems varies from state to state.	Y	A	2	Attention should be given to the lack of privacy protection afforded by statute in some states.
Future					
"Deployment"	Privacy issues may take longer to materialize than other issues.	P	A	2	1. Identify the stakes of all affected participants in the dissemination or confidentiality of IVHS data. 2. Have IVHS America draft a statement of guiding principles on privacy for IVHS technology.
Information					
"Workshop"	Historical information on IVHS users is available.	P	A	2	Anticipate concern and take action by working with consumer and privacy advocates to address them.
"Legal Reports"	Specific statutes of United States Code apply to questions of protection of data derived from use of IVHS technology.	P	O	2	IVHS environment should be viewed as any electronic communications service, carrying with it distinct privacy issues.

PRIVACY					
Report	Issue	Experienced	Status	Impact	Recommendations
Personal					
"Overcoming Barriers"	Information gathered by an IVHS system or its surveillance capacity may be misused.	P	A	0	<ol style="list-style-type: none"> 1. Realize IVHS and law enforcement interests may conflict. 2. Develop measures to address issues. 3. Consider alternate technologies. 4. Treat data as confidential. 5. Make IVHS voluntary for customers.
"Legal Reports"	Automated Highway Systems (AHS) And Automated Vehicle Identification (AVI) could be used to invade personal privacy.	P	O	2	Consequences on an individual's privacy from IVHS must be considered as part of a system's architectural design.
"Legal Reports"	The Fourth Amendment provides protection against using ITS technology in vehicles to continuously track individual vehicles' locations.	P	O	1	Use technology other than continuous monitoring, which is intrusive. Safety concerns could be sufficiently served with other technology.
"Legal Reports"	Danger exists that information technologies can provide so many benefits that individual privacy rights may be destroyed by the technologies.	P	O	1	Examine constitutional and other protections before any ITS system is implemented so that an existing system does not destroy our privacy rights before we realize what we are losing.

PRIVACY					
Report	Issue	Experienced	Status	Impact	Recommendations
Surveillance					
"Analysis"	Technologies capable of compromising privacy can cause negative public reaction to IVHS.	Y	O	2	1. Make all participants from the public aware that the project is tracking their locations. 2. Use a system that separates the database of names of participants from the information of how individuals used the system.
"Legal Reports"	Unconstitutional conditions may be forwarded by implementing IVHS technologies.	P	O	1	1. Stress the realization that because citizens do not have safeguards assuring anonymity in the use of IVHS systems, any limitation on individual access to highways constitutes state over-reaching.
"Workshop"	Real-time information regarding location or destination of IVHS users is not protected.	P	A	0	Anticipate concern and take action by working with consumer and privacy advocates to address them.
Technology					
"Implementation"	There is potential for invasions of privacy using IVHS technologies.	P	A	0	1. The U.S. DOT should remain active in the debate over privacy concerns. 2. The U.S. DOT should remain attentive to public sensitivity regarding surveillance technology and the use of personal information.

PRIVACY					
Report	Issue	Experienced	Status	Impact	Recommendations
Unspecified					
"Workshop"	There is general concern that any information gathered by IVHS applications may be used without the knowledge or consent of IVHS customers and possibly against their interests.	P	A	0	1. Focus on travelers' interests. 2. Build and maintain IVHS visibly. 3. Safeguard information. 4. Ensure security. 5. Obey laws.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis"	IVHS Institutional Issues and Case Studies -- Analysis and Lessons Learned.
"Deployment"	Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States.
"Implementation"	Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.
"Legal Reports"	Privacy and Intelligent Transportation Systems -- Legal Research Reports.
"Overcoming Barriers"	Overcoming Barriers to IVHS -- Lessons from Other Technologies.
"Workshop"	Workshop on IVHS and Intellectual Property.

- ***The U.S. DOT should investigate the applicability of existing privacy law to ITS applications, disseminate its findings, identify possible gaps in the protection of privacy provided and offer modifications which if implemented would fill those gaps. (Information)***
- ***The U.S. DOT should require ITS implementations to include privacy protection safeguards. (Personal)***
- ***The U.S. DOT should emphasize the Constitutional implications involved in invasions of privacy, require participants to be proactive about identifying and addressing privacy concerns, and insist that the public be informed if an ITS system will be tracking them. (Surveillance)***
- ***The U.S. DOT should remain active in the debate over privacy concerns and should remain attentive to public sensitivity regarding surveillance technology and the use of personal information. (Technology)***
- ***The U.S. DOT should endorse and disseminate the nine privacy principles articulated by the Privacy Task Force of the Legal Issues Committee. (Unspecified)***

3.8.1 Awareness

International applications of ITS technology have illuminated privacy concerns, leading one source to conclude that project participants in the United States should look to these applications as research on the social and economic ramifications of ITS. In addition, no single collection of laws exists that an American corporation could follow to satisfy the requirements of every European country regarding ITS implementations. To address these concerns, it is recommended that attention be drawn to the lack of research on the social and economic ramifications of ITS technology in this country, especially the effects of ITS technology on privacy. In addition, when implementing ITS technologies, it is recommended that U.S. companies should follow the strictest rules of law for each area of application. Two actions are recommended in this section: (1) ***The U.S. DOT should publicize available information about the social and economic ramifications of ITS technology and consider sponsoring research to fill in the gaps where information is not available;*** (2) ***the U.S. DOT should advise all ITS participants in projects that have potential for implementation abroad, should be advised to follow the strictest rule of law for the area of that implementation.***

3.8.2 Computer

One source in this review expressed concern that the amount and level of statutory protection of computer systems and computerized data differ from state to state. The same-source advised that the lack of statutory privacy protection afforded in some states should be made known. ***The U.S. DOT should advise all ITS participants to ascertain the applicable privacy laws in the states affected by their ITS projects.***

3.8.3 Future

There is some concern within the ITS community that privacy issues may take longer to materialize than other types of issues. This means that ultimately privacy issues could be more serious in the future than they now appear. To address privacy issues now, before they become more serious, it was recommended that the stakes of all effected participants in the dissemination or confidentiality of ITS data be identified. In addition, it was recommended that ITS America draft a statement of guiding principles regarding privacy issues. ***The U.S. DOT should encourage all ITS participants to follow the ITS America privacy principles.***

3.8.4 Information

Access to historical data on users of ITS systems is not restricted and, thus, there is concern that information is subject to being captured and divulged by service providers. To address these concerns, it was recommended that privacy concerns be anticipated and mitigated by working closely with consumer and privacy advocates. In addition, one source asserted that the ITS environment should be viewed as any other electronic communications service, carrying with it distinct privacy issues, and subject to specific statutes of U.S. Code which apply to the protection of data. ***The U.S. DOT should investigate the applicability of existing privacy law to ITS applications, disseminate its findings, identify possible gaps in the protection of privacy provided, and offer modifications which, if implemented, would fill those gaps.***

3.8.5 Personal

There is concern among ITS participants that either the information gathered by an ITS deployment, or the surveillance capacity of the system may be misused to invade personal privacy. Automated highway systems (AHS) and automated vehicle identification (AVI) are of specific concern due to the potential for intrusions on privacy which exists in the choice of information which flows from the vehicle, how that information is transmitted to any central system and how the central system processes the information. Continuous monitoring of vehicles raises constitutional questions based on the Fourth Amendment which protects against the use of ITS technology to continuously track the locations of individual vehicles. There is also controversy surrounding the adequacy of the privacy protection provided by the Fourth Amendment and other federal laws.

In response to these personal privacy concerns, some general recommendations were made: (1) individual privacy concerns must be considered in the design of ITS architectures; employ alternatives to continuous monitoring technologies; and examine the current privacy rights protections in place before any ITS implementation. An additional set of recommendations specifically advised that ITS participants realize that ITS and law enforcement interests may conflict, develop countermeasures to address privacy issues, consider alternate technologies for ITS implementations, treat ITS data as confidential, make ITS use voluntary, and allow access to aggregate ITS data.

Clearly, personal privacy issues must be addressed by ITS participants, not only because of the legal requirements, but also because there is some concern among potential users who want their privacy protected. ***The U.S. DOT should require ITS implementations to include privacy protection safeguards.***

3.8.6 Surveillance

The inherent tension between personal privacy interests and governmental powers in ITS applications may raise issues of constitutionality. The potential availability of real-time information regarding the location or destination of ITS users has raised concerns among consumer and privacy advocates. ITS technologies in commercial vehicles may also compromise privacy.

In projects that will track the locations of participants, it was recommended that all participants be made aware of that surveillance and that the system be designed so the names of participants are kept separate from historical data regarding their use of the system. It should be recognized that the Constitution implies certain limits in the application of new technologies and so some uses of ITS technology may be found unconstitutional. In any case, ITS participants should strive to anticipate concerns and to work proactively with consumer and privacy advocates to resolve any that are identified. ***The U.S. DOT should emphasize the Constitutional implications involved in invasions of privacy, require participants to be proactive about identifying and addressing privacy concerns, and insist that the public be informed if an ITS system will be tracking them.***

3.8.7 Technology

There is concern that ITS technology could be used to invade privacy. To address this, two recommendations were offered: ***(1) the U.S. DOT should remain active in the debate over privacy concerns; and (2) the U.S. DOT should remain attentive to public sensitivity regarding surveillance technology and the use of personal information.***

3.8.8 Unspecified

There is general concern that any information gathered by ITS applications may be used without the knowledge or consent of ITS customers and possibly against their interests. To address this concern, nine privacy principles were articulated by the Privacy Task Force of the Legal Issues Committee: (1) ITS should focus on the travelers' interests; (2) ITS should be built and maintained visibly; (3) information should be safeguarded; (4) security should be ensured; (5) laws should be obeyed; (6) only necessary information should be collected; (7) information should be protected during non-ITS usage; (8) privacy needs to be balanced against freedom of information requirements; and (9) these privacy principles should be continuously reexamined and approved. ***The U.S. DOT should endorse and disseminate the nine privacy principles articulated by the Privacy Task Force of the Legal Issues Committee.***

3.9 RESOURCES

Issues in the “Resources” category cover the human, financial, and technical support structure that is fundamental to ITS. These issues include those regarding cost allocation, present and future funding sources, as well as challenges of training and availability of technical expertise. Resources issues often center around the difficulty of securing both financial and human resources.

Resources, or more specifically, the lack of sufficient resources has been identified as an area of concern among ITS participants. As it is used here, the term “resources” encompasses all types of inputs to ITS projects, including education, funding, information, public support, and staff.

Recommendations for Addressing Resource Issues:

- ***The U.S. DOT should encourage the inclusion of ITS-related subjects and subject matter into existing curricula through any means at its disposal. Universities which are already participating in ITS or other transportation research should be both a source of information and the focus of the first stage of implementation. (Education)***
- ***The U.S. DOT should clearly identify requirements to match federal funds, the types of non-cash contributions that will be accepted, and methodologies to establish the value of products offered by participants. (Funding)***
- ***The U.S. DOT should collect and distribute information of costs to procure and install ITS technologies. (Funding)***
- ***The U.S. DOT should ensure that participants consider the cost of operation and maintenance when designing ITS projects. (Funding)***
- ***The U.S. DOT should gather and analyze data to measure the level of public support for ITS, including willingness to pay, in order to come to an informed decision regarding appropriate strategies for ITS development. (Public Support)***
- ***The U.S. DOT should address staffing resource issues by requiring participants to acquire and maintain staffing levels commensurate with their project goals and requirements and by facilitating, where possible, the build-up of appropriate administrative and technical skills within the ITS community. (Staff)***

3.9.1 Education

The lack of ITS training programs troubles some participants. The training and support mechanisms for preparing ITS technicians and management staff now available lag behind ITS technical capabilities. It was recommended that an academic strategy to expedite the inclusion of ITS subjects into existing curricula be adopted. ***The U.S. DOT should encourage the inclusion of ITS-related subjects and subject matter into existing curricula through any means at its disposal.***

RESOURCES					
Report	Issue	Experienced	Status	Impact *	Recommendations
Education					
"Metro Traffic"	There are too few education programs available to train personnel at all levels in ITS technology.	P	O	2	Adopt an academic strategy to expedite the inclusion of IVHS subjects in existing curriculums.
Funding					
"Findings"	Funding expectations were not always met. Partners have different expectations over level of program funding and timely release of funds.	Y	O	2	When developing the project schedule, take into account the slow release of funds.
"Overcoming Barriers"	The public sector will need to provide IVHS funding unless the private sector can be convinced that investing in IVHS will be profitable.	Y	A	0	<ol style="list-style-type: none"> 1. Determine customers' willingness to pay for IVHS. 2. Accurately assess all costs. 3. Allocate costs based on the marginal costs and benefits. 4. Structure IVHS not to depend on private investment or limit private risks.
"Overcoming Barriers"	ATMS deployments do not have funding and other resources dedicated to system operation and maintenance.	Y	A	0	The Federal Government should provide financial support to the responsible levels of government and select a realistic national architecture.
"Implementation"	It is not clear whether the budget to hire enough qualified workers for IVHS projects is available.	P	O	3	None.

RESOURCES					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Metro Traffic"	Sources for consistent, sustainable funding have not been identified.	Y	O	4	Encourage metropolitan areas to consider ATMS as an evolutionary process of staged implementation and fund capabilities gradually, as part of normal equipment replacement.
"Metro Traffic"	Costs incurred to design, build, operate, and maintain ATMS will be difficult to allocate among metropolitan area stakeholders.	P	A	3	Employ a consistent and equitable approach to evaluating metropolitan area ATMS funding requests that considers life cycle costs and the presence of coordinated decision-making mechanisms.
"Findings"	Participants did not understand match share and the value of each partner's contribution.	Y	A	3	Identify matching requirements early in the project.
"Findings"	Funding limitations can negatively affect the scope of the operational test.	Y	A	2	Review costs and benefits of different levels of functionality and cut areas that only provide marginal incremental benefits.
"Analysis"	The manner in which non-federal partners apportion expenses of an operational test is not uniform, but rather is left to the ingenuity of the partnerships.	Y	A	2	Employ a third party to assess value of hardware contributions and define cost sharing in terms of functions to be performed.
"Analysis"	Program cost and uncertainty about federal support of IVHS programs is a significant impediment to the commercial deployment of IVHS.	Y	A	3	1. For the operational test, absorb the cost escalation based upon mutual consent of all partners. 2. For full-scale deployment, encourage state/local governments to sell information to highway users to within a fee structure.

RESOURCES					
Report	Issue	Experienced	Status	Impact *	Recommendations
Information					
"Overcoming Barriers"	IVHS users need both the up-front, monetary cost and the hidden costs, such as increased travel times, to make informed travel decisions.	P	A	0	ATMS and ATIS systems should communicate money costs and travel time costs when dispensing travel information.
Public Support					
"Implementation"	Public support and the willingness to pay for large investments in IVHS technologies must be generated.	Y	A	0	Supply local managers with rigorous cost-benefit assessments.
"Analysis"	Market uncertainty and user willingness to pay could hinder deployment.	Y	A	3	Conduct market surveys and assess user acceptance and willingness to pay as an integral part of the project evaluation and include representatives of the user community in the partnership.
Staff					
"Implementation"	There may be a shortage of trained workers for the IVHS industry.	N	P	0	None.
"Overcoming Barriers"	Most MPOs have a limited staff with which to comply with all the regulations under ISTEA.	Y	A	1	1. Emphasize the maximum incorporation of management systems and planning and air quality conformity procedures to keep staffing costs down. 2. Monitor the ability of MPOs to comply with ISTEA.
"Procurement"	Public sector entities often do not have enough technical expertise to conduct the procurement of IVHS systems appropriately.	Y	A	1	Training sessions for state and local procurement personnel and for the business community on topics relating to IVHS procurements could be offered and supported by the Federal Government.

RESOURCES					
Report	Issue	Experienced	Status	Impact *	Recommendations
"Analysis"	A need exists for a program office and full-time support staff for the program.	Y	A	3	Assign a small core staff with multiple and diverse skills augmented by contractor support.
"Findings"	ITS projects have innovative public-private partnerships and technical innovations and are a challenge for many public sector partners.	Y	A	2	Bring in additional technical and administrative expertise from the private sector and train public sector staff.
"Findings"	At many operational tests, staff took on new responsibilities without any change in level of resources and staffing – tests were slowed down.	Y	A	2	Hire additional staff, such as management consultants, to complete action items, project managers to oversee the project, and operational staff for everyday operations.
"Metro Traffic"	Skills are limited both in the number of technologies understood and in the number of "experts" residing within the metropolitan area.	Y	A	2	Before the actual development of courses, seminars and curriculum programs, the skill sets required to implement and maintain ATMS technologies in metropolitan areas must be defined.

* Impact after implementation of recommendations

Key:

Experienced: Y = Yes; N = No; P = Potential

Status: O = Outstanding; A = Addressable; P = Perceived

Impact: 4 = Serious; 3 = Significant; 2 = Moderate; 1 = Mild; 0 = None

Documents:

"Analysis" IVHS Institutional Issues and Case Studies – Analysis and Lessons Learned.

"Findings" Review of ITS Operational Tests – Findings and Recommendations.

"Implementation" Non-technical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.

"Metro Traffic" Institutional Impediments to Metro Traffic Management Coordination.

"Overcoming Barriers" Overcoming Barriers to IVHS – Lessons from Other Technologies.

"Procurement" Procurement Issues in IVHS Development and Deployment.

Universities that are already participating in ITS or other transportation research should be both a source of information and the focus of the first stage of implementation.

3.9.2 Funding

A variety of issues were identified surrounding ITS funding. Most prevalently was the uncertainty surrounding funding sources, followed by that of project costs. A separate, but related, issue concerns the partners' funding expectations.

Uncertainty surrounding funding sources was expressed both as a general issue and applied specifically to funding for ATMS projects, because those projects do not have resources dedicated to maintenance and system operation. A sound group of recommendations for addressing the general issue was proposed: determine the amount consumers are willing to pay for ITS; accurately assess all costs; allocate costs based on the marginal costs generated and the benefits received; and either structure ITS development not to depend on the private sector, or limit private sector risks. Additional recommendations were made to address the specifics relating to general ATMS development and operations and maintenance funding. One source suggested that federal financial support be provided to the levels of government responsible for ATMS maintenance and operation and, also, that a realistic national architecture be selected. The other source advocated that ITS implementors in metropolitan areas be encouraged to think of ATMS as an evolutionary process of staged implementation and to fund additional capabilities gradually, as part of normal equipment replacement.

Uncertainty surrounding project costs was another significant area of concern. According to one source, because funding limitations can negatively affect the scope of the operational test, partners sometimes had their own objectives for funding level for the projects and, at times, these were in conflict. To remedy this, it was recommended that the costs and benefits associated with different levels of functionality be determined and the areas that provide only marginal incremental benefits be cut. Another source discussed the uncertainty surrounding the program cost for operational tests and deployments. This issue arose because program cost and uncertainty about federal support of ITS programs is a significant impediment to the commercial deployment of ITS. This source suggested that the cost escalation of an operational test be absorbed by the project partners since program cost issues were either the result of a conscious decision to expand the scope of the effort or due to uncertainties associated with research and development. Since federal funding ends after the operational test is over, for a full-scale deployment, the state and local governments should be encouraged to sell information to highway users for a fee.

Issues surrounding the determination of partner contributions were also identified. Participants did not understand match requirements and the value of each partner's contribution and there was often difficulty in allocating costs among jurisdictions. In general, the confusion existed around cost sharing goals and the manner in which costs are measured, which is not uniform. Identifying matching requirements early in the project was recommended to address the first issue. In allocating costs among multiple jurisdictions, it was recommended that the partners employ a consistent and equitable approach to evaluating funding requests for the metropolitan

area ATMS which considers life cycle costs and the presence of coordinated decision-making mechanisms. Finally, it was suggested that a third party might be helpful in determining the value of hardware contributions and in defining cost sharing in terms of responsibilities to be performed.

In addition, the ITS operational test funding approval cycle is extensive and is complicated by different funding contributions from public and private partnerships. It is further complicated by the expectations surrounding the level of program funding and the timely release of funds. One source recommended that the partners take the slow release of funds into account when developing the project schedule.

Finally, according to one source, it is not clear that there is a sufficient budget to hire enough qualified workers for ITS projects. No recommendation was given to counteract this possibility.

Three actions were recommended in this section: ***(1) The U.S. DOT should clearly identify requirements to match federal funds, the types of non-cash contributions that will be accepted, and methodologies to establish the value of products offered by participants; (2) The U.S. DOT should also collect and distribute information of costs to procure and install ITS technologies; and (3) the U.S. DOT should ensure that participants consider the cost of operation and maintenance when designing ITS projects.***

3.9.3 Information

ITS users may not be getting all the information they need to make intelligent transportation choices. They need both the upfront monetary cost and the hidden costs, such as increased travel times, to make informed travel decisions. Toward that end, it was recommended that ATMS and ATIS implementations should communicate both monetary costs and travel time costs when dispensing travel information. ***There are no recommendations to the U.S. DOT in this category.***

3.9.4 Public Support

Full scale deployment of ITS depends on how willing consumers are to accept and pay for the products and services. Public support and willingness to pay for large ITS investments needs to be generated. Three recommendations were made to address this situation: (1) conduct market surveys and assessments of the users' willingness-to-pay as an integral part of the project evaluation, include representatives of the user community in the partnership, and supply local transportation managers with rigorous cost-benefit assessments. ***The U.S. DOT should gather and analyze data to measure the level of public support for ITS, including willingness-to-pay, in order to come to an informed decision regarding appropriate strategies for ITS development.***

3.9.5 Staff

Staffing limitations, in both the number of personnel and levels of expertise, has consistently been a problem in ITS projects. The exact nature of the problem is currently a subject of debate. For example, one source discussed the concern within the ITS community that there is a shortage

of trained workers for the ITS industry. That source also on to argued that there is not actually such a shortage.

In some cases, the size of the staff in relation to their responsibilities was the central problem. For instance, most MPOs have a limited staff with which to meet all the regulations under the ISTEA. This could be addressed, in part, by emphasizing the maximum incorporation of management systems and planning and air control quality conformity procedures to keep staffing costs down and monitoring the ability of MPOs to comply with the ISTEA. On the same theme, at many operational tests, staff took on new responsibilities without any change in levels of resources and staffing which slowed down the tests. Hiring more staff, such as management consultants to complete action items, project managers to oversee the project, and operational staff to perform day-to-day activities, would be in order. On a separate, but closely related, theme, a need exists for a program office and full-time support staff for the program. The impact of an insufficient program office is greatest on program scheduling which often experiences delays up to six months. A small core staff, ideally with multiple and diverse skills, which could be augmented with contractor support would serve this need.

In other cases the focus was on the skills possessed by the work force. ITS projects are a challenge to many public sector partners because they include both unfamiliar public-private partnerships and technical innovations. This requires bringing in additional technical and administrative expertise from the private sector to assist and train public sector staff. Similarly, it was asserted that many public sector entities lack sufficient technical expertise to conduct ITS procurements properly. To remedy this, training sessions for state and local procurement personnel and for the business community on topics related to ITS procurements could be offered and supported by the Federal Government. Also in this area, ATMS skills were of specific concern to one source who related that in stakeholder organizations, skills are limited both in the number of technologies understood and in the number of experts residing within the metropolitan area. This source recommended that, prior to actually developing curricula, that the skill sets required to implement and maintain ATMS technologies first be defined.

The U.S. DOT should address staffing resource issues by requiring participants to acquire and maintain staffing levels commensurate with their project goals and requirements and by facilitating, where possible, the build-up of appropriate administrative and technical skills within the ITS community.

4. SUMMARY

Through their analysis of the constraints facing the deployment of ITS products and services, the authors of the papers that were reviewed implicitly identified several specific categories in which these issues were most prevalent. They also presented recommendations to address these issues. Volpe Center analysts reviewed these issues, evaluated the recommendations, and identified actions that could be taken by the U.S. DOT to foster the development of ITS products and services. Because similar actions may have been presented in two or more categories, these actions were consolidated into seven areas:

- General ITS Information
- Public-Private Partnerships
- Government Operations
- Intellectual Property Rights
- Liability
- Privacy
- Standards

By implementing these actions, the U.S. DOT would perform three significant roles: educator, facilitator, and researcher. The degree to which the U.S. DOT performs these roles within the different issue areas varies considerably. In some areas, these roles overlap. This section discusses ***the most important actions*** available to the U.S. DOT.

In the area of “General ITS Information,” the major roles are that of researcher and educator. The U.S. DOT should collect and provide information on (1) innovative solutions used to overcome problems deploying ITS, including those used to overcome jurisdictional barriers; (2) the costs to procure and install ITS; (3) the benefits gained from deploying ITS; and (4) foreign ITS activities. Another task would be the education of local elected officials. The U.S. DOT could also be a facilitator by providing some type of on-demand source of ITS information.

In the area of “Public-Private Partnerships,” the roles of facilitator and educator predominate. The U.S. DOT should facilitate the development of partnerships by providing team-building support. The Department should provide assistance in developing teaming agreements, which would address the roles and responsibilities of the partners, the appointment of a project manager, the acquisition of appropriate administrative and technical skills, and the assignment of intellectual property rights. This can be done by sponsoring retreats, seminars, or other methods of facilitation.

As an educator, the Department should provide information to help overcome the cultural barriers that exist between the public and private sectors, including providing the public sector with information on standard business practices used by the private sector. The Department should also provide information on partner selection criteria and other innovative techniques used by public sector agencies to develop partnerships and to alleviate concerns on antitrust violations, organizational conflict of interest, and industry competitors being partners.

Other educational activities include disseminating the results of any facilitation actions taken by the Department, documenting-and disseminating information on innovative contracting and procurement techniques, and reaching out specifically to small firms to educate them on ITS and government practices. As researcher, the U.S. DOT should gather and analyze data to measure the level of public support and willingness to pay for ITS products and services.

In the area of "Government Operations," the primary role is that of facilitator and the secondary role is educator. The Department should facilitate the deployment of ITS by streamlining administrative procedures and resolving overlapping and conflicting requirements. The Department should evaluate the costs and benefits of government requirements that differ from standard business practices and, where feasible, make changes that would reduce the cost of complying with these regulations. The Department should also consolidate the regulations of the different operating administrations in order to facilitate projects involving multimodal applications.

Other facilitation activities were suggested. The Department should (1) investigate more flexible funding mechanisms; (2) eliminate restrictions that limit or prohibit the sale of traffic data, that limit the use of highway rights of way, and that limit state and local agencies from delegating specific highway operations to private firms; (3) support legislation that expands the Federal Government's rights to software in order to facilitate commercialization; and (4) emphasize competition over regulation.

The U.S. DOT should educate potential partners, especially those from the private sector, on federal accounting requirements. Specifically, the Department should spell out the requirements to match federal funds, the types of non-cash contributions that will be accepted, and methodologies to establish the value of products offered by project participants.

In the area of "Intellectual Property Rights," the U.S. DOT role should be that of facilitator. The Department must develop and disseminate a clearly articulated policy for the assignment of intellectual property that includes a commitment to retaining the flexibility in current federal law. This policy should serve as guidelines by which the private sector can address the current federal intellectual property requirements. The U.S. DOT should also provide examples of agreements successfully used to assign intellectual property.

In the area of "Liability," the principal role for the U.S. DOT is researcher. The Department should investigate the need for the clear assignment of liability for ITS products. As part of this investigation, the U.S. DOT should analyze (1) the historical record of instances of liability litigation, especially in the area of advanced vehicle control systems; (2) whether the invocation of the immunity doctrine for government contractors would unacceptably limit either the ability of consumers to receive compensation if injured or any other course of action currently available to consumers; (3) the potential availability of reasonably priced insurance for ITS applications; (4) the possibility of limiting ITS liability; and (5) possible application of alternative dispute procedures to resolve ITS liability issues. As a result of this research, a guideline which outlines recommended practices for addressing potential ITS-related liability should be developed.

In the area of "Privacy," the U.S. DOT role is one of educator. The Department should educate participants on the need to protect the privacy of the users of ITS products and services. This activity would include disseminating and encouraging the use of the privacy principles developed by the Privacy Task Force of the Legal Issues Committee of ITS America and advising ITS participants to ascertain the applicable privacy laws in the states affected by their projects.

In the area of "Standards," the role of facilitator is the most important. The U.S. DOT should develop national standards as quickly as possible. These standards should be as open and flexible as possible so that innovation is not stifled and varied technical approaches can be accommodated. Also, international applications should be taken into account when developing the standards.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

AHS	automated highway systems
ATIS	advanced traveler information systems
ATMS	advanced traffic management systems
AVI	automated vehicle identification
AVCS	advanced vehicle control systems
CalTrans	California Department of Transportation
CFR	Code of Federal Regulations
c v o	Commercial Vehicle Operations
DOT	Department of Transportation
ECHR	Economic Convention on Human Rights and Fundamental Freedoms
ETTM	electronic toll and traffic management
FCC	Federal Communications Commission
FHWA	U.S. Department of Transportation Federal Highway Administration
GIS	geographic information system
IP	intellectual property
ISTEA	Inter-modal Surface Transportation Efficiency Act of 1991
ITS	intelligent transportation systems
IVHS	intelligent vehicle-highway systems
MPO	metropolitan planning organization

NCRPA	National Cooperative Research and Production Act of 1993
OCI	organizational conflict of interest
OECD	Organization for Economic Cooperation and Development
RFP	request for proposal
SAIC	Science Applications International Corporation
SBIR	Small Business Innovation Research
TIP	transportation improvement program
USC	United States Code
U.S. DOT	United States Department of Transportation
Volpe Center	U.S. Department of Transportation John A. Volpe National Transportation Systems Center

APPENDIX B

DOCUMENT SUMMARIES

The following document summaries represent brief encapsulations of the reports that were analyzed in support of this document. The institutional issues described in this document were extracted from the following documents.

Document: "Public and Private Sector Roles in Intelligent Vehicle-Highway Systems Deployment," (Final Report: Summary of Seminar Proceedings April 8-9, 1992; Rockville, Maryland)

Author: Federal Highway Administration

Date: August 1992

This report is the third ***Searching for Solutions: A Policy Discussion Series*** publication. It summarizes a Federal Highway Administration (FHWA) workshop on key issues in public and private sector roles for the deployment of intelligent vehicle-highway systems (IVHS) technologies and services. The workshop was intended to develop recommendations concerning needed research related to the issues of public and private sector involvement in IVHS deployment, methods of evaluation for institutional issues in IVHS operational tests, and public and private roles and strategies for promoting more near-term IVHS deployment.

There were four papers presented by the first panel, "Current U.S. and Foreign Experience with Public/Private Sector Deployment of IVHS," and summarized in the proceedings. The first report summarized, "A Sociotechnological Perspective on Public/Private Partnerships for IVHS Infrastructures," emphasized the innovative involvement of the private sector in the development of the IVHS infrastructure. This paper outlined motivations for private sector involvement in infrastructure development, presented several examples of possible partnerships between the public and private sectors for the development of infrastructure, and discussed issues regarding the implementation of IVHS. The issues mentioned in the summary dealt with public sector procurement procedures, the effect of regulatory policies on the private sectors' involvement with IVHS, multiple jurisdictions, legal liabilities, cost-benefit assessments, and the automobile industry's lack of commitment, which in turn effects the electronics industry's commitment. The summary did not elaborate further on these barriers to implementing IVHS. The paper recommended that partnerships in other industries and other countries be examined for relevant lessons, more workshops and meetings be held, field tests utilizing technical and institutional innovation be performed concurrently, and the definition of roles for the private and public sectors, including possible barriers and solutions, be included in the planning for the full deployment of IVHS systems.

The following summary discussed the paper, “An Analysis of Public/Private Cooperation in European, Japanese and North American M-IS Efforts,” which examined foreign experience in IVHS and applied it to the implementation of IVHS technology in the U.S. The report concluded that the U.S. could benefit from the approaches used by the Japanese and the Europeans, such as forming a large consortia of private sector participants, using a sliding scale for public funding and allowing the private sector to keep intellectual property rights, soliciting ideas from the private sector for project development, allowing private firms to pursue several areas of interest through broad solicitations, providing public sector infrastructure studies as a platform for private sector use, and implementing codes of practice which address liability concerns and encourage product development.

The next paper summarized was “Opportunities for Private Sector Involvement in the Deployment and Operation of Advanced Traveler Information Systems (ATIS).” By dividing ATIS activities into two primary functions, the collection and dissemination of information, this paper outlines five scenarios for private sector involvement: public collection of data for both public and private sector use, franchised operations (both exclusive and not), complete privatization, public ownership and private operation, and a unified partnership sharing both collection and dissemination roles. The barriers to private sector involvement in ATIS that were identified were public sector unwillingness to share responsibilities, jurisdictional fragmentation, legal constraints regarding the use of public right of way, unspecified procurement and contracting regulations, and market uncertainties.

The last paper presented to this panel and summarized was “The California Department of Transportation (CalTrans) Experience with Public/Private Arrangements.” CalTrans’ experience with public/private arrangements spans half of its twenty-year involvement with IVHS. In order to address the public/private issues which have arisen, such as the integrity of information transmitted, difficult procurement processes, and the understanding of private sector incentives and needs, the paper recommends establishing a national program to coordinate the task of identifying, clarifying and resolving such issues. The function of this program, according to the summary, would be to look into dividing responsibilities among the federal, state and local levels, provide funding, and share information among IVHS participants.

The next panel, “Public/Private Roles in IVHS Deployment,” included presentations of five papers. The first paper summarized, “Economic Issues Associated with the Definition of Public/Private Roles in the Deployment of IVHS,” focused on a comprehensive surveillance infrastructure, which was assumed to be a foundation for all aspects of IVHS. The author found it unlikely that the public sector could fund such a system alone, but concluded that a franchise model might work.

In the second paper summarized, “IVHS Deployment and Public/Private Sector Issues,” a model was presented in which the public sector operated the advanced traffic management system (ATMS) and the private sector the ATIS with the aggregate data processed in one or more regional transportation management centers run by a public agency. The information would then be dispersed through multiple channels, both public and private. The article lists several benefits resulting from this approach: it retains continuity of ATMS responsibility within the public

sector; it is consistent with current ATMS deployments in various programs; it incorporates the collection and distribution of transportation data by the public sector, which is better suited to doing it economically; it ensures public control over traffic patterns; and the open architecture would allow extensive private sector competition for equipment to distribute the information.

“Ways to Improve Traditional Opportunities for IVHS Development and Deployment,” a paper presented during this panel and summarized in the proceedings, listed three specific barriers to the development and deployment of IVHS: technical issues, which are relatively easy to resolve; institutional issues, which are currently being explored; and issues around market development and behavior modification, which will contribute to the success of IVHS. This paper asserts that the FHWA, which at this point is ahead of state and local agencies in planning for NHS roles, innovation and strategies, must assume a more aggressive role in stimulating state and local IVHS development by tying the allocation of federal money to the state and local agencies’ IVHS deployment activities. Equity issues, such as the cost of any in-vehicle equipment required to receive the full benefit of an IVHS system, were also mentioned as worthy of additional attention.

A second paper entitled, “IVHS Deployment and Public/Private Sector Issues,” focused on encouraging more private sector involvement with IVHS and was summarized for these proceedings. Taking the point of view of a telecommunications firm, the paper concluded that private sector firms need to be able to determine their initial costs, operating costs, and revenues before making the investment into IVHS. Several recommendations were offered: outline possibilities for private sector participation in operational tests; incorporate methods of estimating alternate routing into the operational tests; information and benefits should be shared with the private sector; develop an outreach program to involve the private sector more; and develop an understanding of how IVHS technology fits in with the forces driving private companies.

Finally, “IVHS Deployment and Public/Private Issues: A Purely Private Model,” examines the franchising model. Resulting recommendations were discussed: an “authority” needs to be established, possibly through a public corporation, with which the private sector can interact; and a public sector business plan needs to be developed which addresses marketing strategies, minimizes technical obsolescence, promotes safety, offers cost effective procurement policies, and returns revenue to the public authority. Two possible paths were offered for IVHS deployment scenarios. The first would use FHWA funding for the development of a proof-of-concept model. The other would utilize the request for proposals (RFP) process with financial incentives to stimulate private sector interest. The summary did not provide any additional details.

The final panel, “Procurement Issues, Operational Tests, Design and Deployment Issues, and Other Topics,” discussed three papers. The first summary, “Design and Development Alternatives for ATMS and ATIS Components of NHS,” considered three approaches to the implementation of TVHS: the engineer-contractor approach, the program-manager approach and the design-build approach. The first is dismissed because of flaws, such as the length of time it takes to deploy due to sequential tasking sometimes with long gaps of inactivity and the need to

accept lowest bids. The use of a single point of contact in the program-manger approach with a cost-plus-fixed fee contract would break procurement up into appropriate packages and allow easier modifications and potentially reduced costs. The design-build approach, which differs more from the classic engineer-contractor approach, could offer shorter delivery time, lower demands on the public agency, and reduced costs through procurement efficiency and selection of a designer-builder on the basis of qualifications. The summary did not elaborate on the best choice.

The next summary, “Enhanced Procurement Procedures and Other Solutions to Maximize Private Sector Involvement with IVHS,” examined ATMS and toll roads focusing on the financing of systems, using a design-build approach, operations, maintenance, and franchising. The traditional procurement approach was found to be limited by the restricted participation allowed to the private sector; the design-build model, where a contractor agrees to complete the work for a specified price in a stated time frame was preferred. The development of national intelligent transportation systems (ITS) standards, so that every product would not need to be qualified for each state separately, was also discussed in this summary.

Finally, the summary of “Evaluating Institutional Effectiveness: Development of Concepts and Methods for Incorporation into IVHS Operational Field Tests” categorized institutional influence in three ways: relationships between organizations, relationships within organizations, and the impacts of program activities on the end users of the technology. Additionally, it was noted that the nature of the technology might effect the deployment of IVHS projects. The summary recommended that operational field tests review implementation in two ways: first, establish the institutional setting by documenting the implementation conditions; then conduct in-depth case studies on selected tests to identify and evaluate specified institutional arrangements. In closing, the point was made that some failure should be an expected and important part of the process of implementation and should be learned from.

Eight points were offered in summary as common themes from the workshop:

- Education is needed regarding public and private sector opportunity within IVHS.
- Public agencies need to adopt new methods. especially in the area of procurement.
- The public sector needs to be aware of factors that motivate the private sector.
- The private sector needs better cost-benefit assessments and property right protection.
- Public sector incentives boost private sector opportunities in ATIS and ATMS.
- New relationships must be cultivated by the public sector with unfamiliar industries.
- Public transit is a necessary part of innovative approaches to transportation needs.
- Federal and state environmental concerns provide motivation for IVHS deployments.

Document: "Legal Constraints To The Research, Development, and Deployment of IVHS Technology in the United States," (Final Report)

Author: Professor Kent Syverud/Michigan Law School

Date: December 16, 1992

This document addresses the legal feasibility of intelligent vehicle-highway systems (IVHS) and the constraints posed for IVHS technologies by American law, legal institutions, and lawyers. The purpose of this study is not to solve all the legal problems posed by IVHS technology, but rather to identify those problems that require further attention and those problems which do not. The conclusions are based on a survey of relevant literature and interviews with numerous IVHS participants. An outline of the players and their legal relationships is given to facilitate comprehension of the legal hurdles presently faced by M-IS participants.

The small amount of existing research directly pertaining to IVHS technologies has focused almost entirely on two types of legal constraints to IVHS: legal liability and intergovernmental cooperation. The potential tort and product liability of IVHS has been the major concern prompting participants to seek legal advice. In a previous study, "Liability and the Insurance Implications of IVHS Technology," (Syverud 1990), the author had hypothesized that the liability problems of WI-IS vehicle information systems, with the exception of systems which dilute driver control of the vehicle, were not serious and could be managed using the same risk management devices commonly used for many other automotive and highway technologies. Research to date, based on litigation experience with cruise control systems, has not validated the author's hypothesis that IVHS systems which dilute driver control will result in serious liability, because manufacturers were able to design the technology to limit both the probability of accidents and the likelihood that the technology would be at fault.

Many IVHS applications require cooperation across the levels of government: federal, state, and local, which share responsibility for regulating and operating American cars and highways. Three studies, "Legal Issues Relevant to the Current IVHS Project of the Road Commission for Oakland County, Michigan," (Carty 1992 (draft)), "The Effect of IVHS Liability Issues on Intergovernmental Cooperation," (Grubba 1990), and "Institutional Barriers & Opportunities for IVHS Systems in Commercial Vehicle Operations: An Iowa Case Study," (Maggio 1992 (draft)), have analyzed problems of intergovernmental cooperation on particular IVHS projects and have found that coordination of efforts and negotiations among various governmental entities is time-consuming, and often requires research and technical expertise in state law and regulation. None of the studies reported that the need for intergovernmental cooperation was a serious barrier blocking the implementation of IVHS applications.

Aside from tort liability and intergovernmental cooperation, IVHS participants have flagged numerous other potential legal barriers to the technology, including most prominently, problems of privacy law, procurement law, intellectual property, and antitrust law. However, published research on these issues as they apply to IVHS is sparse.

One of the more significant obstacles to understanding IVHS legal barriers is the need to understand the incentives and relationships of the many types of organizations involved in IVHS efforts. Many IVHS programs involve a wide array of public-private partnerships, intergovernmental arrangements, and private joint ventures. Universities and quasi-public organizations are also parties to many arrangements. To a significant extent, some of the perceived “legal constraints” to IVHS are in fact simply the experiences of private companies who are dealing, for the first time, with established regulatory methods for highways and automobiles.

IVHS organizations interact to promote IVHS technologies through an array of legal and institutional relationships. Most of these relationships are combinations or permutations of six different models: traditional government contractor models, deployment projects and operational tests, private market relationships, government franchises, privatized infrastructure, and advisory relationships.

Cooperation between public and private entities is often necessary in funding and executing IVHS projects, and frequently requires negotiation concerning the allocation of legal rights and responsibilities. These negotiations have at times been extensive and on-going and have been the most fertile source of legal barriers experienced by IVHS organizations. In addition, the powers and limitations of utilized independent advisory committees is poorly understood and a primer by a government lawyer on the subject was suggested by the author.

The study revealed that six categories of legal problems have already been investigated or experienced by IVHS participants: tort and products liability issues; procurement and intellectual property issues; intergovernmental cooperation issues; privacy issues; contract negotiation issues; and Federal Communications Commission issues. The only issues which have actually materialized in disputes that have significantly stalled or constrained IVHS projects are procurement and intellectual property issues and contract negotiation issues. All other issues have turned out, once investigated in actual IVHS projects, not to pose serious obstacles.

None of the IVHS applications that have been implemented as operational tests or other deployments have produced a single lawsuit or even threat of a lawsuit arising out of tort or product liability law. Concern remains that fear of liability is stalling development of advanced vehicle control systems (AVCS) technology. Participants in IVHS AVCS research are seriously worried about the possibility of catastrophic liability that could attach to a design flaw or a central control system failure in a headway-keeping system or automated highway.

Almost everyone interviewed by the author identified specific procurement related concerns that have already constrained IVHS technology. The most common complaint was directed at the FHWA and involved the FHWA’s insistence on retaining intellectual property rights to products and applications developed in part through federal funding. Although no project has failed and no participant has withdrawn from FHWA projects due to procurement related concerns, procurement issues seem to have been the most time-consuming and irritating legal constraint that IVHS participants have confronted. The negotiations have been long and drawn out, especially over intellectual property issues.

Many approaches to managing legal constraints to IVHS have been mentioned, researched, or attempted in the last few years. The author found none of the tort liability approaches entirely satisfactory and emphasized that one of them—the choice of manufacturers to implement IVHS technologies abroad prior to implementation in the U.S.—has serious potential for stifling development domestically and giving the lead in IVHS technologies to foreign competitors. This would damage U.S. competitiveness in highway and automobile technology. It was also noted that indemnification by statute for AVCS would be difficult to obtain, although it may be the only means to achieve significant deployment of automated highway systems in the U.S.

Although no participants viewed privacy issues as posing serious obstacles to future IVHS research, development, or deployment, the author is convinced that privacy problems may be more serious in the future than is currently anticipated. The author argues that privacy issues, which may take longer to materialize than issues in other areas, can be best managed at present by a concerted effort to identify the stakes of all effected participants in the dissemination or confidentiality of IVHS data. Upon identifying the stakes and potential conflicts, the author recommends that IVHS America should work toward drafting a statement of guiding principles on privacy issues for IVHS technologies.

The author believes that many of the procurement, intellectual property, and contractual negotiation problems that inspire the most bitter complaints today can be overcome through educational efforts and the experiences of IVHS players with the unique procedures and problems of IVHS procurement at the federal, state, and local levels. The most serious legal constraint to IVHS research, development and deployment, according to this study, seems to remain the tort liability problems of AVCS.

Document: “IVHS Public/Private Partnerships: Managing the Legal Issues,” Workshop Proceedings

Author: IVHS America Legal Issues Committee and the Federal Highway Administration

Date: Workshop held January 25-26, 1993

The workshop proceedings are divided into eight sections: intelligent vehicle-highway systems (IVHS) background materials, an outline of cost accounting for government contracts, project documents from Westchester County, various project agreements, a discussion of teaming agreements, a sample privatization agreement, a brief outline of intellectual property rights under government contracts-including the text of relevant laws and regulations, and biographies of workshop participants. This summary will focus on sections five and seven, the discussion of teaming agreements and the outline of intellectual property rights, respectively. These two sections are the most relevant to this task.

In the paper “Teaming Agreements,” teaming agreements are defined to mean agreements made between prime and subcontractors before a contract is awarded to work together on a project. Typically most control and responsibility rests with the prime as do the eventual profits. No new legal entity is created by such an agreement which is generally made at the time a request for proposal (RFP) is issued. The importance of these kinds of arrangements has recently been on the rise due to two main considerations: the increasing complexity of technological requirements and the government procurement strategy of competitive teaming.

The paper emphasizes the importance of teammate selection and includes a list of questions for prime contractors considering subcontractors for a teaming agreement. Naturally, one issue raised is that of compatibility. Working well together is likely to contribute to the project’s chance for success, so teammates should be selected with technical and organizational compatibility in mind. As a subset of this issue, the potential for future competition between teammates should be included when considering a teaming agreement.

The importance of the agreement is such that great care should go into its crafting. Although there is not a fixed formula for drafting a teaming agreement, because the goals and resources involved in each situation is unique. the agreement should be in writing, with all responsibilities and rights specifically and clearly articulated. A major point to remember is that the language chosen for the teaming agreement could substantially effect the final subcontract with significant impact of the potential liability each partner faces. While the desirable level of detail is specific to the nature of each agreement, leaving an agreement vague in order to preserve flexibility also adds in an unknown variable which could lead to serious conflict among the partners. This must be balanced against the cost of providing a very detailed and specific proposal which could prove difficult to re-negotiate or modify when necessary. The interests of all parties need to be analyzed and addressed in any agreement which maximizes the chances for winning and successfully completing a contract. Legally, one point to remember is that while federal procurement laws govern the relationship between the Federal Government and the prime, state law governs the relationship between the prime and the subs.

Some more general concerns to keep in mind when drafting a teaming agreement are compliance with antitrust law and confidentiality agreements regarding the use of each other's proprietary information. The latter is actually best addressed before the start of any teaming agreement negotiations in order to facilitate the flow of information and build trust between the parties. A general outline for provisions which should be included in any teaming agreement would include a statement of purpose which addresses antitrust and intellectual property concerns along with a discussion concerning why the parties are agreeing to team, definitions which include the procurement program, a detailed statement of work, a section of the responsibilities of the agreeing parties-this is the most important part of the teaming agreement, effects of the teaming agreement on the abilities of the parties to contract elsewhere, a disavowal of joint-venture status, procedures for modifications, limits on the use of intellectual property and any relevant licensing agreements, clauses for expirations and termination of the agreement, dispute resolution, and any other clauses which the parties might feel appropriate to include based on the nature of the team and the work.

In conclusion, the paper notes that while teaming agreements have the potential to allow parties to successfully compete for work which otherwise would be unavailable, and, thus, to open new opportunities for growth, the competing interests involved requires that great care go into the negotiation and drafting of the teaming agreement. Otherwise, participants may face at best an unsuccessful venture or at worst litigation.

The outline "Intellectual Property Rights under Government Contracts," discusses the use of both patents and data. The overall intent behind government policy is summarized as "get government developed patents. or data, out into the public domain as soon as possible while recognizing that the public sector needs to be compensated and protected regarding its contributions."

The outline gives a brief history of intellectual rights: first, the government always took title, but that discouraged the commercialization of government owned patents; later, a blanket policy allowing non-profit and educational institutions to retain titles was adopted and small businesses eventually were included as well; finally. a Presidential Memorandum from Ronald Reagan dated February 18, 1983 gave all contractors the same rights as those enjoyed by non-profits and small businesses.

The outline goes on to discuss specific provisions regarding patents and data. The policy of the aforementioned Presidential Memorandum is outlined and put into practice for most contracting officers by 48 Code of Federal Regulations (CFR) Section 27.302 and 48 CFR 52.227- 11, respectively.

Under 35 United States Code (USC) Section 202(a), the government is allowed'to take title under certain circumstances, such as when the contractor is not located in the U.S. and also does not have a place of business here, for national security reasons, contracts for the operation of Department of Energy contractor operated facilities, and, "in exceptional circumstances when it is determined by the agency that restriction or limitation of the right to retain title to any subject

invention will better promote the policies and objectives of this chapter.” However, 35 USC Section 202(b)(2) is meant to curtail the possible abuse of such a broad clause by stating, “Whenever the Administrator of the Office of Federal Procurement Policy has determined that one or more Federal agencies are utilizing the [above] authority [to take title to inventions]...in a manner that is contrary to the policies and objectives of this chapter, the Administrator is authorized to issue regulations describing classes of situations in which agencies may not exercise [the above authority].”

The minimum rights of the Federal Government include a paid-up, non-exclusive, irrevocable license for governmental use. This does not allow sublicensing to competitors of the patent holder. However, the government is permitted to “march-in” and require a competing manufacturer to be licensed under reasonable terms when the patent owner has not commercialized an invention which is in demand, has not met health or safety needs, has not met federal requirements regarding public use, or has not complied with the required preference for U.S. industry in the manufacture of the invention. No specific references to actual laws or regulations were made in the outline’s discussion of these rights.

The government enjoys three types of rights regarding data delivered under a contract, depending on the type of data: unlimited rights for most data; limited rights to trade secrets, commercial or financial data pertaining to items, components or processes developed at private expense; and restricted rights, usually concerning software. Among the specific clauses and provisions discussed, 48 CFR Section 52.227-14 gives the government unlimited rights in cases where the data is first produced in the performance of the contract; and where form, fit and function data are delivered under the contract, operating and maintenance manuals are produced, data is delivered without specified limitations or restrictions. This section also gives the contractor the right to release, use, reproduce, publish, or distribute data which was first produced under the contract or specifically used in its performance, unless otherwise specified.

Clause 48 CFR Section 27.408 covers cosponsored research and development activities and states, “Since the purpose of the cosponsored R & D, the legitimate proprietary interests of the contractor, the needs of the Government, and the respective contributions of both parties may vary, no specific clauses are prescribed, but a clause providing less than unlimited rights in the Government for data developed and delivered under the contract...may be tailored to the circumstances...As a guide, such [a tailored] clause may be appropriate when the contractor contributes money or resources, or agrees to make repayment of the non-recurring costs, of a value of approximately 50% of the total cost of the contract...and the respective elements are not readily segregable...” When the contribution of the contractor is readily segregable, the data may be treated as data under any other type of contract.

Document: “Institutional Impediments to Metro Traffic Management Coordination”

Author: Booz, Allen & Hamilton Inc.

Date: September 1993

This report describes the institutional impediments to greater metropolitan traffic management coordination and implementation of advanced traffic management systems (ATMS), which is an intelligent transportation system (ITS) technology. The report also presents appropriate solutions for the identified impediments. In the context of this study, institutional impediments were identified through examining current practices in six metropolitan areas, selected to represent a mix of population size, geographic locations, and levels of experience and sophistication in traffic management integration and implementation in ATMS technologies.

Key impediments identified in the report fall into the three major categories of “Awareness and Understanding of ITS and ATMS,” “Organizational Cooperation,” and “Availability and Sources of Funding.” The first specific issue included in the Awareness and Understanding of ITS and ATMS category is the issue of the lack of a common understanding and vision of ATMS. The degree of understanding of ATMS is inconsistent among stakeholders and is viewed differently by each metropolitan area and by individuals within an area. In fact, a common question asked of the report’s interview team was, “What are the objectives of ITS and ATMS?” Project participants note that the vision held by individuals interviewed of ITS technologies is often based on technical level committees or traffic and incident management programs. The report finds that the general public does not have a clear view of ITS or ATMS as programs. Proposed recommendations to combat the lack of understanding of ITS and ATMS include to conduct a marketing and advertising campaign introducing the technologies associated with ITS with a goal of creating consumer demand for the services and benefits provided.

A lack of understanding of “What’s in it for me?” prevails among all three major ATMS stakeholder groups-public sector organizations (including politicians), the private sector (business), and the general public. With the exception of a respondent in one metropolitan area, none of the individuals interviewed for this report was aware of any formal benefit or cost analysis of ATMS projects that had been done. A recommendation to combat this issue is to answer the “What’s in it for me?” question by providing good demonstrable project evaluations of ATMS projects and defensible cost and benefit analysis, and to support these evaluations and analysis with hard data.

Another impediment included in the Awareness and Understanding of ITS and ATMS category is that few formal outreach programs are underway that focus on ITS and ATMS. Project participants note that outreach programs are essential mechanisms for providing information to the various stakeholders involved. Outreach from the national level would provide the program objectives and a statement of the “vision”-important ingredients necessary for the success of the program. Local outreach would provide necessary background to implementation personnel, specifically, state, county, and city government organizations; supporters, mainly politicians; and users, the general public. Project participants maintain that if the general public and private

sectors are to buy into deployment of the targeted technologies, there must be more of these outreach efforts and they must address the subject matter in more generic terms.

Another issue in this area is the few formal or informal education programs available to train personnel at all levels in ITS technologies. ITS technology areas are evolving from a variety of sectors. Some of the technologies are a normal evolution of previous automated traffic management and control systems, while some are the result of technology transfer from defense-related industries. The training and support mechanisms necessary for preparing technicians and management staff lag behind the capabilities of the technology. To deal with this void, project participants recommend adopting an academic strategy to expedite the inclusion of ITS subjects in existing college and university curriculums.

In the category of Organizational Cooperation, project participants note that responsibility for traffic management system operations is dispersed among numerous jurisdictions in metropolitan areas. As a result, changes to the operational organizations involved in metropolitan traffic management will be difficult to achieve because of resource constraints and “turf battles.” To deal with this issue, project participants recommend developing work plan guidelines for implementing ATMS. These guidelines will help guide metropolitan areas in implementing ATMS from concept to contract with standardized forms and procedures. The plan should outline a step-by-step approach for implementing one or more ATMS technologies in an area.

Another organizational problem is that limited ATMS skills are available to stakeholder organizations, even in those areas in which some of the technologies have been implemented. The skills are limited both in the number of technologies understood and in the number of “experts” residing within the metropolitan area. A proposed strategy for dealing with this issue is to define skill sets required by metropolitan areas. Preceding the actual development of courses, seminars, and curriculum programs, the skill sets required to implement and maintain various ATMS technologies in metropolitan areas must be defined. First, existing job categories that can bring about these skills should be examined, and then, any additional specialized training should be identified.

A further organizational impediment identified by project participants is the confusion that exists surrounding private sector roles in public-private partnerships. Although recent legislation permits more significant involvement by the private sector in financing highway infrastructure for profit, procurement laws and guidelines to some degree do not encourage this concept. The public-private partnerships found in many of the metropolitan areas visited by the review team are very limited. A proposed strategy to deal with this is to sponsor federally-funded training seminars or programs to metropolitan areas attempting to implement ATMS technologies. The seminars should focus on team building across organizational boundaries. Case studies and practical exercises would be appropriate, and the training should be given over two to three days in an off-site environment. In addition, the training should include a mix of people ranging from high and middle level management to staff personnel.

The issue of Availability and Sources of Funding surfaced in all of the metropolitan areas visited by the review team, although the review team did not ask directly about future, specific sources

of funding. Clearly, the need for consistent and sustainable funding is a primary issue in this area. Project participants note that sources for funding for designing, building, operating, and maintaining ATMS have not been fully identified and that in the metropolitan areas visited, perceptions exist that hinder availability of this funding. These perceptions include that state and local governments are unwilling or unable to take on greater debt and are particularly concerned about their ability to support the operations and maintenance phase of an ATMS program; that the general public is unwilling to tolerate new or additional taxes or tolls; and that private sector financing is unlikely until public and private roles are further defined and business viability is proved. The proposed strategy for combating these perceptions includes encouraging a vision of evolutionary ATMS implementation. This refers to encouraging metropolitan areas to think of ATMS as an evolutionary process of staged implementation, rather than a “quantum leap” to a new technological base. Capabilities can be funded and built gradually as part of normal equipment replacement programs.

The allocation of costs among jurisdictions is the final issue presented in the availability and sources of funding category. The costs incurred to design, build, operate, and maintain ATMS will be difficult to allocate among metropolitan area stakeholders. Cost allocations should logically be based on the benefits to be received by the various stakeholders. These beneficiaries may not be obvious, but will likely include the general public, both inside and outside metropolitan area boundaries: businesses in which long distance commuters are employed; businesses close to work locations; and governments realizing additional tax income from the local business. A strategy presented to deal with this issue is to develop and distribute general cost allocation guidelines and models for use by the metropolitan areas. The report concedes that the allocation of costs associated ATMS deployment operations and maintenance will be difficult. However, approaches to cost allocation have been developed and documented in the past for the Federal Highway Administration and others. These allocation approaches and formulas should be reviewed and updated in light of any new legislation, and new guidance should be prepared as needed.

Document: “Advanced Vehicle Control Systems Potential Tort Liability For Developers”

Author: Nossaman, Guthner, Knox and Elliott

Date: December 1, 1993

While advanced vehicle control systems (AVCS) exhibit great promise for increasing the safety and efficiency of highway transportation, the manufacturers, sellers, and designers of these systems face serious vulnerabilities to potential tort liability from AVCS-related accidents. Any product is subject to the possibility of malfunction, and the higher speeds and increased density of traffic expected as a result of AVCS implementations could conceivably lead to massive numbers of injuries, fatalities, and lawsuits.

Of all the intelligent vehicle-highway systems (IVHS) technologies under development, AVCS carries the greatest likelihood for product liability because it encompasses technologies which transfer control from the driver of a vehicle to independent systems. There are three legal bases for charging a manufacturer, designer, or distributor of AVCS with tort liability: negligence, strict liability, and breach of warranty.

Liability for negligence is predicated on the failure of the defendant to exercise the appropriate level of due care in order to ensure that a product does not subject its user to unreasonable risk. The injured victim must prove failure to exercise due care, proximate cause and damages. Strict liability focuses on the defectiveness of the product rather than the actions of the defendant. This is fertile ground for AVCS liability since a defendant cannot be absolved of responsibility based on due care, and no privity (legally close relationship) with the defendant is required.

Defenses to strict liability and negligence claims include contributory and comparative negligence, assumption of the risk, and product modification or misuse. Contributory and comparative negligence might not be applicable defenses if an AVCS product results in a transfer of vehicle control from the driver to the vehicle. However, there are AVCS products, such as collision warning systems or vision enhancement systems, where contributory or comparative negligence could be a factor in an accident where the driver fails to react appropriately to a warning from the system.

When a consumer knows of a defect in a product and the subsequent risk of using the defective product, but nevertheless voluntarily chooses to use the defective product and is then injured, the consumer is said to have assumed the risk involved in using the product. Some states consider this defense to be part of comparative negligence. The application of this defense to systems which completely control a vehicle is likely to be rare as few people are likely to assume such a great risk.

Product misuse or modification is another type of defense against liability claims. Those who manufacture, distribute, or retail an AVCS product would not be liable for injuries caused by intentional or unforeseeable misuse, or by use in violation of safety standards. Misuse is only a defense when it is both the proximate cause and unforeseeable. The manufacturer or vendor will

not be strictly liable if a substantial modification, which was both the cause of the accident and not foreseeable, was made to the original product either by the user or a third party. This defense may not be applicable to AVCS depending on whether or not the system can be modified by the user at all.

Breach of warranty can take two forms: breach of express warranty and breach of implied warranty. Express warranties are statements made by either the manufacturer or vendor of goods, either orally or in writing, that affirm the goods shall conform to the promises of the provider as part of the basis of the sale. The law imposes certain implied warranties onto products which could expose IVHS vendors to liability. Implied warranty of merchantability addresses the consumer's expectation that products will be free of significant defects and will perform as goods of that kind are expected to perform. The implied warranty of fitness for a particular purpose requires that the consumer purchase the good for a specific rather than an ordinary purpose. The implied warranty of fitness would then be limited in applicability to AVCS products since they would probably only be purchased for their ordinary purpose

If an injury is the result of a product's failure to conform to the express warranty, then the injured party may sue for a contractual breach of warranty. Although technically a contract dispute, this is typically coupled with claims of negligence or strict liability. Of all the potential liability claims, breach of express warranty is least likely to impede the development of AVCS because private sector entities can choose not to warrant a feature or safety level they will breach.

Other types of tort claims which AVCS manufacturers or vendors may face are false or negligence advertising, fraud, and negligence misrepresentation. Since AVCS involves the introduction of new products, about which consumers will have little knowledge, into the marketplace, it is important to make sure only truthful information is transmitted to the public by the manufacturers and sellers. Imposing strict liability for certain misrepresentations would serve this purpose and is important considering the potentially serious problems which could otherwise result.

The extent of the Federal Government's potential tort liability is one of the key issues arising from its involvement with AVCS projects. Although it is expected that the private sector will bear primary responsibility for the development of AVCS, the Federal Government will be funding AVCS projects and developing performance specifications and guidelines. This could result in a shift of automobile accident liability from the driver, who now usually bears it, to the government.

The government's potential tort liability is diminished by the discretionary function exception, which the Supreme Court has ruled to include actions taken to meet policy goals and actions at operational levels, as long as the actions involve choice and judgment and are not controlled by statute or regulation. Liability for economic losses is diminished by the misrepresentation exception which shields the government against suits for misrepresentation, both negligence and intentional and against some suits based on the failure to provide information or the failure to warn.

Some or all IVHS products will likely be developed by the private sector based on government plans or specifications. Private contractors working from these specifications may be protected from liability under the government contractor's defense. This would be significant because, the development of AVCS services rests largely on the private sector, with the public sector (the U.S. DOT) providing the performance specifications. Infrastructure will be provided by private companies under contract to the state and local governments. The contract specifications defense, in which it is argued that a contractor should not be liable for producing a product whose specifications are outside of its control, may also be used. In the context of AVCS, this defense provides some protection to contractors responsible for the assembly, but not the design, of AVCS products.

Contribution, where liability is distributed among all involved parties, and indemnity, where the liability is assigned to a specific entity are two principles which will allow the redistribution of much of the lawsuit costs which arise out of AVCS products. This redistribution will be largely away from the developers, distributors, and retailers and toward the manufacturers. The availability for reasonable priced insurance will significantly impact the willingness of the private sector to participate in AVCS development.

Existing tort law exposes the private entities involved with AVCS to claims for negligence, strict product liability, breach of warranty, fraud, negligent representation, and negligent or fraudulent advertising. The potential tort liability could be drastically reduced through a variety of legislative changes to existing law: preempting state tort law by uniform federal laws; enacting limitations to liability, such as modifications to strict liability or to failure to warn liability; disallowing all suits against the private sector; limiting the amount and type of compensatory damages; limiting punitive awards; mandating a consistent statute of limitations; providing joint and several liability; providing indemnification by the Federal Government; and mandating alternative dispute resolution.

Document: "Intellectual Property Rights and the National IVHS Program"

Author: Nossaman, Guthner, Knox and Elliott

Date: December 1, 1993

The objective of this paper is to determine the extent to which the national Intelligent Vehicle-Highway Systems (IVHS) program may be constrained by issues surrounding intellectual property rights. This effort was incorporated in the Department of Transportation's report to Congress on non-technical constraints to IVHS, which is required by the Intelligent Vehicle Highway Systems Act of 1991 (IVHS Act).

This paper examines the adequacy of current law and government procurement policy for protecting the intellectual property rights of private sector developers of IVHS technology and the public interest in obtaining sufficient rights to technology developed with public funds and assuring the appropriate use of basic technologies to enhance public safety and mobility. Special concerns with respect to intellectual property rights in the development of IVHS technologies are discussed and actions recommended to address the issues and concerns raised by this analysis.

The success of the IVHS program depends heavily on the private sector and cooperation between the public and private sectors. In addition to the need for cooperation between the public and private sectors, the separate needs of each sector must also be addressed. In this case, the private sector's need to make a profit and the public sector's interest in retaining rights to use and promote technology developed with public funds are often a source of conflict. The potential loss of intellectual property rights to core technologies, including the release of these technologies into the public domain, is a very serious issue for private sector entities considering involvement in the IVHS community. It discourages firms from participating in publicly funded IVHS projects and must be considered the most significant potential constraint to the IVHS program related to intellectual property. The increased costs of extended negotiations for procurement contracts due to intellectual property concerns is a secondary constraint.

While state and local governments generally have greater flexibility in the contractual acquisition and disposition of intellectual property rights, a limitation arises when projects are funded in whole or in part by federal money. In this case, state and local grantees are required to impose the grantor's requirements regarding intellectual property. Thus, the requirements of the Federal Government will be a central issue at all levels.

The forms of intellectual property at issue in the IVHS program are patents, copyrights and trade secrets. The extent of the restrictions on the allocation of intellectual property rights due to federal funding is based on the source and purpose of that funding.

The minimum rights retained by the government under the standard patent rights clause are a paid-up, non-exclusive, irrevocable license for governmental use and "march-in" rights which require a competing manufacturer to be licensed under reasonable terms when the patent owner has not commercialized an invention which is in demand, has not met health or safety needs, has

not met federal requirements regarding public use, or has not complied with the required preference for U.S. industry in the manufacture of the invention. There is a perception in the private sector that these rights threaten profitability and that may cause private entities to avoid “entanglements” in publicly funded IVHS projects. However, in actuality, federal policy promotes the retention of ownership rights by private sector entities working with federal funds. Such rights may be inadvertently lost due to neglect, but reasonable expectations of private sector participants can be met so long as those participants take positive action to retain their full rights. Steps to prevent the application of restrictions to pre-existing or independently developed technology are implementing a patent protection program which tracks and documents such inventions, defining the statement of work for a project funded with federal funds as narrowly as possible in accordance with project goals, separating privately funded projects from publicly funded ones, and, where appropriate, and defining the phrase “for or on behalf of the United States” to limit the scope of the license retained by the government.

As with federal patent policy, current policy concerning copyrights and data rights can accommodate reasonable expectations of private sector participants in IVHS development. The same precautions discussed with respect to patents can be applied in this case. In the case of trade secrets, federal law protects trade secrets which may be revealed in the course of a federally funded project by prohibiting their disclosure. Again, clear documentation of intellectual property in advance of entering into a publicly funded project is necessary to maximize the preservation of intellectual property rights.

Caution should also be used in dealing with state law regarding intellectual property as requirements will differ and can be dependent on the funding arrangements of the particular project. Participants should be prepared to negotiate with state agencies as they would with another private sector entity.

This paper concludes that the current federal policies can accommodate the reasonable expectations of private sector participants in IVHS development while noting that there is still fear in the private sector regarding the complexity and ambiguity of federal policy. It suggests that the most effective means to address this concern is education and clarification. Toward that end the authors recommend developing new and explicit regulations or guidelines to define (1) the circumstances under which the Federal Government will seek rights to specific technologies developed in whole or part with federal funds; (2) steps a private contractor may take to avoid improper attribution of existing or independently developed technology; and (3) the range of uses for technology where the government retains any rights. Although liberalization of intellectual property policy has the potential to alleviate the fears of the private sector and fuel increased participation in the IVHS program, the authors do not believe that a wholesale change in government policy would be clearly productive.

Document: “Workshop on IVHS and Intellectual Property”

Author: Federal Highway Administration and IVHS America

Date: January 25, 1994

This document consists of a program agenda, biographical information on workshop speakers, a list of workshop issues, breakout session guidelines, the Intelligent Vehicle-Highway Systems (IVHS) Legal Issues Newsletter, and seven papers, articles, or materials related to workshop presentations. The document also includes various references, such as a sample intellectual property provision from an operational test partnership agreement, relevant laws compiled and annotated, a summary of “Intellectual Property Rights under Government Contracts,” the texts of regulations of interest, and an IVHS America Legal Issue Committee Roster.

Workshop issues consisted of questions submitted for consideration by the workshop participants. These questions are taken verbatim from the report:

- (1) What legal and administrative considerations does FHWA rely on to determine the allocation and administration of patent rights?
- (2) Is there any pending legislation which is likely to affect that allocation or administration?
- (3) What is the definition of “government purposes” for which a “reserved license” may be used?
- (4) Is this clause negotiable?
- (5) What is the difference between materials that are subject to copyright and those subject to patent, and how are they treated differently by federal and state governments or industry?
- (6) Under the various state public records acts, is it appropriate to accept the detailed cost proposals of contractors as proprietary and confidential and consequently refuse to disclose them?
- (7) Is such information a “trade secret,” for example, under a statute like the California Public Records Act (Government Code sec. 6250 et seq.) and is an indemnification agreement from the successful proposer holding the government harmless from liability for refusing to disclose the information an effective way to avert any exposure?
- (8) Are there other materials that need to be safeguarded as proprietary or “trade secrets” which concern private sector parties to IVHS transactions?
- (9) Are existing federal and state provisions and procedures protecting such trade secrets adequate?
- (10) How does or should federal intellectual property (IP) provisions “flow through” state and local parties to contracts with the private participants?

A copy of “IVHS Legal Issues,” the newsletter of the Legal Issues Committee of IVHS America, which focuses on intellectual property aspects to IVHS was also included in this document. The newsletter includes articles on intellectual property, a survey of relevant intellectual property legislation, U.S. DOT and IVHS America intellectual property projects, among other items of general interest to the reader. The first article in the newsletter is entitled, “Intellectual Property Rights and the National IVHS Program,” and is excerpted from a larger work of the same name,

which has been reviewed separately. Other articles published in the newsletter are “Intellectual Property Components of Procurement Reform” and “The Government License Under Federal Funding Agreements.”

“Intellectual Property Components of Procurement Reform” discusses two areas of procurement reform which may be of interest to IVHS participants: proposed changes in technology transfer rules and potential changes in allocation of technical data rights under federal contracts. Under current law, the Federal Government cannot obtain copyrights to computer programs which limits private sector interest in developing such material cooperatively since they would not be able to commercialize their efforts. Pending legislation would remove this restraint and enable the Federal Government to enjoy expanded rights to technology which could then be commercialized through technology transfer programs. Current policy regarding technical data rights, a subset of intellectual property rights, allocates these rights based on the funding used to generate them. Recent procurement reform efforts include a policy aimed at guaranteeing the government only those rights necessary to obtain competitive prices for future purchases. If a contractor could demonstrate that competitive prices could be obtained for the Federal Government without the use of the contractor’s intellectual property, or that the contractor should be a sole-source provider, the intellectual property rights in question would remain with the contractor and would not be passed to the Federal Government. At the time of publication, the author expected the debate to heat up in early 1994 when a government report on the subject was expected to be published.

“Government License Under Federal Funding Agreements” discusses the Federal Government licensing provisions of several federal patent laws and policies. The article argues that while the scope of the Federal Government’s retained license in inventions made with federal assistance remains undefined, statutory and policy provisions exist which limit the Federal Government’s rights to, or use of, the license, such as: (1) the Federal Government has licensing rights only to inventions conceived or first actually reduced to practice in performance of the contract; (2) the Federal Government cannot waive its rights to the license; (3) the Federal Government is restricted to using the license for its own purposes; and (4) the Federal Government cannot use its license in a manner that will place it in the position of being a competitor with the private sector. The article goes on to discuss the Bayh-Dole Act, asserting that its primary purpose is to facilitate the commercialization of inventions made with federal assistance. This is meant to address the concern that the public is not receiving the full benefits of intellectual property developed with federal funding when the private sector is not permitted to exercise its expertise in delivering new products and inventions to the marketplace.

Also in the newsletter were several items of relevance to privacy issues in IVHS including “Strawman,” a draft of privacy principles developed by the Privacy Task Group of the Legal Issues Committee, and the article “Privacy and IVHS.” “Strawman” proposed nine IVHS information privacy principles, which are repeated here verbatim:

- (1) IVHS information systems should center on the traveler’s interests;
- (2) IVHS information systems should be built and maintained in a manner visible to travelers;

- (3) IVHS information systems should have an appropriate role in enhancing travelers' safety and security interests, but absent consent, information identifying individuals should be safeguarded from all sources, including law enforcement;
- (4) IVHS systems should be secure;
- (5) IVHS information systems should comply with state and federal laws governing privacy and information use;
- (6) IVHS information systems should only collect information that is needed to fulfill IVHS purposes;
- (7) IVHS information systems, coupled with appropriate privacy protection, may be used for non-IVHS applications;
- (8) Federal and state freedom of information obligations require disclosure of information from government maintained databases which should balance the traveler's interest in privacy and the public's right to know;
- (9) These principles are dynamic.

"Privacy and IVHS" is the last entry of interest from the newsletter. This article asserts that there are two types of privacy issues related to IVHS development: information privacy, which deals with the access to historical information, and surveillance, which deals with real-time information regarding location or destination. The report mentions two approaches to these issues. The first is a "wait-and see" approach, meaning that no proactive action is taken and privacy concerns are addressed as they arise. The report does not recommend this. The latter is a proactive approach, meaning that system developers, et al., anticipate concerns, take action to address them in IVHS development and work with consumer and privacy advocates during IVHS design. The article does not provide any specifics regarding this second option.

"Protecting the Patent Rights of Small Businesses: Does the Bayh-Dole Act Live Up to Its Promise?" is reprinted from the **American Intellectual Property Law Association Quarterly** and discusses proposed revisions to the Bayh-Dole Act which might address some of the intellectual property concerns expressed by the IVHS community. The article outlines the dilemma faced by a small business that enters into a Small Business Innovation Research (SBIR) contract with the U.S. government. The government only obtains rights to "subject inventions," which are defined as inventions which are either "conceived" or "first actually reduced to practice" during the performance of a federally funded contract. Even though the contractor may file or already have been issued a patent, unless the invention has been successfully produced ("reduced to practice") prior to entering into the contract, the invention is considered a "subject invention." The contractor may elect rights in a subject invention once specific obligations to the government are fulfilled, primarily disclosure of inventions, prompt filing of patent applications, and making a written election for each subject invention. The government would retain "a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced on behalf of the United States any subject invention throughout the world." Thus the contractor may only assert its rights against commercial, non-governmental use. The extent of the commercial, non-governmental applications of the patent then defined its value with inventions which have primarily governmental applications worth very little to the contractor. The article discusses revisions of the applicable regulations, including narrowing the definition of subject invention to exclude

those inventions for which patent applications have been filed prior to the signing of a funding agreement and for which a patent is subsequently issued.

Next, “Technology Transfer Laws Governing Federally Funded Research and Development” is reprinted from the Pepperdine Law Review followed by the report “Intellectual Property Rights and the National IVHS Program,” in its entirety. Details of the latter report are addressed in a separate review. “Technology Transfer Laws Governing Federally Funded Research and Development” examines the legal basis for the Federal Government to promote the commercialization of technology developed with federal funding. The analysis has two parts: an examination of the legal authority of the government to patent and commercially license technology created in federal laboratories, and an exploration of the government’s authority to permit the commercialization of inventions made by government contractors or grantees during the course of federally funded research. The article concludes that the legal framework established by the Federal Government has been successful in facilitating technology transfer to the public sector.

Finally, “Intellectual Property Rights in FHWA-Funded IVHS Projects” then discusses the relevant basic laws and regulations and contractual provisions in representative FHWA funding agreements. Although federal law allows private entities to retain ownership of intellectual property developed using federal funds, the government retains the right to use that property for Federal Government purposes. Thus the twin goals of fostering private development and public applications of technology are met. However, some issues remain due to the nature of IVHS projects. For example, state and local governments play very active roles in many projects, but the federal requirements are not particularly well suited to accounting for the responsibilities these levels of government bear to the private sector. Some other difficult areas are the silence of uniform requirements for grants regarding rights to non-copyrighted data, lack of guidance on the application of the governments retained license to copyrights and patents, and the lack of guidance surrounding the rights to data or inventions developed under jointly funded projects—a situation characteristic of the IVHS program. The paper concludes that while it can be frustrating to have a lot of ambiguity in these situations, the ambiguity is also the flexibility that can be used to negotiate agreements based on the particularities of the project. Successful negotiation in such cases would require all interested parties be included.

Document: "IVHS Institutional Issues and Case Studies-Analysis and Lessons Learned"

Author: Science Applications International Corporation (SAIC)

Date: April 1994

This document describes institutional issues encountered during six Intelligent Transportation Systems (ITS) operational tests, strategies identified to combat these issues, and lessons learned. The report also presents recommendations for improving the performance of other operational field tests and deployments of ITS products and services. Unlike case studies in which projects have been completed and positive and negative lessons were learned after the total success of the system could be assessed, the case studies for this report were performed on projects that were in various stages of development, none of which had been fully deployed. Therefore, the report represents a snapshot in time during the progress of the projects, and issues identified at the time of the report's creation may only be temporary. The Analysis and Lessons Learned report is based on the ADVANCE, the Advantage I-75, the HELP/Crescent, the TRANSCOM/TRANSMIT, the TravTek, and the Westchester Commuter Central case studies.

Institutional issues identified in the report fall into the four major categories of "organizational and management," "regulatory and legal," "human and facilities resources," and "financial." Of the four categories identified, the largest number of issues identified are in the organizational and management category. Included in this category are cultural differences in public-private partnerships. Specifically, these differences refer to the projects' impediments that resulted from the different ways partners did business, particularly between the public and the private sectors. The strategy identified for combating these impediments is increased communication and patience, instilled by strong and determined leadership.

Another organizational and management issue identified in the report is the lack of inter-partner communications. Due to a proliferation of negative stereotypes regarding cultural differences; lack of trust; unclear and changing definition of goals, roles and responsibilities; and imprecise definition of evaluation, communication between partners suffered during the projects' start-up period. A proposed strategy for dealing with this impediment is to hold a 5- to 7- day retreat at the beginning of the project for the purpose of team building and developing the essential elements of a joint partnership agreement.

Management challenges are the final organizational issue noted in the Analysis and Lessons Learned report. These challenges refer to evaluation planning problems, over dependence on unproved technology, and contract and contractor problems. The suggested method for dealing with these challenges is to identify a strong program manager.

Regulatory and legal issues have more obvious near and far-term implications for ITS products and services than do other categories of issues identified. Unclear government accounting requirements is one problem in this area. Specifically, these are requirements maintaining that work performed with federal funding requires the accounting of direct, overhead, and fee

expenses incurred by private sector vendors. While the issue was not totally resolved at the time the case study was conducted, the solution will likely be the utilization of a third party auditor.

Another regulatory and legal issue is burdensome administrative requirements. The difficulty of administering funding from multiple sources is viewed as a hindrance in every operational test discussed. Project participants recommend implementing an end-to-end review of existing ITS administrative processes and procedures to deal with this issue.

Concern about liability and insurance, that is, the issue of who will insure vehicles for collision and liability for occurrences such as wrong-way directions, etc., is a further regulatory point. The strategy for dealing with this concern includes the proposal to require partners to self-insure and sign an agreement acknowledging the risks, and to screen drivers for safety.

Human and facilities resources issues in the Analysis and Lessons Learned report focus primarily on people, in response to two questions: 1) Do you have enough people, 2) Are the people qualified to do the work? One specific issue mentioned in this area is the quality and sufficiency of partner leadership. This refers to the criticality of the program manager role and the lack of partner leadership, authority, and continuity. The recommended strategy for dealing with this issue is to select a program manager who will make a full-time commitment to the position from project start through deployment and is good at communication and collaboration.

Other human resources issues relate to the quality and sufficiency of support resources and the perceived lack of quality and sufficiency of federal and state DOT staff resources, program staff resources, and contractor support resources. Recommendations for resolving these issues include to structure staffs with a combination of new hiring, retraining, and external support; maintaining a small staff with multiple diverse skills augmented with contractor support; and bringing integration and evaluation contractors on-board early to ensure resource flexibility.

Issues of financial and market uncertainty present the greatest diversity in definition as well as risk to deployment of ITS products and services. These include cost sharing and the manner in which costs will be measured. Specifically, the project reports indicate that the way in which non-federal partners apportion the expenses of an operational test is not uniform, but rather is left to the ingenuity of the partnerships. Proposed strategies for dealing with this issue include to link partners' cost shares to project activities or functions that must be performed, to use an independent party to assess dollar value of contributions, and to pro-rate cost share as a function of benefits accrued.

Numerous recommendations emerge from the six operational tests discussed in the Analysis and Lessons Learned report. First, project participants advocate developing an information packet to facilitate project start-up. Because start-up processes are unnecessarily problem-prone, an information packet would help participants to get organized and guide them through initial project activities. At a minimum, the information packet would include checklists on what must be done to enter into a partnership with the U.S. Department of Transportation, a glossary of administrative terms and acronyms, a description of roles and responsibilities of the partners and the various Federal Highway Administration offices, a summary of the various administrative

requirements, and a listing of lessons learned based on a survey of all on-going ITS operational tests.

Another recommendation described in the report is to promote the selection of a program manager who will make a full-time commitment and is good at communication and collaboration. Project participants found the program manager to be key to the success of any operational test. In addition to being good at communication and collaboration, the program manager should be detail-oriented and totally dedicated to the job. Additionally, this person must be skillful at public relations and have the ability to work with senior and middle management.

The third recommendation identified in the Analysis and Lessons Learned report is to provide commercial vehicle operations (CVO) operational test participants with special assistance as required. CVO ITS projects are particularly susceptible to institutional problems because of the number of organizations with different interests involved in those projects. Special care must be taken to provide the assistance requested and the time required to work out the problems which will likely arise.

Because evaluation requirements and terms are not well defined or understood, the report's fourth recommendation is to expand and institutionalize evaluation guidelines and requirements. Current Department evaluation guidance can be found in two source documents: the DOT Federal Register announcement dated September 1993 that requested partnership proposals for new operational tests and a MITRE working paper dated October 1993 entitled Generic Operational Test Evaluation Guidelines.

The final recommendation presented in the Analysis and Lessons Learned report is to develop and implement an ITS deployment strategy. Project participants found that sufficient attention is not being given to the critical issues associated with deployment, so a priority should be given to developing and implementing a national ITS deployment strategy. The recommendation states that a need exists to define, understand, and quantify the potential benefits of ITS to the general public. A master plan should be used as a road map to guide an ITS benefit assessment effort. In order to identify these benefits, requirements should be identified early in a test's life cycle so that they can be included in the evaluation plan. This recommendation also identifies a need to develop outreach programs at the national, state, and local levels.

Document: "Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highways Systems," (a Report to Congress)

Author: U.S. Department of Transportation

Date: June 1994

This document is the first of two special reports that Section 6054 (d) of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required the U.S. DOT to prepare on intelligent vehicle-highway systems (IVHS) non-technical and institutional issues. The report is divided into ten chapters: Barriers to Private Sector Participation in the Development and Deployment of IVHS Technologies; Institutional Impediments to Metropolitan Traffic Management Coordination; Procurement of IVHS Products and Services; the Role of Design and Performance Standards in the IVHS Program; Staffing and Education Needs; Antitrust Issues; Liability Concerns; Privacy Issues; Intellectual Property Considerations; and IVHS and the Environment.

In chapter 1, "Barriers to Private Sector Participation in the Development and Deployment of IVHS Technologies," the argument is made that in order to capitalize on the private sector's experience in developing, marketing and commercializing new products and services, which this report asserts is essential to the success of the national IVHS program, greater cooperation between the public and private sectors must be made easier. This can be accomplished through the elimination of barriers to private sector participation in the development and deployment of IVHS technologies, such as constraints that restrict or prohibit the sale of traffic data, limit the use of highway rights-of-way, or inhibit the ability of state and local agencies to delegate specific highway operations to private firms.

The discussion in chapter 2, "Institutional Impediments to Metropolitan Traffic Coordination," cites a recent report sponsored by the U.S. DOT, "Institutional Impediments to Metro Traffic Management Coordination," which concluded that public transportation agencies and political jurisdictions generally worked together effectively to introduce and operate traffic management systems. Many of the interviewees believed that greater interaction and cooperation is yet possible without significant changes to law, regulations or policy. A need was expressed by local managers for rigorous cost-benefit analyses to assist in the generation of public support and willingness to pay for large investments in advanced technologies. This report has also been summarized separately as part of this task.

Chapter 3, "Procurement of IVHS Products and Services," relates the fear that some within the IVHS community have that federal, state, and local requirements cause undue delay and difficulty in progressing with IVHS projects. Procedures designed to ensure fair treatment of potential contractors, such as maintaining strict arms-length relationships between public agencies and vendors, can make it difficult to attain the close working relationships necessary to facilitate the development of IVHS technologies. There may not be enough flexibility in current government contracting and acquisition rules to foster long term developmental projects. Conflict of interest requirements and lack of familiarity with government contracting requirements are two of the most pressing issues. The U.S. DOT is attempting to streamline

administrative processes and educate small firms about federal procurement policies. Many of the concerns discussed in this chapter were raised in the report “Procurement Issues in IVHS Development and Deployment,” which has also been reviewed as part of this task.

Chapter 4, “The Role of Design and Performance Standards in the IVHS Program,” relates the position that some private sector IVHS developers are arguing for the implementation of IVHS design and performance standards. Such standards could reduce market uncertainty, promote acceptability among users, limit liability, improve safety performance, and promote technological development. Although the chapter recommends starting with the establishment of a consensus on systems architecture, it goes on to warn that adopting standards too early could have a stifling effect on innovation and competition within the IVHS community. Large scale standardization is seen as too premature. While some role for the government is recognized as necessary in this endeavor, the chapter concludes that the private sector might be in a better position for establishing most standards for goods and services.

Chapter 5, “Staffing and Educational Needs,” addresses the concern that there may be a shortage of trained workers for the IVHS industry. If necessary the declining defense industry was cited as a potential source of workers with professional and technical skills. However, the chapter concludes that there does not seem to be an immanent shortage. A related issue, which is not resolved, is whether the budget to hire enough qualified workers will be available to local and state transportation departments.

Although the U.S. DOT does not anticipate problems in the area of antitrust law in the conduct of legitimate IVHS joint ventures, chapter 6. “Antitrust Issues,” discusses relevant guidelines which have been developed against this possibility. The National Cooperative Research and Production Act of 1993 (NCRPA) established guidelines to limit the potential antitrust liability of firms participating in IVHS joint ventures. IVHS America has also adopted guidelines intended to preclude anti-competitive actions.

Chapter 7, “Liability Concerns.” asserts that U.S. DOT does not believe that tort liability issues present significant barriers to IVHS development. No evidence has been presented to demonstrate that liability concerns have impeded the development of IVHS products or services.

Chapter 8, “Privacy Issues,” discusses the issues raised by IVHS technologies concerning potential invasions of privacy. The U.S. DOT is sensitive to this potential and is studying the matter. A review of relevant privacy law. “Privacy Implications Arising from Intelligent Vehicle-Highway Systems,” was commissioned for this purpose. Unspecified material from the IVHS America Legal Issues Committee was also cited as reference for this chapter. The chapter emphasizes the commitment of U.S. DOT to remain active in the debate over privacy concerns and its attentiveness to public sensitivity regarding surveillance technology and the use of personal information. The report mentions that IVHS America is developing “privacy principles” to address some of these concerns.

Uncertainty regarding intellectual property rights could discourage the participation of the private sector in the development of federal or state funded IVHS technology. There seems to be enough

flexibility in the existing system to protect the interests of both the private developers and the public sector.

IVHS has the potential for use in approaches to improving environmental quality. The paper advocated more research to ascertain which approaches would be most beneficial.

According to this report, the U.S. DOT is educating potential partners in the IVHS program through conferences, workshops and other training activities regarding the rules and processes that apply to federally funded transportation projects.

Document: "Overcoming Barriers to IVHS-Lessons From Other Technologies," (Draft Report A)

Author: The Urban Institute

Date: February 24, 1995

"Overcoming Barriers to IVHS-Lessons From Other Technologies," is a document which contains one report, Task A, and four draft reports, Tasks B, C, E, and F. Tasks A and B are not titled in this document. Task C is "Models of Public and Private Participation in ATMS/ATIS," and Tasks E and F are jointly presented as, "Analysis of Franchises and License Agreements for the Provision of Public Services and Modular Franchise Agreements for Advanced Traffic Management Systems and Advanced Traveler Information Systems." Tasks C, E and F are not reviewed here. There is no reference to Task D in the document. Task A is the most relevant for the purposes of this summary. It focuses on the institutional issues facing deployments of advanced traffic management systems (ATMS) and advanced traveler information systems (ATIS). Task B concerns industrial policy and is not reviewed here.

Task A identifies a list of barriers to two types of intelligent vehicle-highway systems (IVHS), ATMS and ATIS, by exploring the conflicting forces inherent in the IVHS program, for example, public and private interests and offers recommendations concerning how to overcome them. Only the main conclusions are included in this summary.

Three types of institutional barriers were addressed: potential serious obstacles to deployment, factors which could delay deployment, and obstacles to the complete realization of benefits from the deployment of ATMS and ATIS. Five lines of inquiry inform the investigation into these institutional barriers: (1) the identification of institutional settings which in and of themselves are potential barriers to successful deployments; (2) the investigation of areas of potential conflict, such as the interaction between the public and private sectors; (3) the examination of institutional fragmentation; (4) the assessment of the relationship between the phases of deployment and institutional issues; and (5) the evaluation of other potential institutional issues through additional research.

The most significant barrier identified by this report is the uncertainty regarding how IVHS efforts will be funded. It points out that the private sector will fund development only if it is shown to be clearly profitable, otherwise funding will fall to the public sector. Four recommendations for addressing this issue are offered: both the government and the private sector need to determine the willingness to pay for IVHS among its constituents for a variety of scenarios; an accurate assessment of costs-capital, operating, and maintenance, as well as external and non-quantifiable-is a necessary precursor to the acceptable allocation of costs among participants; the allocation of costs should depend on the marginal costs-generated and the benefits received; and, in order to protect the IVHS program, the government should either develop it to survive with minimum private investment, or limit the risks of private firms to acceptable levels.

Coordinating efforts, especially among private interests, could be a major problem for ATMS and ATIS deployment as some businesses hesitate to commit resources before receiving commitments from other interested parties, for instance automobile manufacturers might hesitate installing ATIS equipment in cars until a telecommunications company provides roadside infrastructure. The report recommends that, once a national architecture has been determined, the government provide strong financial incentives to the telecommunications industry to provide the roadside infrastructure to support IVHS.

Failing to account for the critical path of IVHS deployment, especially if an ATIS will require information from an ATMS, could pose an obstacle to IVHS deployment. The report recommends that the government perform critical path studies for stand-alone and integrated ATMS and ATIS deployment.

One of the barriers identified by the report as “most difficult” to overcome, is the difference between the work cultures of various organizations, including competing interests, fragmentation within organizations, and coordination of policies and multiple jurisdictions. The report offers seven possibilities for overcoming this difficulty: (1) build upon and publicize the success of existing coordination efforts, such as IVHS America and international coordination with Japan and Europe; (2) develop international standards where possible to encourage economies of scale; increase profitability and facilitate interoperability of systems; (3) the Federal Government should require the cooperation of public agencies and authorities managing both toll and free roads in ATMS and ATIS implementations when appropriate and should also set performance objectives for such systems which the agencies and authorities would be required to meet; (4) decision-making authority should be consolidated at the level which represents the greatest number of consolidated interests. in most cases this would mean at the metropolitan planning organization (MPO) level; (5) the Federal Government should carefully encourage other government entities at all levels to overcome institutional fragmentation, possibly using strategies, such as financial incentives for the development of common geographic information system (GIS) platforms and locational reference systems at the local levels which would be compatible with national ATIS standards, or financial incentives for the acceleration of the deployment of broadband digital communications infrastructure for use within the public agencies as a means of sharing data in the hope of eroding institutional barriers; (6) IVHS America should provide expert facilitators who have the proven ability to assist in IVHS decision making and building bridges between participants of widely varied interests; and (7) the government should take into account the results of on-going research related to strategies for overcoming jurisdictional fragmentation as they are made available.

One of the potentially most severe problems facing ATMS is the lack of funds and other resources dedicated to the maintenance and operation of the system. To address this problem the report suggests that the Federal Government take strong steps to ensure the availability of funds and staff for IVHS deployment, such as providing financial support to the levels of government responsible for these functions and selecting a national architecture which includes realistic and complete cost models.

Most MPOs have a limited staff with which to comply with all the regulations under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The case for inclusion of ATMS or ATIS projects in a transportation improvement program (TIP) is made more difficult when MPOs have insufficient staff to perform the necessary analyses to document the benefits in comparison to other transportation improvement projects. The report recommends that the Federal Government encourage an approach to ISTEA compliance which emphasizes the maximum incorporation of the management systems and planning and air quality conformity procedures in order to keep staffing and planning costs down. The ability of the MPOs to comply with ISTEA requirements should also be monitored.

TIPS developed at the state and local levels are vulnerable to legal action with respect to environmental regulations. To address this the report suggests that the Federal Government encourage MPOs and states to analyze the environmental ramifications of major projects using ATMS and ATIS. The government could conduct a model evaluation which could serve as a baseline for state and MPO analysis.

Those who see themselves as not benefiting from IVHS applications are more likely to believe themselves harmed by large federal expenditures on it and, to oppose it politically. The report offers two possibilities for addressing these concerns: IVHS America should include two more categories of advanced transportation systems, Advanced Bicycle Transportation Systems and Advanced Transportation Systems for Pedestrians to serve safety and travel concerns currently overlooked, and IVHS America should invite airline, railroad, and waterborne transportation interests to participate in order to include mutually beneficial intermodal interfaces in IVHS planning.

The possibility that the IVHS community would not pursue opportunities to provide service to low income or other potentially unprofitable areas is a concern. This could cause political problems related to public expectations of universal access. The report recommends that the Federal Government and IVHS America develop a policy regarding universal access based on cost-benefit assessments. Providing alternatives, such as free routes in areas where electronic toll and traffic management technology (ETTM) is in place, may be necessary, but broader social goals, such as reduced congestion or improved air quality, may outweigh equity issues.

Personal privacy concerns have been articulated throughout IVHS development and ignoring these concerns about the misuse of collected information or surveillance capability could significantly harm both individual projects and the entire IVHS program. In order to avoid this the report has seven recommendations: (1) realize that the interests of the IVHS community and law enforcement agencies may conflict; (2) develop measures for addressing both information privacy and surveillance issues; (3) address public concerns regarding privacy early and with candor; (4) investigate technologies which could achieve IVHS goals without collecting personal information; (5) establish methods for treating data collected as confidential; (6) design IVHS implementations to be voluntary, allowing customers to decide what trade-offs they are willing to make; and (7) allow aggregate data to be used without restriction.

Another potential conflict is inherent in the different approaches to intellectual property rights practiced by the public and private sectors. The public sector prefers to retain intellectual property rights when the research or development was publicly funded, while the private sector is concerned with making a profit and protecting proprietary interests. Some middle ground needs to be found in order to avoid major conflicts surrounding this issue. The report makes six recommendations: (1) distribute intellectual property rights in accordance with actual costs incurred by the participants and assure private sector investors of a reasonable return on their investments; (2) consider the risks borne by private sector participants when drawing up a contract; (3) actively avoid the creation of a de facto technological monopoly with public funds; (4) develop a national uniform policy for the IVHS program in order to avoid complications from multiple local policy variations; (5) differentiate between widely available technical standards based on an open architecture and the intellectual property rights to an implementation of the standards; and (6) use an escrow account for software being developed in part with public funds to provide protection to the government in case a private firm defaults on its contractual obligation to provide it.

Among the remaining tensions which need to be resolved are the conflicts between decentralized decision making and centralized ATMS functions. The report lists three recommendations regarding this issue: (1) decentralize control wherever possible, making sure that local decision making authorities understand that occasionally a decision which would be seen as 'non-optimal' at the local level might be necessary at the system level; (2) carefully select those functions which might be better centralized, such as emergency response and incident management; and (3) if necessary, use short-term reliance on centralized ATIS management in order to facilitate deployments and take advantage of economies of scale, but plan to change over to decentralization and a competitive marketplace in the mid- to long-run.

There is also unresolved tension between competitive and regulatory approaches to IVHS deployments. While the competitive approach should be used wherever possible, there are circumstances where the restriction of markets can be justified: using scarce public resources, such as the radio frequency spectrum; achieving economies of scale; reducing risk which is blocking IVHS development; and wasteful duplication of public utility rights of way. The report recommends the use of great caution in determining when to forgo the benefits of competition in favor of a regulatory approach.

The difference in the perceived and real costs of IVHS can result from the treatment of out of pocket expenses and hidden costs, such as increased travel time or air pollution costs. Inadequate information could result in poor decision making by ATMS and ATIS users and managers. The report recommends that ATMS and ATIS systems communicate money costs and travel time costs when dispensing travel information. Congestion pricing or a comparison of emission levels from various transportation options offered by a system could also facilitate informed decision making, leading to greater travel efficiency.

There is also conflict based on the competition between top-down and bottom-up approaches to IVHS planning. The report recommends: (1) avoid mandating a single IVHS design-keep the national IVHS architecture open; (2) any national standards or protocols which are adopted

should accommodate a wide variety of technical solutions; (3) take advantage of ISTEA flexible funding provisions to protect the interests of local, regional and state governments; (4) use block grants or other discretionary funding mechanisms to allow local, regional and state governments to custom fit IVHS applications to their own needs.

Many within the ITS community argue for standards, which they claim are necessary to secure commitment from parties interested in ITS but uncertain of its future, while others delay on the grounds that implementing standards too soon could stifle innovation and development. The report recommends that the Federal Government support early international standards which remain open and are designed to accommodate various implementations and support multiple vendors.

Document: “Examples of How IVHS Architecture Decisions Affect Personal Privacy,” from “Privacy and Intelligent Transportation Systems-Legal Research Reports”

Author: Santa Clara University

Date: March 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide “analysis of federal and state privacy laws and development of safeguards to protect privacy” in the context of intelligent vehicle-highway systems (M-IS).

The “Examples of How IVHS Architecture Decisions Affect Personal Privacy” research report discusses the consequences of different implementations of automated highway systems (AHS) and automated vehicle identification (AVI) on an individual’s privacy rights. The report employs hypothetical scenarios to illustrate some of the privacy-related issues affected by IVHS technological choices in system architecture and communications design. For example, one scenario describes the space-time issue inherent in AVI, in which the AVI identifies a vehicle and sends that vehicle’s identity to a central site for the purpose of toll billing. The space-time information refers to the vehicle’s location at a specific moment. With AVI technology, the vehicle’s space-time data and identification are available. The basic issues involve what information flows from the vehicle, how that information is transmitted to any central system, and how the information is processed in the central system. The consequences of different technological implementations affect the amount and specificity of attached space-time information available to those who desire to monitor an individual’s movements.

The report concludes by maintaining that the technological advantages of IVHS are extraordinary, but the consequences from a particular IVHS implementation on an individual’s privacy rights are also important. These consequences must be considered as part of a system’s architectural design. The report stresses that one significant IVHS goal must be to candidly inform the public about potential impacts on privacy that could result from IVHS. The resulting public dialog from this disclosure will help shape legal rules that balance the need to protect the privacy rights of a law-abiding citizen with the need to provide the government with the appropriate tools to protect the public good.

Document: "IVHS Electronic Communication Service Providers and Application of the Electronic Communications Privacy Act to IVHS," from "Privacy and Intelligent Transportation Systems-Legal Research Reports"

Author: Santa Clara University

Date: January 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy" in the context of intelligent vehicle-highway systems (IVHS).

This research report analyzes the extent to which data in the IVHS environment may be captured and divulged by service providers. In the report, a hypothetical IVHS environment is presented as an electronic communications service. The report draws a parallel between the IVHS environment and a computer network. Like the manner in which we log onto a network, individual vehicles log onto a municipality network through a series of roadside receivers and transmitters, called road nodes. To respond to privacy-related questions that arise from viewing IVHS in this manner, the report states these issues in terms of legal questions, lists the statutory sections of the United States Code that relate to them, and provides a detailed response as well as a summarized answer to each question.

In any network environment, such as ITS, information is typically transmitted in sets of data frames. Each complete message communication is broken down into a set of data frames, which are then recompiled by the recipient of the transmitted message. In each data frame there are three major fields of information. These are the protocol and identification field, data field, and checksum field. The data field is the only field that contains substantive message information. The protocol and identification field contains the identities of both the sender and recipient of the data frame. This field also contains information about the network route of the data frame, the position of the data frame in the entire message, and network management information. The checksum field contains error detection information.

In relating these terms with IVHS, the first question presented in the report is whether a municipality network provider may capture and view the data field portion of all data frames that it detects. In response, the relevant sections of the United States Code are listed and explained in relation to that question. In this case, the specific codes are listed, explained in detail and summarized. The response is that a municipality network provider will not be allowed to capture the data field portion of the IVHS users' data frames unless it is either generally available to the public or interfering with the operation of the IVHS communication service. The second question presented is whether a municipality network provider may capture and view the protocol and identification field portions of all data frames that it detects. After supplying the relevant codes for this issue, the report analyzes those codes and offers the answer to the question. Yes, the municipality provider is most likely authorized to access the information in

the protocol and identification field, when such information relates to the protection, operation, maintenance, or testing of the IVHS communication service.

The third privacy-related question in the area of IVHS and service providers is whether a municipality network provider may divulge legitimately captured data field information to third parties. The statutory codes relating to this are listed, and the answer, that no, without either the consent of the message's originator or the inadvertent discovery of criminal activity, no disclosure may be made, except that which is necessary to forward the message onto its final destination. The question of whether a municipality network provider may divulge legitimately captured non-data field information to private third parties is offered next. After enumerating the relevant sections of the United States Code the issue is answered. Yes, legitimately recorded information, which is not from the communications' data fields, may be disclosed to non-governmental third parties, in the normal course of business.

The final question presented as illustrative of the IVHS privacy issue is whether a municipality network provider may divulge legitimately captured non-data field information to governmental third parties. The statutory codes relating to this issue are listed in the report and the answer, in this case that disclosure to governmental third parties is allowed only when there is a proper subpoena, warrant, court order, or consent of the IVHS service user, is presented. Viewing IVHS privacy issues as legal questions and presenting actual statutes that relate to them adds clarity to the issues and gives them a practical application.

Document: "Analysis of State Laws Protecting Computer Systems and Computerized Data."
from "privacy and Intelligent Transportation Systems-Legal Research Reports"

Author: Santa Clara University

Date: March 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy" in the context of intelligent vehicle-highway systems (IVHS).

Almost all states have statutes designed to protect computer systems and computerized data. The research report "Analysis of State Laws Protecting Computer Systems and Computerized Data," uses bar graphs to describe the presence or absence of a particular type of data protection issue addressed by the statutes of each state. Bar graphs illustrate to what extent each state protects data from fraudulent usage. The report describes the range of protection among states, from Massachusetts, which provides some protection to data, but never actually uses the word "computer," to West Virginia, which addresses "fraud, unauthorized use, alteration, destruction, disruption," and many other manipulations of data.

The report describes the amount and level of protection afforded to different states by dividing the form of protection into eight classifications. The first classification is statutory protection against "Unauthorized Computer Related," activity, which indicates that the word "computer" is used in the statute. The bar graph shows that all states provide at least some protection from this type of unauthorized use. The next classification is protection from "Unauthorized Use/Access to Computer/Data," which indicates that the state's statute addresses unauthorized access to a computer or to data stored on a computer. Again, the report's graph illustrates that all states carry statutory protection against this form of use. Regarding protection from "Altering/Destroying Data," which indicates that the state's statute addresses unauthorized destruction or alteration of data stored on a computer, the bar graph shows that the vast majority of states include this as a legal protection.

Regarding the category "Fraud," which indicates that the state's statute addresses fraud, or contains the words "defraud" or "fraud," the graph reveals that approximately two-thirds of the states include this as a statutory protection. In the area of "Computer Disruption," which indicates that the state's statute addresses the disruption of authorized access to a computer or data stored on a computer, the bar graph reveals that approximately half of the states provide protection of this kind. Protection against "Larceny/Theft," indicating that the state's statute is reasonably explicit in addressing theft of computer services and data, is present in almost one-third of the states' statutes. Finally, statutory protection against "Trespassing," indicating that the state's statute contains the word "trespass" is afforded by only a handful of states.

Document: "ITS and the Fourth Amendment: Driving with Big Brother," from "Privacy and Intelligent Transportation Systems-Legal Research Reports"

Author: Santa Clara University

Date: December 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy" in the context of intelligent vehicle-highway systems (IVHS).

The Fourth Amendment to the U.S. Constitution protects the right of people to be secure in their homes, papers, and effects against unreasonable searches and seizures. Only with a warrant, secured with probable cause, are searches of these areas allowed. "ITS and the Fourth Amendment: Driving with Big Brother" discusses the issues of progress and privacy in transportation, paying particular attention to the concept of continuous monitoring of individual vehicles. Continuous monitoring of individual vehicles refers to the use of ITS technology in vehicles that would allow radio or infrared technology to continuously track individual vehicles' locations. The report describes positions of proponents of this technology who contend that the prospect of safer, less congested roadways justifies going forward with the project. It also outlines the feelings of opponents of continuous monitoring who argue the warrantless collection of information concerning citizens' daily lives completely disregards individuals' rights to privacy.

Examining the positive aspects of continuous monitoring more closely, the report describes the possibility of tracking a drug suspect without placing a police officer in danger, or of locating a recently stolen vehicle with ease. Proponents argue that these and other uses of the technology warrant the potential loss of privacy that this monitoring would bring.

Opponents, however, maintain that to a significant segment of the population, the government's increasing collection of information concerning the private lives of individuals constitutes one of the most serious threats to privacy. In this position, the best intentions do little to assuage the discomfort caused by the realization that someone at a computer terminal is keeping track of wherever an individual goes.

In concluding, the report aligns itself with the position of opponents of continuous monitoring technology. It maintains that continuous monitoring technology is stronger "medicine" than is necessary. The government's genuine concern for the safety of individuals using public roadways would be equally served, the report contends, by non-continuous monitoring unrelated to individual vehicles or drivers.

Document: "Private Vehicles: An Oxymoron," from "Privacy and Intelligent Transportation Systems-Legal Research Reports"

Author: Santa Clara University

Date: October 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy" in the context of intelligent vehicle-highway systems (IVHS).

"Private Vehicles: An Oxymoron," argues that neither the Fourth Amendment to the U.S. Constitution nor federal laws provide sufficient privacy protection for ITS equipped vehicles. The Fourth Amendment to the U.S. Constitution protects the right of people to be secure in their homes, papers, and effects against unreasonable searches and seizures. Only with a warrant, secured with probable cause, are searches of these areas allowed. This report contends that there exists a danger that computer data collection and information technologies can provide so many benefits that individual privacy rights may be destroyed by the use of those technologies. This is especially true of ITS technologies, in which the ability to monitor movements and to correlate those movements with other data commonly supplied by individuals, such as credit card usage information and other information used by government and business, imposes an extremely high risk to individual privacy rights. Furthermore, the report states that the Supreme Court has not found a privacy right associated with individual vehicles, nor is there any reason to think that the Court would find a Fourth Amendment issue with monitoring ITS-equipped vehicles operating on public thoroughfares.

The goal of ITS is to improve the transportation system by improving the efficiency of the existing infrastructure so as to transport more people and goods using the same thoroughfares. For example, in toll plaza delays, ITS technologies will enable a vehicle to pay a toll while traveling at speed past a toll area, thus eliminating the inefficiency of stopping to pay the toll. Application of ITS technologies can remove an existing traffic bottleneck and make the highway more efficient. However, in addition to increasing efficiency, this application threatens privacy because computers and computerized data gathering are required to effectuate these technologies.

Despite the threat to privacy that ITS technologies carry, the Supreme Court has strongly differentiated a person's Fourth Amendment rights while inside a vehicle as compared to those in the home. The report outlines the public's options to combat this prospective loss of privacy. They include passing a Constitutional Amendment to explicitly include Constitutional protection against electronic surveillance, passing laws that protect any existing de facto-privacy rights, or designing the ITS system so that it does not use space-time information, which refers to information about a vehicle's location at any given moment. The report concludes with a warning that these and other options must be examined before the ITS system is implemented so that an existing system does not destroy our privacy rights before we realize what we are losing.

Document: "Playing Chicken: Would IVHS Consent Requirements Constitute an Unlawfully Coercive Game of Who Blinks First?" from 'Privacy and Intelligent Transportation Systems-Legal Research Reports'

Author: Santa Clara University

Date: September 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy"* in the context of intelligent vehicle-highway systems (IVHS).

The report "Playing Chicken: Would IVHS Consent Requirements Constitute an Unlawfully Coercive Game of Who Blinks First?" concludes that the United States Constitution mandates certain limits in the application of new technology. The report concedes that Congress has set the stage for the development and implementation of M-IS. The fact that such systems monitor activity on public thoroughfares and gather and retain information pertaining to individuals choosing to travel on certain routes raises a number of legal issues. In particular, there is a conflict between personal privacy interests and governmental powers in the use of IVHS. Should the government require citizens to consent to IVHS-produced intrusions on privacy in exchange for permission to use public highways, the legal issue would become one of "unconstitutional conditions."

The concept of unconstitutional conditions contends that, although a state has authority to grant or deny a privilege or benefit, it may not institute a condition of the receipt of that privilege that violates a constitutional right. Analysis of IVHS consent requirements in light of the concept of unconstitutional conditions of IVHS consent requirements indicates that, where privacy interests and efficiency concerns intersect, neither the government nor individual citizens have the right to trade privacy for efficiency: that power does not belong to any party. The report points out that privacy rights prevail over non-legal concerns. In the absence of safeguards assuring anonymity in the use of IVHS systems, the report maintains that any limitation on individual access to highways constitutes overreaching on the part of the state. The United States legal structure provides the stable and relatively inflexible system of law that can be met by innovative technological design and around which research and development decisions should be made. Given the promise of IVHS technologies, the incorporation of prescribed legal limits in implementation plans will likely be a slight burden. In fact, because these limits reflect societal norms, they direct the technological application toward greater acceptance by the population.

Document: "Privacy Concerns about IVHS Outside the United States," from "Privacy and Intelligent Transportation Systems-Legal Research Reports"

Author: Santa Clara University

Date: July 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide "analysis of federal and state privacy laws and development of safeguards to protect privacy" in the context of intelligent vehicle-highway systems (IVHS).

"Privacy Concerns about IVHS Outside the United States," opens by describing specific technological implementations of IVHS technology in Hong Kong, Portugal, the United Kingdom, China, and South Africa and other locations and describes the effects these technologies have had on individuals' privacy. For example, between 1983 and 1985 the Hong Kong government fitted some 2,600 cars with electronic tags which allowed cars to be monitored as they passed over wires buried in the road. An itemized bill was sent to the registered driver of each car. Charges depended on the vehicle type, time of day, location, and direction. Records of where and when drivers had traveled were kept on a central computer system so that charges could be individually calculated.

Vehicle owners began to feel uneasy about the system when they realized that the driving charges sent to their homes included an itemized listing of the time, date, and location the driver for each charge. Some claimed that privacy concerns about IVHS were the result of political concerns about the impending 1997 Chinese takeover of Hong Kong. Other attributed the trouble to citizens not wanting their spouses or employers keeping track of their whereabouts on a minute-by-minute basis. The experiment was eventually abandoned in 1985.

In Finland, incensed motorists staged protests when their electronic toll system was first opened. In fact, several toll booths were actually blown up, although it is not clear whether privacy or paying tolls caused the protesters to react in this manner. Today, about 210,000 vehicles pass through the electronic toll system built around the city of Oslo. All cars traveling on toll roads are equipped with electronic tags which permit the drivers to pass through toll centers forty times per month. The computer at each toll station registers the tags as each driver passes. If the car tries to pass without a tag or with an invalid tag, a camera activated by the computer at the toll station photographs the car as it passes through the toll station.

The report presents these examples to illustrate that the United States can learn from the implementation of these technologies. The primary conclusion of the study is that too few countries have researched the social and economic ramifications of IVHS sufficiently, and none have conducted thorough research regarding the effects of IVHS technology on privacy. The author concedes that complying with privacy laws, and creating technology which is sensitive to the public's privacy concerns in the United States and abroad will not be an easy task for United

States companies. The author concludes that companies that take up the privacy challenge are likely to enjoy greater success marketing their products at home and abroad. United States companies designing IVHS technology for the world market could be the first to make privacy protection a standard feature.

Document: “The Intelligent Vehicle Highway System and Applicable European Legislation, Examples of How IVHS Architecture Decisions Affect Personal Privacy,” from “Privacy and Intelligent Transportation Systems-Legal Research Reports”

Author: Santa Clara University

Date: September 1994

This report is contained in a collection of legal research reports that represent some of the products of a research project conducted at Santa Clara University School of Law. The purpose of the Santa Clara Project was to provide “analysis of federal and state privacy laws and development of safeguards to protect privacy” in the context of intelligent vehicle-highway systems (IVHS) .

The report “The Intelligent Vehicle Highway System and Applicable European Legislation” focuses on laws, conventions, and regulations that would affect the implementation of IVHS technology in Europe. The report is divided into sections that cover the application of laws to different aspects of IVHS. Within each of these sections, the paper focuses on the effects of the laws of selected countries, and, when applicable, on the regulations of the Council of Europe, European Convention on Human Rights and Fundamental Freedoms (ECHR), European Economic Community projects regarding traffic control, and the Organization for Economic Cooperation and Development (OECD) regulations for data protection.

By describing different countries’ legal perspectives to privacy, the report communicates that the laws of countries in the European Community are complex, and despite the existence of a united Europe, legal difficulties prevail. For example, in Germany, personal rights under Basic Law protect individuals “human dignity” against the state’s power, and protect the right to freely develop one’s own personality. In a landmark case, the Federal Constitutional Court, in 1983, established the constitutional right to informational self-determination. According to the Court, the Basic Law gives individuals the right to decide the scope of their exposure and the uses of their personal information.

While the German laws specifically protect individuals’ privacy, other European countries vary on the topic. For example, the right to privacy has not been explicitly recognized in the United Kingdom, although there is an implicit recognition of privacy from the perspective of autonomy interests. By presenting these examples the author makes the point that, at this time, there is no single collection of laws which a United States corporation could obey in order to satisfy the requirements of every country in Europe regarding implementation of IVHS technologies. The report concludes that, because of this disparity, and in order to facilitate application of the IVHS system in the future, when Europe will truly act as a single entity, it is advisable for United States companies to follow the strictest rules of law for each area of interest.

Document: “Analysis of ITS Operational Tests-Findings and Recommendations”

Author: Volpe National Transportation Systems Center

Date: September 1995

This document describes institutional issues encountered at six Intelligent Transportation Systems (ITS) activities, strategies identified to combat these issues, and lessons learned. The report also presents recommendations for improving the performance of other operational field tests and deployments of ITS products and services. The Findings and Analysis report is based on the Guidestar Program, which includes the Genesis and Travlink operational tests, and the FAST-TRAC, Houston Smart Commuter, SaFIRES, SmartTraveler, and TravelAid operational tests.

Institutional issues identified in the report fall into the following five major categories: “organizational and managerial,” “procedural and regulatory,” “human resources,” “funding,” and “technology.” Regarding organizational and managerial issues, there are four issue categories relating to how operational tests are organized and managed. These are new business relationships, inter-agency coordination, intra-agency coordination, and managerial processes. The issue of new business relationships describes the difficulties associated with these relationships, and maintains that working in a partnership was new and different for principal participants and that the roles and responsibilities of the participants were not clearly defined. Regarding inter-agency coordination, project participants noted that poor communication among organizations can affect progress. In the realm of intra-agency coordination, project participants predicated that the lack of upper management support will affect project participation. Finally, with respect to managerial processes, ITS project participants found that the projects required new management structures and that failure to involve outside parties in a timely manner will delay that project.

There are four issue categories relating to operational test procedures and regulations: contracting, evaluation, intellectual property rights, and non-competitive selections. Contracting issues refer to the fact that current contracting procedures are not suited to ITS projects and that several partners were unfamiliar with the required contracting procedures. Regarding evaluation, difficulties arose because the scope of the evaluation changed during the course of the operational test and operational tests are difficult to evaluate. The assignment of intellectual property rights was raised as an issue because the ownership and use of intellectual property were not clearly defined. In the area of non-competitive selections, project participants questioned the selection of projects and partners outside of the competitive process.

Project participants identified two human resources issues relating to expertise and staff workload. The first is that project staffs did not possess the skills required for ITS projects. ITS projects, with their innovative public-private partnerships and technical innovations, were a challenge for many public sector partners, many of whom had little experience in systems development and the latest technologies. Another human resources issue identified is that ITS

projects affect the workload of the staffs of the partners. At many operational tests, staff took on new responsibilities without any change in the level of resources and staffing.

Public and private partnerships from all six tests identified several issues related to funding, largely as a result of the complexity of funding a public-private partnership with funds from multiple sources. The first of these is that match requirements for the project were not clearly defined or understood. At the start of many projects, it was apparent that the percentage match share and value of each partner's contributions were unclear to many participants. A second funding issue was that funding expectations are not always met. The funding approval cycle for ITS operational tests is an extensive process, further complicated by different funding contributions from public and private partnerships. Partners have different expectations over level of program funding and timely release of funds. The third funding issue identified is that funding limitations can negatively affect the scope of the operational test. For example, data collection might have been a priority for one partner, whereas technology evaluation was more important for another. The final funding issue described by participants of these operational tests is that funding constraints hinder local government participation in ITS. City and county governments play an important role in expanding road capacity and implementing ITS and other products and services. Unfortunately, not all local governments are convinced that the ITS program could benefit them and hesitate allocating their limited resources to deploying ITS.

Public and private project participants identified several issues relating to the impact of integrating technology into the ITS program. The first technology issue identified is that the ITS program lacks standards. These standards have not been developed and existing technology standards are constantly being changed. This affects systems architecture for operational tests. The second technology issue noted is that selecting the most appropriate technology is difficult. Incorrect selection of a product could affect not only the participants' use of the product but also the evaluation and project results. Another technology-related issue is that operational test participants found working with telecommunications regulations difficult. At the beginning of an operational test, the communications system has to be designed, the design parameters set, and the Federal Communications Commission (FCC) licensing requirements determined. These telecommunications systems are extremely complex to design and regulate.

Lessons learned from the operational tests are organized into categories of "building support," "developing plans," "working out the details," "managing the project," and "maintaining support." In the area of building support, the primary lesson learned is that public and private sector partners learned to work together. Once partners decide to participate in ITS, it is critical they stay part of the project by learning to work together and having an active role in the decision making process. Another lesson in this area is that having a project champion and securing upper management support contributes to a successful project. These champions must learn about ITS concepts and practices and develop a standing and competence in ITS so that they can convince government officials, upper management, and others of the benefits of ITS.

In the area of developing plans, an issue identified by most operational tests is that project planning and coordination was disorganized at the start of the project, mainly because of the newness of the concept of ITS. Another lesson in this area is that conflicts may arise when developing a partnership and to understand that the project will not fail if a partner leaves.

In the realm of working out the details, the main lesson learned is that contracting procedures must be open and flexible. Most operational test participants identified this lesson as the most significant in working out project details. Participants maintained that it was the contractual portion of the project, rather than the technical portion, that presented the challenge. Another lesson in this category is that operational and evaluation components must be in place at the same time. Project evaluations are a critical and challenging component of the operational test and must be viewed as an integral part of the project concept.

Regarding managing the project, the first lesson learned was that projects require a full-time manager. Because of its impact on the success of the project, many participants stated this lesson as extremely important. The lack of a full-time manager resulted in several problems, including that establishing and maintaining communication among the partners was difficult, the roles and responsibilities of the partners were not defined clearly, and the project lacked direction. Another lesson in the area of managing the project is that partners must have the required technical expertise. Because many state departments of transportation were structured to implement civil engineering projects, these agencies did not have computer and telecommunications expertise.

In the area of maintaining support, ongoing support at the national, state, and local levels is necessary to successfully move ITS products and services into the mainstream. The primary lesson learned in this area is that good communication within the project is essential. Good communication results in good coordination and cooperation, and these are the keys to success. The fact that funding for operations and maintenance is critical to the success of ITS deployments is another lesson in the realm of maintaining support. A third lesson in this area is that ITS products and technology must be promoted. This lesson contends that it is important to develop support for an ITS industry. First, establish local and state ITS organizations and get large companies involved in ITS. Second, educate the public about ITS and its benefits. Third, increase private sector involvement in ITS. Fourth, commit funding for outreach and education programs that promote ITS.

Document: "Procurement Issues in IVHS Development and Deployment"

Author: Procurement Task Force of the Legal Issues Committee of IVHS America

Date: Undated

There is great concern among those in the intelligent vehicle-highway systems (IVHS) community that procurement issues will impede the development and deployment of IVHS technology. This paper discusses the major concerns which have been identified in this area and includes recommendations for addressing them.

One issue which has been practically universal in each IVHS deployment to date is the distribution of intellectual property rights. Most of the private sector members of the NHS community fear that the Federal Government will require most, if not all, of the intellectual property rights associated with the development of IVHS applications, but will not be willing to provide them with adequate compensation in return for their efforts. This is especially problematic considering that the private sector expects to have both public and private sector customers for IVHS products and so needs to be assured of its ability to protect the market value of those products. Fair distribution of intellectual property rights is made more difficult by the fact that many IVHS projects are developed by consortia which can include state, local, and quasi-public agencies in addition to universities and the private sector.

The paper details three recommendations for addressing the distribution of intellectual property rights. First, the Federal Government should retain only those intellectual property rights to an IVHS system which are necessary to provide the public sector with protection against a monopoly on key IVHS technologies. This can be done by an agency adopting alternative policies through published regulations. Next, the government should create a specific, uniform policy regarding retention of intellectual property rights, which should include specific, publicized methods for obtaining waivers in designated circumstances. The government should also be willing to negotiate these issues before a contract is awarded. Finally, the government should utilize accumulated experiences from other IVHS procurements in addressing these issues.

The development and deployment of IVHS systems often requires coordination among different levels of government and regions with multiple jurisdictions. This can result in delays, conflicts around differing regulations concerning procurement and other issues, difficulty in complying with applicable regulations, uncertainty in regulatory requirements and adds to other issues discussed in this paper. Due to the pervasiveness of this issue, the paper recommends that the Federal Government promote efforts to coordinate requirements, seek revisions to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) allowing conflicting or overlapping regional requirements to be conformed and serve the IVHS community as a clearinghouse for solutions to these conflicts as they arise.

High tech procurements are the most difficult of all government procurements and many of the private and public sector organizations involved in the procurement of IVHS systems are

unfamiliar and inexperienced with them. This leads to delays and mistakes, and inhibits competition because it favors those companies with such experience. Public sector entities, which may want to procure IVHS systems, often do not have enough technical expertise to conduct the procurement appropriately. This may not even become clear until the procurement process is underway. On the other side, inexperienced private companies will have to come up to speed on government requirements which may include relatively obscure government contracting laws. To address this, training sessions for state and local procurement personnel and for the business community on topics relating to IVHS procurements could be offered and supported by the Federal Government.

Complying with federal cost accounting, cost certification, and auditing requirements is difficult. It can create an expensive burden on IVHS participants, increase costs to taxpayers, and inhibit competition by reducing the number of businesses willing and able to take on IVHS development. The paper recommends applying these requirements only to those procurements which are clearly relevant to the goals of the requirements, increasing the uniformity of cost accounting rules, centralizing decision making concerning cost and pricing information requirements in order to promote consistency in determinations, and supporting training sessions for potential IVHS vendors on government requirements.

The potential for considerable liability costs to possible IVHS vendors may reduce their willingness to participate in IVHS projects resulting in increased costs and reduced competition. The Federal Government has a number of avenues open for addressing this issue: The Federal Government can obtain from Congress the ability to indemnify contractors for liability, assist contractors in invoking the government contractor immunity doctrine, and explore the willingness of the insurance industry to provide insurance at reasonable rates to participants involved in IVHS development.

The cost of complying with government requirements can substantially add to the cost of an IVHS project at a time when the government is especially cost conscious. An evaluation of government requirements which differ from standard business practices and an analysis of the benefits to taxpayers and society accrued from these practices could help to determine where it may be appropriate to reduce the cost of compliance. The author notes that this issue pervades other procurement related issues, and feels that it is not only significant enough to be addressed on its own but also should be pursued aggressively.

Organizational conflict of interest (OCI) rules limit the extent to which the same company can design and build a specified system. Many large vendors who have invested considerably in developing IVHS technology are concerned that participation in the design of a system could exclude them from future IVHS sales. Often these vendors are also those with the most expertise in design consulting and systems engineering. The author recommends that the Federal Government provide clarification on the applicability of OCI rules to institutions involved in IVHS development and proactively address the extent to which federal OCI requirements will impact participants seeking to provide design services on the federal level and sell products at the state and local levels.

The cost of IVHS development and the desirability of participation in IVHS development are influenced by the effect of the political process on procurement policies. Private companies may be discouraged from participation in IVHS activities because of the uncertainties involved in a government procurement. To address this problem the government should analyze the causes of the uncertainties and additional costs, gathering information from both the public and private sectors, and develop approaches which minimize them. This information should then be made public.

There are no established procurement procedures to carry out public-private partnerships, which have been identified as the basis for the systematic development and implementation of IVHS systems in the U.S. At the core of this issue is the lack of definition for a public-private partnership and the failure of existing procurement procedures to address one or more of the common features in these partnerships as they have developed within the IVHS community. This is an opportunity for the government, in consultation with IVHS America, to develop guidelines for the use of public-private partnerships in IVHS endeavors and create specific procurement procedures that apply specifically to such entities.