

Proceedings of the ITS Standards Program Review and Interoperability Workshop

December 17 & 18, 1997

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US Department
of Transportation

ITS
America

ITSA-SI-NO82

**Proceedings of the
ITS Standards Program Review
and
Interoperability Workshop**

December 17 & 18, 1997

Held at
George Mason University
The Institute of Public Policy
Arlington, Va.

George Mason University
The Institute of Public Policy

University of
Michigan



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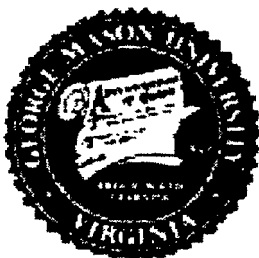


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ACKNOWLEDGMENTS

This workshop would not have been possible without the contributions of a number of key people. These include:

- Mike Schagrin, Manager, ITS Standards Program, ITS Joint Program Office, U.S. DOT
- ITS America members and staff:
 - Bob Parsons, Chairman of the Interoperability Subcommittee
 - Allan Kirson, Chairman of the Standards and Protocols Committee
 - Rob Jaffe, Chairman of the Systems Architecture Committee
 - Ray Starsman, Director, Systems Integration, ITS America
 - Roy Courtney, Associate Director, Systems Integration, ITS America
 - Karyl Irion, Systems Engineer, ITS America
 - Judy McQueen, Coherence, Inc.
 - Bob McQueen, Post, Buckley, Schuh and Jernigan
- Jonathan Gifford, Associate Professor of Public Management and Policy, George Mason University
- Roger Stough, Director, Center for Regional Analysis and Transport Policy, George Mason University
- Chip White, Director, ITS Research Center of Excellence, University of Michigan
- Kan Chen, KCI

In addition, a special note of appreciation is due to the rapporteurs and moderators of each of the breakout sessions, as well as the presentation speakers.

Executive Summary

1.0 Introduction

An ITS Standards Program Review and Interoperability Workshop was held on Dec. 17-18, 1997 in Arlington, Va. It was sponsored by the U.S. DOT, ITS America, George Mason University (GMU) and the University of Michigan. The purpose was to review the US ITS standards development process in ITS America's Council of Standards Organization (CSO). The second purpose was to evaluate the activities in ITS America's Interoperability Subcommittee, specifically to determine an agreeable definition for the term "interoperability" and derive or support proposed approaches under consideration for testing, certifying and assuring interoperability between and within ITS user applications. In addition, priority ITS applications were requested to be identified to focus ongoing efforts.

The final participation consisted of 80 representatives, deliberately drawn from a variety of sectors: private, public (Federal, State and local) and International Sectors (see Attendees list). These were grouped together into five breakout sessions in order to obtain coherent opinions from groups with similar concerns and issues. The invited speakers included 13 experts on standards systems integration and certification testing, including two experts from Japan and two from Europe. In addition, there were speakers from analogous forums in other industries (domestic & international) which have had to address their industries solutions to the complex problem of interoperability, testing and certification. The sets of questions and proposed approaches provided to the breakout sessions for consideration, were based on many other efforts, including the ITS America Interoperability Subcommittee, ITS America Annual Meeting Panels and U.S. DOT considerations regarding the requirement for testing standards.

The ten reports from the five breakout groups are provided below in two separate sections, Section 2 addresses standards and Section 3 addresses interoperability/testing and certification. The specific participation in each breakout group and the processes or questions addressed in the two areas of standards and interoperability/testing and certification are indicated in the beginning of each of the reports.

The Workshop Program, including the list of Speakers and Topics is provided in Appendix A.

2.0 Standards Recommendations

The breakout sessions reports and presentations, provided in the report, resulted in a series of eight recommendations. Five recommendations involving the standards process, specifically suggested that the DOT:

1. Develop a policy regarding the level of standardization desired.
2. Define the meaning of minimal compliance to standards.

3. Provide training, outreach, guidance documents and workshops to explain standards to local implementers who were not involved in the standards development process.
4. Provide financial support to help local agencies make the transition to approved ITS standardized systems.
5. Support maintenance and revision of standards.

Other recommendations with regard to the standards process, include the following:

- A. Bring standards writers, developers, and implementers together in a forum or consortium to oversee the process.
- B. Provide real world MDI-like (Model Deployment Initiative) laboratory to test a suite of related standards and demonstrate that they work together interoperably.
- C. Deploy beyond the MDI test site only after the demonstration successfully shows that the goals have been achieved and guidance, training and operational concepts are firm.

3.0 Interoperability Recommendations

The five recommendations and conclusions of the interoperability sessions are:

Recommendation 1. Interoperability Subcommittee definition for the term “interoperability” and refine as necessary. This definition follows:

Interoperability: The ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together. (Reference: ISO/TC204 Document N271).

There are three types or categories of interoperability as follows:

- (1) Institutional (contractual) involving financial agreements and contractual relationships (e.g., MOU’s) between operators and user’s of an ITS service.
- (2) Procedural interoperability involving data and procedures to exchange meaningful information.
- (3) Technical interoperability which entails the ability of equipment to communicate.

Recommendation 2. Support the approach taken thus far by the Interoperability Subcommittee to evaluate end-to-end performance of a dataflow within or across user services or ITS applications. This entails preparing an end-to-end diagram depicting the interfaces of all transactions needed to provide an ITS Service.

Recommendation 3. Based on safety considerations, the following ITS Services were identified as priority services for initial or ongoing evaluation by the Interoperability Subcommittee:

- Electronic Payment Services
- Commercial Vehicle Operations
- Emergency Management
- Incident Management
- Travel & Transportation Management
- En-Route Guidance

Recommendation 4. The Workshop confirmed Certification/Assurance approaches, as follows:

- Let the marketplace drive interoperability.
- DOT, ITS America or other forum should champion interoperability. The forum should be well-balanced among stakeholders: Government, SDO, developers and users.
- Tools for Certification/Assurance include:
 - implementers agreement
 - manufacturer's MOU
 - product certification
 - truth-in-labeling
 - standards
 - DOT Mandate for Interoperability
- Continue to evaluate the best approach by the Interoperability Subcommittee.

Recommendation 5. Finally, there was consensus that interoperability testing in combination with certified independent test results is the preferred method for ensuring standards compliance. A national laboratory would be the preferred independent testing organization. Manufacturers would likely prefer a method that ensured worldwide recognition of the test results, because it would save on costs.

1.0 Key Issues in ITS Standardization and Interoperability (by Jonathan L. Gifford¹ and Chelsea C. White III²)

1.1 Introduction

For more than a decade, the U.S. and many other nations of the world have been vigorously engaged in the development and promotion of advanced communications and control technologies in road transportation. These “intelligent transportation systems” (ITS) embrace a broad range of equipment and services targeted at those who use the road system or have some responsibility for planning, designing, operating and maintaining it.

From the outset of interest in the development and deployment of ITS, the issue of standardization and interoperability of equipment and services has been a central concern. Key issues have been how to determine the appropriate extent of standardization of equipment and services, and how to achieve it. On the one hand, the benefits of a broadly interoperable system of equipment and services using open standards were clear. Road users would benefit because equipment would be usable across the nation. Large markets of uniform products would encourage competition and drive down unit costs. Additionally, the operators of road and transit systems would be able to avoid reliance on proprietary systems dominated by a single vendor.

However, it soon became apparent that the development of such a system would be extremely difficult. The road transportation sector in the U.S. is highly fragmented and governed by a host of independent or semi-independent institutions that make coordination difficult and expensive. Knowledge and awareness of ITS technologies was not widespread among those responsible for providing road transportation facilities and services. Products and services were not well defined, and it was quite unclear which products and services would actually be successful in the marketplace.

Moreover, there was a great tension between the desire to install facilities and equipment quickly, on the one hand, and to develop standards so that installed equipment would be compatible, on the other. Immediate deployment would take advantage of the benefits ITS technologies had to offer. But the development of a complete standard often required from three to five years.

In the U.S., the federal government’s strategy was to proceed on two tracks. The first track focused on deployment of the technology, using a range of programmatic techniques including grants to localities and metropolitan areas for deployment studies and more than 70 field operational tests of ITS concepts and equipment. The second track focused on the

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development of a national system architecture for ITS and subsequent grants to standards development organizations to develop specific standards.

An additional concern that has emerged more recently is the interoperability of distinct ITS systems and services. The national system architecture identified approximately 30 distinct “ITS user services.” Until recently, the standards development efforts focused primarily on defining the standards necessary for a particular user service. The concern about interoperability focused on how to determine where communication across user services might be desirable. For example, should the standards for a user service like electronic toll payment accommodate the exchange of information with traffic control centers? If so, how should the standards development activities in the two distinct user services be brought into harmony?

1.2 ITS Standards Program Review and Interoperability Workshop

The “ITS Standards Program Review and Interoperability Workshop” held at George Mason University’s Arlington, Virginia, campus on December 17-18, 1997, sought to strengthen the U.S. standards development program and increase attention to the issue of ITS interoperability. The workshop program was designed to focus on these two objectives with presentations by experts on relevant topics and by convening breakout groups on specific questions related to strengthening the U.S. program and highlighting interoperability issues. (A copy of the program appears elsewhere in this document). The genesis of the workshop was a proposal in late 1996 from Kan Chen of KCI, Roger Stough at George Mason University, and Chip White at the University of Michigan for an event in February 1997. The Joint Program Office at U.S. Department of Transportation and ITS America supported the initiative, and the focus broadened to include an assessment of the U.S. standards program, including interoperability issues. A planning group organized the workshop in multiple teleconferences, developed the program and identified invitees. Approximately 80 individuals participated, drawn from the public and private sector, from local, state and federal government, and from abroad. Planning group participants appear in the adjacent text box.

This document is a quick-turnaround record of the workshop. As such, it contains copies of the various speakers’ transparencies, selected background documents, and the reports of the two sets of five breakout groups. In order to make the record available as soon as possible, the editors of the workshop proceedings have provided little editing of the materials it contains. Hence, it is a resource document for the standards community.

1.3 Workshop Summary and Key Issues

The Workshop Program reflects the emphasis on the two main topics of interest, standards and interoperability. Structurally, the agenda has two parts. The first addresses standards and lasted from the beginning of the Workshop until mid-afternoon of the first day. The second addresses interoperability, which occupied the remainder of the Workshop. Brief introductory and summary remarks were made at the beginning and at the end of the Workshop, respectively. Christine Johnson gave the keynote speech at the Workshop dinner at the end of the first day of the Workshop, and Jim Costantino was the luncheon speaker the following day.

The standards development process was the subject of Sessions 1.1 through 1.4. Sessions 1.1 and 1.2 were plenary sessions that provided background information. An overview of the U.S.

standards development program was presented in Session 1.1, and other processes for developing standards in Europe, Japan, and the United States were presented in Session 1.2. Five concurrent breakout groups met during Session 1.3, and reports from these groups were presented in Session 1.4, which was also a plenary session

The interoperability half of the Workshop was organized similarly with breakout and report sessions following sessions designed to provide background information. Session 1.5 presented ITS interoperability approaches and lessons learned from the ITS America Interoperability Committee, the I-95 Corridor Coalition, the VICS program in Japan, and various European experiences. Session 1.6 was focused on interoperability and lessons learned from the Internet, whereas Session 2.2 (Session 2.1 was canceled) presented a general look at the use of consortia in ITS standards development (paper 221) and the experiences of a consortium for transit standards development (paper 222). Five concurrent breakout groups then comprised Session 2.3, with reports presented during the plenary Session 2.4. General summary discussions were presented during Session 2.5, and the Workshop was adjourned during closing Session 2.6.

1.3.1 U.S. Standards Program

Several core issues emerged in the Session 1.3 breakout groups. (The details of breakout group deliberations are presented elsewhere in this document.)

There are already “lessons learned” and useful procedures from European and Japanese current activities, such as experience with the accommodation of legacy systems and the VASCO testing procedures for DSRC.

The Council of Standards Organizations (CSO) needs more input from systems integrators and other stakeholders. It could play a more effective role by attempting to better synchronize and in general better organize U.S. standards development (and perhaps testing, certification, maintenance, and revision) across the standards development organizations (SDOs). Such an activity would formally include standards implementers, users, and product developers. It was noted that such a coordination activity might require the help of a systems integrator and would help to improve the process of communicating, for example lessons learned, across the SDOs. Similarly, there was a sense that the binding constraint on standards development in the context of the current process was not financial support but the limited number of qualified people available to support standards development.

With regard to international standards, it was expressed that there is a need for a policy that defines the scope and limits of U.S. Department of Transportation (USDOT) support of the international standards process.

Concern was expressed that not all the stakeholders of the standards development process, although invited, have involved themselves in the process and that these stakeholders need to be involved in the process in some way.

It was noted that participants in standards processes are often self-selected individuals who have the strongest interest in standardization and interoperability. Thus, it is important to keep

in perspective not only the advantages of standardization and interoperability, but also their limitations and the value of areas of technical and institutional development.

One core issue was how specific and how general standards should be. Some standards have such substantial latitude that compliant devices may not be interoperable.

A related question was the degree to which the objective of standards should be enabling advanced capabilities. One participant commented that if you want a standard, do nothing and locals will pick the cheapest technology. There may be a bias towards high-performance capabilities in the standards community, that is, standards that enable lots of capabilities that may be utilized in few or very few local implementations. Such an approach could provide economies of scale in production and distribution for equipment suppliers. But it is also worth remembering that Ford's reliance for too long on a single Model T for all auto customers cost it market share when GM began to offer greater variety. Moreover, Tucson, New York City and Portland, for example, are likely going to have very different ideas of what features a regional ITS should accommodate.

1.3.2 Interoperability

With respect to interoperability, there were also several key points. First, the majority of the participants endorsed the following definition for interoperability taken from ISO TC204 Document N271: "The ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together."³ Some groups expressed concern, however, about this definition being too general to be useful. In addition, when using this definition, three types of interoperability need to be considered:

1. **Technical**, involving the ability of equipment to communicate;
2. **Procedural**, involving data and procedures to exchange meaningful information; and
3. **Institutional**, involving financial agreements and contractual relationships between operators and users of an ITS service.

Technical interoperability enables procedural interoperability, but does not guarantee it. Technical and procedural interoperability enable institutional interoperability, but do not guarantee it.

For example, a standard may guarantee the technical interoperability of a DSRC tag. Different implementations of the standard, however, might prevent procedural interoperability by, for example, the selection of different values for particular parameters, such as frequency or

³ Z. Ketselidou *et al.*, "Automatic Toll Collection Systems in Europe: The Requirements for Interoperability," Presented at Third Annual World Congress on Intelligent Transportation Systems, Orlando, Florida. October 14-18, 1996.

message length. Further, identical implementations of a DSRC standard do not ensure that one toll road operator will honor a tag issued by another, which would require institutional interoperability.

ITS occur at the regional or metropolitan level, and interoperability across regions may not be cost-effective. Areas that have truly national user markets, like commercial vehicle operations, may be taking care of themselves. High-priority candidate user services for interoperability include: electronic payment, emergency management, commercial vehicle operations (CFO), travel information, incident management, and en-route guidance.

It is important to recognize the inherent tension between a nationally or internationally interoperable system and local innovation and customization, as every study of innovation acknowledges. The issue is where to be with respect to that tension.

Third, the consensus of the 80 participants, the majority of whom were from the United States, but also included representatives from Japan and Europe, was that ITS interoperability must address such attributes as privacy, safety, performance, security and reliability.

Fourth, the workshop examined the many institutional arrangements for establishing standards and promoting interoperability, including a pure laissez-faire approach that lets the market settle on standards, formal standards development organizations, government mandates or funding requirements, and consortia. Successful standardization and interoperability initiatives often rely on a combination of these organizations, rather than any single one.

Fifth, the workshop examined the issue of testing and validation of the interoperability of equipment. There was considerable agreement on a two-step approach. The first step was testing individual components or equipment for conformity with applicable standards to ensure that all parties had implemented a standard in the same way. The second testing and validation step was to test the integrated performance of the equipment working as part of a system. In addition, vendors were seen as the parties most logically responsible for testing at the first level (equipment), whereas buyers should be responsible for testing the second level (integrated performance).

Sixth, there was strong interest in using consortia to aid the development of standards and interoperability. User groups and consortia can provide significant impetus by providing endorsement (through trademark management), testing, monitoring, and other support services. The potential applicability of consortia is widespread, ranging from the identification of user requirements to testing and validation.

1.4 Conclusions

ITS standards and interoperability are developing in a social, economic and political environment that is changing. The end of the Cold War and continued integration of trade and tourism at a global scale have diminished-although certainly not eliminated!-the significance of national governments as central actors in economic and technical affairs. Alongside national governments, regions of various scales are emerging as critical determinants of economic

prosperity and social well being. Institutions created to represent and defend national government interests are being supplemented by new institutions and processes that are tied more closely to regional and functional missions-industry consortia, trade groups, and regional consortia.⁴ As James Madison observed, "In times of war, the national government must be the center. In times of peace, attention moves to the state and local level."

In Europe, these changes are apparent in the tension between pan-European harmonization of technical and regulatory standards, on the one hand, and subsidiarity, the deference given to national laws and customs, on the other. U.S. debates about federalism and the relative scope of state and federal authority are a reflection of the same issues.⁵

In the private sector, the desirable organization of an industry involves a tradeoff between flexibility and efficiency. Organizations that are efficient in a static environment may be inefficient in a dynamic environment, and organizational structures that are inefficient in a static environment may be efficient in a dynamic environment.⁶ During periods of rapid and significant structural change in an industry, coalitions, consortia and alliances may be more common. They are more easily dissolved than the development of new internal division or mergers, their sunk costs are lower, their commitments are less irreversible, and their inertia lower.⁷

For ITS standards and interoperability initiatives, these changes provide an opportunity to identify groups of industries, users, system operators, and suppliers who will benefit from standardization and interoperability. It may be useful to create coalitions, partnerships and other organizations to help focus and advance their interests.

Other large technical systems, such as those deployed by the Department of Defense and the Federal Aviation Administration, place much of their authority in centralized control structures to ensure reliable command and control. The ITS community must examine what institutional forms are best suited not to the success of standards and interoperability, but rather best suited to providing affordable ITS equipment and services in a timely manner to users and system operators.

⁴Kenichi Omae. *The End of the Nation State: The Rise of the Regional Economies* (New York, NY: Free Press, 1995).

⁵Jean-Pierre Camus, FIRST ITS WORLD CONGRESS.

⁶B.H. Klein, *Dynamic Economics* (Harvard University Press. 1987).

⁷ C.U. Ciborra. "Innovation. Networks and Organizational Learning," in *The Economics of Information Networks*, 91 -102, ed. C. Antonelli (Elsevier Science, 1992).

Planning Group Participants and Affiliations

Ken Brooke, Mitretek
Kan Chen, KCI
Roy Courtney, ITS America
Jonathan Gifford, George Mason University
Karyl Irion, ITS America
Robert S. Jaffe, Jaffe Engineering
Allan Kirson, Motorola
Bob McQueen, Post Buckley Schuh & Jernigan
Judy McQueen, Coherence, Inc.
Dale Nussman, Mitretek Systems
Bob Parsons, Parsons Transportation Associates
Mike Schagrin, U.S. DOT Joint Program Office
Andrew M. Schoka, Mitretek Systems
Susan Scott, Jet Propulsion Laboratory
Lee Simmons, FHWA
Ray Starsman, ITS America
Roger Stough, George Mason University
Chip White, University of Michigan

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2. Standards Breakout Groups: Reports of the Breakout Group I- 5 [Session 1.3]

SESSION 1.3, BREAKOUT GROUP ONE

1. Date and time of session: Wednesday, December 17, 1997 11:00AM-12:30PM
2. Name of facilitator: Bob McQueen
3. Name of recorder: Dale Nussman
4. Assigned topic: Process for Developing Standards
5. Names and affiliations of participants:

BREAKOUT GROUP 1 - ROOM 421

Bailey, Jack	ARINC	
Barrett, Robert	JPL	
Fleischut, Steve	Penn State	
Gifford, Jonathan	GMU	
Goodwin, Cecil	Viggen	
Heise, Cliff	Odetics	
Kurihara, Tom	ITE	
Leader, Shel	Edwards & Kelsey	
McCreery, Daniel	NEMA	
McQueen, Bob	PBS&J	Facilitator
Nussman, Dale	Mitretek	Recorder
Parsons, Bob	Parsons Transp.	
Pittenger, Jerry	Battelle	
Simmons, Lee	USDOT	
Stough, Roger	GMU	
Taylor, Russ	Lockheed Martin	
Thirumalai, K.T.	TRB	

1. While the current process by which standards are being developed seems to be working well, are there other mechanisms (processes and tools) by which standards can be developed more quickly and to a higher quality?

Audience Response: Much is being done on a voluntary basis to accelerate standards. Consideration should be given to paying for participation. Others asked if that isn't what the SDOs are paid for, i.e., the development of standards. It was pointed out that the SDOs are coordinators for standards development and the SDOs often hire specialists for the generation of standards. Much of community is not participating because they see no quick return/benefit to them. Another participant pointed out that others may not wish to have standards; it may be against their interests. Question: Is there a current list of standards that are being developed or are they created on an ad hoc basis? It was pointed out that the ITS standards are being created in response to the needs of the ITS Architecture. It was also pointed out that standards needs were identified via surveys and workshops.

Discussion item: "Should standards developers/participants be paid vs. voluntary participation?" Response: The facilitator (Bob McQueen) presented the European process where a user group that identifies a need for a new standard solicits support from the European Council. A statement was made that the FHWA is one of the few exceptions in the US in funding standards activities. An opinion was given that the infusion of government money is resulting in the development of many standards that would not be possible using only volunteers. A comment was made that additional money would

probably not help the standards effort. Several participants felt that a game plan was sorely absent and needed to be developed.

Discussion item: “Are limited resources available?” Again it was stated that more money won’t help unless the process is changed. There seemed to be a consensus of opinion that the CSO is not being effective. Why? Because no process is apparent. No one has put together a system to show how information moves across all of projects (e.g. interaction between efforts). The architecture team did a good job in establishing a process for the development of a systems architecture. It was felt that the CSO may be the right mechanism, but the CSO needs help and the process requires improvement. It was suggested that perhaps JPL, Mitretek and/or, ITS America could help to improve the CSO standards process. Things that need to be done include identification of interoperability issues. Also a data registry is needed. One participant suggested that a top down decomposition type of analyze of the standards process would help to improve the process (as was done for the Architecture).

Discussion Item: How can the process be improved? Should we use the European model? It was felt that there should be one group looking across the other groups. It was expressed that there is a need to define the timing of activities for better synchronization; i.e., a need for a systems integrator to pull all of the elements together.

Issue: Many stakeholders are not at the table.

Are there elements of the European and Japanese models that we should consider using?

Is the use of consortia for actual standards development (as opposed to guiding interoperability needs) something we should actively pursue?

2. How are current application areas (commercial vehicle operations, tolls, traffic management, transit, etc.) contributing to standards development?

There need to be a detailed process by which operational experiences should be fed back into the standards development process.

Battelle rep: I can’t think of one time when we’ve been contacted, and we have a wealth of experience in system deployment.. .There is not enough feedback on lessons learned.. .

Aud: Is there enough feedback from standards activities, e.g. Joel Markowitz activities?

Ans. This should be ok since Joel serves both with SAE and ITS-A. SDO’s include both users and implementers, so feedback should exist. However, it is perceived that feedback is spotty and inconsistent across/between SDOs.

Discussion: What can be done to improve situation? Aud: Include implementors, users, and others with equal voice in standards process. How do we deal with those who don’t participate? Response: Need to have a system to get their inputs/feedback. Battelle and SAIC have ITS assessment contracts, and these could be used to get feedback. Should there be a Federal requirement to get feedback from activities and provide guidance on use/implementation of standards?

3. It is understood that each SDO will be responsible for taking ownership and maintaining their individual standards. However, with all of the new ITS standards being developed, what is the best process for managing these from an overarching (i.e., system) perspective (management refers to configuration management, identifying new needs, resolving conflicts across applications, etc.)?

This topic was addressed and answered above.

Aud: Feels existing process can be used, if improved.. .

Regarding Mike Schagrin's Life Cycle Diagram, there is a need to show synchronization under "Technical Standards Development". Also the diagram should show "Feedback" for implementors to standards development.

SESSION 1.3, BREAKOUT GROUP TWO

1. Date and time of session: Wednesday, December 17, 1997 11:00AM - 12:30PM
2. Name of facilitator: Ray Starsman
3. Name of recorder: Judy McQueen
4. Assigned topic: Process for Implementing Standards – Public Perspective
5. Names and affiliations of participants:

BREAKOUT GROUP 2

-ROOM 423

Cox, Chris	I-95 Coalition	
Crabtree, Joe	U of Kentucky	
Eisenhart, Bruce	Lockheed Martin	
Kronenberger, Bill	Houston Metro	
Lowe, Doug	TX DOT	
McQueen, Judy	Coherence Inc.	Recorder
Onder, Mike	USDOT	
Saxton, Lyle	Consultant	
Schagrin, Michael	USDOT	
Seymour, Ed	TTI	
Starsman, Ray	ITSA	Facilitator
Tate, James	NY Thruway	
Wright, Jim	MN DOT	
Yuan, Ray	APL	

1. What experience have agencies had with implementing new or draft ITS standards? Identify particular lessons learned with utilizing these standards.

The initial experience that agencies have had is with proprietary standards. Changeable message signs, detectors, and signals commonly in use are based on proprietary standards. Due to pressure from the users, some manufacturers have moved to interoperable and in some cases open standards. For example in the area of Commercial Vehicle Operations, the tags used on ADVANTAGE 75 have become interoperable with those used in HELP.

The disadvantage of proprietary standards is that consumers, both public and private, get locked into a single vendor.

The need to be able to communicate across jurisdictional boundaries and to mobile travelers has made customers more aware of the need for open national standards, including underlying data dictionaries, message sets and data models. However, while these standards are needed now, it is important that they be written well and we should not rush the standard development, product development and deployment cycle so much that we get inadequate or non-interoperable results. We need testing and validation procedures for both standards and products. We need to agree on standard operational concepts and deployers, integrators, producers and developers need training to understand the emerging standards. The process to obtain interoperable, open standards is necessary to meet the customer and traveler demands for interoperable ITS systems.

2. What level of operational testing and performance evaluation should be completed prior to indicating that a standard is acceptable for

implementation by public agencies? At what stage in the development of a particular standard should it be published for review and comment?

It is necessary to bring the standards writing and implementation people together in order to generate a single, unambiguous standard. This might be a forum similar to the DSRC forum. To verify that the standards work, it is necessary to implement a suite of standards in a focused standards MDI-like real world laboratory. The suite must be demonstrated to work together in deployment. We need to be clear up front concerning the goal of the standards MDI. The goal could be plug and play or communications across interfaces or geographic interoperability. In addition to the standard, implementation guidance, operational concepts and training are needed.

While the need for open standards is great, it is not recommended that ITS deployments be stopped until the standards are available. The process of standards-deployment-operations-standards, etc. is a continuum with feedback between each of its steps. In any given cycle, there will always be legacy systems and planning for new capabilities and improved technologies.

3. How will standards implementation be affected by legacy systems? What issues need to be considered? Is tying into legacy systems with standard compliant products of major concern?

As indicated in the points above, the process of standards deployment and operations is a continuum and the existence of legacy systems and the need to deploy new capabilities will never cease. We need to plan continuously for change. This brings home the difficulty in developing standards in such a rapidly changing environment as ITS. We will have to figure out how to determine when a standard is good enough to use and if it is sufficiently important and good enough to mandate. The participants in this breakout session were concerned that in our enthusiasm to deploy ITS interoperably we were trying to make the standards process faster and easier than it can be done.

In conclusion, the breakout session recommends the following actions:

1. Bring standards writers, developers, and implementors together in a forum.
2. Provide real world MDI-like laboratory to test a suite of related standards and demonstrate that they work together interoperably.
3. Deploy beyond the MDI test site only after the demonstration successfully shows that the goals have been achieved and guidance, training and operational concepts are firm.

SESSION 1.3, BREAKOUT GROUP THREE

1. Date and time of session: Wednesday, December 17, 1997 10:00AM – 12:00PM
2. Name of facilitator: Shelley Lynch
3. Name of recorder: Susan Scott
4. Assigned topic: Processes for Implementing Standards -Public Perspective
5. Names and affiliations of participants:

BREAKOUT GROUP 3

-ROOM 424

Figueredo, Jorge	OOCEA	
Gray, Neil	IBTTA	
Hogan, Mike	NIST	
Ice, Ron	Odetics	
Jacobson, Leslie	Wash DOT	
Karoly, Al	NY State DOT	
Lister, Mac	USDOT	
Lynch, Shelley	USDOT	Facilitator
Mauer, Donald	NJ Turnpike	
Okunieff, Paula	Cambridge Sys.	
Phillips, David	Chicago Trans.A	
Schoene, George	USDOT	
Scott, Susan	JPL	Recorder
Strickland, Bo	Consultant	
Tadej, Peggy	K a m a n	
Obenberger,Jon	USDOT	

1. **What supporting materials in the way of test performance results, technical support documents, training, or awareness information is needed by the public sector to effectively implement new ITS standards? Who needs what information (e.g., managers, technicians, CEOs)?** Provide specific examples of the type of information, level of detail, and materials required to assist agencies in their awareness and understanding to facilitate the implementation of standards.

The first issue is *who needs to be engaged* in implementing new ITS standards. Lab technicians, managerial personnel, traffic operations personnel, and maintenance personnel need to be involved. From a transit perspective, the schedule department has to be involved from an early stage, as does the department assigned to implementing AVL technologies (which may be operations or engineering). The system integrators for both hardware and software need to be involved - these people may be vendors. The systems designers have to be involved. If a planning department exists, that department needs to be involved, because in some cases the planning department controls capital investment. The system administrators, board of or other public oversight board, and legal staff also have to be involved in the case of toll administration. Executive staff and the finance director have to be involved in the case of toll administration, but not necessarily for traffic or transit management. *Programming structure differs widely from agency to agency, so there isn't a good general rule on who should be involved.*

The second issue is *what kind of information* each type of person needs? The personnel discussed in the previous paragraph were grouped into five general categories based on their information needs.

Traffic system managers or system engineers - whoever makes the decision on what standard to use - need to know the details of the standards. They need to have an understanding of the technical standard itself and all of the documentation, including test performance results. If there is standards training available, this is the target audience.

Executive-level managers that approve the decision of the technical decision-makers need awareness-level information on what the standards do. They need information on why the standard is being used, and the fiscal impact. They need information on how the standard compares to alternative approaches, including other standards, and the broader context into which those standards fit.

Implementers - those who put the system into place (designers, project managers) - need the technical definition of what the standard is and how to test compliance. The technical decision makers and/or the implementers make decisions on which elements of the standard are applicable to a particular existing system. The project manager needs a detailed implementation schedule and what impact it will have on operations.

Supporting elements such as purchasing people and administrators need information on what standard has been chosen and why. If this requires new procurement procedures, they will need a high-level justification of why the standard is being implemented. They may need information on what text to put in legal boilerplate for procurement (i.e. - "equipment must be stamped standard XXX compatible and must have passed certification text y")

Maintainers of the systems need technical information on what the standard is and how to do compliance testing. For data dictionary and message set standards, they need the technical details.

2. What strategies do agencies anticipate will be the most effective to ensure manufacturer compliance with new and evolving standards? What technical support information or testing capabilities do agencies envision requiring to ensure manufacturer or product developer compliance with these standards?

If the agency performs conformance testing, it will want samples to test. If the agency accepts outside testing, it will want testing results certified by an outside party. Vendors can provide test results, or "declare" compliance. Another alternative is that the vendor can perform tests in the presence of agency personnel. Testing for conformance to contract requirements almost always requires on-site testing, while testing compliance to a standard could more easily be done through an outside testing lab. There are additional tests needed for reliability, performance in particular environment, etc. The approach taken by DOT in providing the NTCIP Exerciser to make it easy for manufacturers to test compliance to the NTCIP standard is an approach that might be applicable to testing of other ITS standards. Deciding how much testing to do for software remains a craft, not a science.

Interoperability testing is a different issue from conformance/compliance testing, but might cut down on costs for testing of individual standards and components. Interoperability testing can be performed by testing pairs of components or by declaring a reference implementation against which to test (such as Windows 95).

There was a consensus that interoperability testing in combination with certified independent test results was the preferred method for ensuring standards compliance. A national laboratory would be the preferred independent testing organization. Manufacturers would likely prefer a method that ensured worldwide recognition of the test results.

3. There will be a number of institutional and resource constraints associated with ensuring compliance with ITS standards. What measures should be considered by U.S. DOT to facilitate the implementation and compliance of standards by State and local agencies?

There will be numerous institutional constraints in implementing ITS standards. These will include issues of budget, timing, and cost/benefit analysis. If the agency has no history with a particular standard, there may be some institutional resistance. There is always a risk associated with being the first implementer of a new technology or standard - agencies don't want to be the first to deploy. There may be a perception that standards reduce flexibility and functionality, particularly if a state agency is dictating standards compliance to local agencies that perceive that they have unique implementation issues.

There is a significant institutional issue with legacy systems, particularly when those legacy systems are mission-critical and the migration path is yet undefined. Vendors may be reluctant to supply components if there is a perception that the standard will change every few years. The future migration path is critical to resolving some of these issues. In some cases, the institutional issues of dealing with 37 proprietary systems may make standardization necessary. As the number of agencies involved in coordination multiplies, standards (versus multiple incompatible legacy systems) actually become increasingly attractive, so in some cases legacy systems are an institutional "push" towards standards rather than a constraint. It depends upon the legacy system whether backwards compatibility is required - in some cases agencies are willing to "throw away" existing equipment to comply with a new standard.

There may be significant costs involved in implementing standards. If components can be "swapped out" incrementally, that will help deal with the costs of evolving towards a standardized system. There may be costs involved in building translators to make legacy equipment compatible with new standards. In some cases, there is not enough hardware memory in the existing system (for example, 386 computers) to comply with new equipment, even if the equipment is compatible in theory. There needs to be an understanding that the migration to standards cannot happen overnight. However, there are also significant costs in NOT implementing standards - no effective system is static.

The institutional issue of having to deal with multiple generations of incompatible products, such as transit AVL systems, is another "push" towards standards. Agencies would rather buy standardized equipment once than deal with several generations of incompatible products that are no longer supported by the manufacturer.

There is a danger with implementing standards prematurely. There needs to be a more cautious examination of how standards meet implementation needs. State or federal authorities should not mandate standards that have not been carefully measured against local implementation requirements. However, if standards are delayed, they may be obsolete given the rapid evolution of ITS itself. There is always a compromise between getting standards done quickly and ensuring that the standards meet local needs. Standards need to be flexible to accommodate future needs. There needs to be a mechanism in place for enhancements and revisions to the standard. The standards process needs long term support to ensure both backwards compatibility and appropriateness for future systems. As the standard itself evolves, there needs to be backwards compatibility with products designed to previous versions of the standard.

Actions for DOT:

DOT needs to support maintenance and revision of standards.

If DOT wishes people to use the standards in progress, there is a need for training and outreach. DOT needs to provide guidance documents and workshops to explain 1000-page standards to local implementors who were not involved in the standards development process.

DOT needs to provide financial support to help local agencies make the transition to standardized systems.

DOT needs to mandate some minimal compliance to standards in order to level the playing field. For example, buses should be pre-wired for ITS devices as a federal regulation.

DOT needs to provide guidance on the desired outcome and what level of standardization is the “end goal.”

SESSION 1.3, BREAKOUT GROUP FOUR

1. Date and time of session: Wednesday, December 17, 1997 10:00AM - 12:00PM
2. Name of facilitator: Allan Kirson
3. Name of recorder: Alex Lopez
4. Assigned topic: Processes for Implementing Standards – Industry Perspective
5. Names and affiliations of participants:

BREAKOUT GROUP 4 -ROOM 426

Brooke, Ken	Mitretek	
Chen, Kan	KCI	
Cunningham, Ron	Lockheed Martin IMS	
Greene, Ed	Ford Motor Company	
Jaffe, Rob	Jaffe Engineering Development Ind.	
Jones, Bill	USDOT	
Kehzli, Mark	Lockheed Martin IMS	
Kirson, Allan	Motorola	Facilitator
Lopez, Alex	ITS America	Recorder
Mammano, Frank	Consultant	
Mills, Dwight	IT5 America	
Onder, Mike	USDOT – JPO	
Schnacke, Dick	Amtech	
Schopp, Bruce	NEMA	
Schuman, Rick	ITS America	
Tarnoff, Phil	Consultant	

1. **Is the standards process working in producing standards that are ready for implementation? How can the process be improved?** Identify any expected product certification needs.

This is dependent on actual standard being developed. One way to judge the completeness of a standard is whether it includes testing or not. It was noted that there are two phases of testing that should be addressed, i.e., product level testing and field deployment testing.

Some standards include the testing component, but since these have not yet been tested, they are published as “recommended practices” and upgraded to full standard status after testing has been completed. Standards are sometimes “downgraded” to “recommended practice” because no testing was undertaken due to the accelerated development schedule. In a normal consensus standards effort, testing is often performed as part of the standards development process, which allows a tested “standard” to be published. This usually takes 3-5 years. An accelerated standard has not had this benefit, so testing has to be performed afterwards.

Notwithstanding the above, if the FHWA had not provided the “seed” money for standard development we would not be where we are today. What we should be saying when describing milestones for accelerated standards is that, “in a year [for example] we will have a draft standard, ready for testing.”

FHWA needs guidance as to what should and should not be done to steer this process. We may have too many standards under development at once, making the process

difficult to manage. System integrators are finding difficulty with too much development going on at once. We may want to step back and review the status and priorities, and focus on doing a few things well. ITS A is trying to develop a systemic approach to standards which may help this process.

NTCIP/TCIP has gotten broader participation by trying to deal with an entire set of standards at once. Should standards activity be limited to only a few areas? Try to fine tune responses to the ITS A survey on standards. Step back, evaluate and analyze what should be done next, instead of doing everything at once.

Is our ability to effectively produce relevant standards “sapped” by the fact that only a few people are really qualified to develop the standards?

Standards development organizations should require that ITS standards include testing as part of the standard, or as a related, referenced standard. SDOs should look into approaching the academic community to perform computer modeling and simulation as a step towards accomplishing testing and certification of developed standards.

When buyers of new equipment require conformance to new standards, then manufacturers will implement the standards. Therefore, new and improved marketing approaches should be explored during standards development. Standards developers should think about how they are going to “market” the standard during its development to gain broad participation and awareness, and then consider how they will “sell” the standard once it is complete. Also, education will be required for those who wish to implement the standard in products or those who need to know the performance characteristics so that they can make intelligent decisions when buying new systems.

2. What are the roles and responsibilities of various groups and organizations in facilitating implementation (e.g., US DOT, ITS America, product developers, system integrators, etc)?

We did not have time to discuss this question, other than to say that the procuring authority will have a direct effect on the development of conforming products by requiring conformance in their procurement contracts.

3. What groups are missing from the current standards process that are crucial to implementation? How can we get these people involved?

The list should include automobile manufacturers, depts. of motor vehicles (tags), incident management organizations, including those involved after an incident. Outreach should include specific groups, e.g., Police, Fire, Sheriffs, APCO, Ambulance, EMS directors, etc. The real problem is the complexity involved with trying to determine all the “right people” involved in standards development. Perhaps the list can be “tiered” or “culled” based upon their level of interest, or based on whether they really have to influence the standard or will just use whatever comes out.

The banking industry should be included in ETC efforts and other fee collection applications. A comment was made that in Europe the banking industry is reluctant to give up information (may be privacy issue).

The consensus standards process allows any interested party to participate. If they choose not to, then they should not complain about the outcome. However this requires that

standards efforts are well advertised, so that the various affected groups are at least aware of the activity and decide consciously not to participate.

Many ITS standards are communications oriented, and some rely on existing RF infrastructures. Therefore, the FCC and common carriers should be involved with standards development, e.g., FCC impact on DSRC is significant.

4. How will standards implementation be affected by legacy system issues? Is this a real problem, or a “red herring?”

It is a real problem, but one that will diminish in severity over time as the wholesale replacement of “older” systems becomes one of evolutionary change as technology advances. We will always be faced with “wrapping” some existing system into a new framework to be into compliance with the National Architecture.

How can the body of standards being developed assist in deploying new systems? We should develop a systematic learning process to learn what the Europeans and Japanese are doing to address legacy systems. There are more legacy systems in other parts of the world that have been integrated into new systems.

CVO is handling legacy systems by using EDI standards. Applications are being developed that ride on top of existing systems, and use EDI to interoperate. This is a phased approach, which will disappear as new conformant systems are deployed.

The real issue is how two or more systems can operate in the same environment at the same time. So, should the 30 user services be regrouped by common physical interfaces?

New standards should accommodate legacy systems with a “do no harm” philosophy. Legacy is not synonymous with closed systems. Never get replacement of good existing systems. Sign of thriving markets. Expense will increase for users of legacy systems. New standards and legacy systems coexist today, the problem will come about by the use of required standards, tied to federal funds. DOT will not be required to dump legacy systems.

SESSION 1.3, BREAKOUT GROUP FIVE

1. Date and time of session: Wednesday, December 17, 1997 10:00AM — 12:00PM
2. Name of facilitator: Roy Courtney
3. Name of recorder: Karyl Irion
4. Assigned topic: International
5. Names and affiliations of participants:

BREAKOUT GROUP 5 - ROOM 428

Armstrong, Lee	Armstrong Consul.	
Courtney, Roy	ITSA	Facilitator
Glass, Bob	JPL	
Gordon, Steve	SAE	
Greene, Edward	Ford	
Irion, Karyl	ITSA	Recorder
Kipreos, Thanos	TIA	
Mills, Dwight	ITS America	
Oyama, Satoshi	Hitachi	
Pickford, Andrew	Combitech	
Rokitansky, Karl-Herbert	U Achen	
Schoka, Andy	Mitretek	
Tsuda, Hiroshi	ITSA-Nissan	
Weiland, Richard	SEI	
White, Chip	UofM	
Harasan, ITS America		

Note: special thanks are due to Andrew Pickford of Transport Technology Consultants for his invaluable assistance in helping to summarize the session and prepare the notes.

1. What elements of the US Program need to be harmonized internationally?

Recommendations:

- A. Group 5 recommended a joint coordination among ITS partners to determine which US standards are of interest to provide as an input to the international community, e.g. Coordinate with Europe and Japan on the use of ISO Fasttrack for NTCIP.
- B. The group also recommended that there be international coordination at the various stages of the US standard development process, for example, such items as the following:
 - Use European model for US DSRC analysis.
 - Data Registry
 - National Architecture
- C. The group suggested that the US consider the acceptance of international tests, analyses, field trials, etc. as possible examples for the US approach.

2. What are the criteria for determining which US standards should be considered for the international arena?

- A. Group 5 decided that an important criteria for considering a US standard for the international arena is if it involves interoperability across borders, e.g., CVO border crossing in North America.
 - B. The marketability of products/services is another important determinant for considering bringing a US standard to an international arena. The larger market that would be available to the product if it was compatible in other countries would be a cogent argument. In addition, a subsystem may be cost-effective with a worldwide market and not just in the US or a small locale or niche where it will not be cost-effective.
 - C. The degree of maturity of the product technologically, with the higher credibility and quality assurance would also be a greater candidate for a US standard to be shared overseas, if feasible. It would have a competitive advantage over other less developed products and would be a better candidate for a consensus standards due it's greater development.
 - D. Providing already established US standards internationally would avoid unnecessary or duplicative time and effort.
 - E. Environmental/safety concerns are a strong reason for sharing US standards internationally, since it would be mutually beneficial and again, products would be marketed under similar and thus fair restrictions.
 - F. Applicability and implementability in foreign countries is an important determinant when choosing standards for international introduction, for example, in the case of the use of 915 MHz internationally for DSRC, is not technically or institutionally feasible, although it is being implemented in the US.
 - G. Commonality of interfaces/functions provides synergy and a wider market, therefore US standards that involve commonality of interfaces should be considered for international introduction.
 - H. Economic impact is a determinant for international standards candidates because large markets relates to high volumes and lower cost per unit.
- 3. What is the process to determine where/when international standards are needed?**

The group defined the following process steps:

- A. Develop agreed upon and accepted criteria
- B. Develop a standard way to propose new standards
- C. Create an organization to assess proposals for international standards
- D. Define methodology for implementation, plans, and procedures for international ITS standards development.
- E. Monitor activities in various international arenas, for example ISO, CEN, IEC, NAFTA, and ITU.

- F. Perform regularly scheduled, periodic reviews of the ITS international standards development.
- G. Develop a program of pro-active outreach.

4. What resources are needed to ensure adequate U.S. support of the international standards process?

The group identified the following items, in approximate priority order, as critical resources required to ensure U.S. support of the international standards process:

- A. Develop a policy defining the scope and limits of U.S. DOT support of the international standards process.
- B. Establish an organizational structure, such as a Central Forum, which incorporates existing SDO's to manage the U.S. international standards activities.
- C. Human resources must address the right skill mix, right stakeholder mix, and dedication and continuity of participation by individuals.
- D. Financial resources provided through Federal leadership, private participation and public participation.
- E. Special facilities for test and Development
- F. Central Registry and Data Dictionary

5. What existing or developing international standards can be used to satisfy U.S. needs (and therefore, which ones should we pay the closest attention to)?

This topic was not addressed.

6. What exists currently in the International arena already for ITS standards?

Currently, the following international arenas and areas contain ITS standards:

- ISO TC204 work items,
- TC22 work items
- TC2 11 work items
- ITU - WG8A work items
- NAFTA Partnership work
- Outreach to other countries by ITS America, et al

Recommendation:

Create a Central Forum for developing a U.S. role in international ITS standards. For example: Information Infrastructure Panel re: NII, GII issues. This Forum would be

above any one SDO or current consortium. Currently, the approach is fragmented and sporadic. The Forum would provide coordination of objectives, priority-setting, strategy development relative to international development. For example, Japan is planning the development of a steering committee for coordinating Japan's role in all international ITS Standards arenas, e.g. DSRC and ITU and ISO/TC 204/WG15.

3. Interoperability Breakout Groups: Reports of the Breakout Group 1 - 5 [Session 2.3]

SESSION 2.3, BREAKOUT GROUP ONE

1. Date and time of session: Thursday, December 18, 1997 10:00AM — 12:00PM
2. Name of facilitator: Bob McQueen
3. Name of recorder: Dale Nussman
4. Assigned topic: Interoperability Testing/Certification Issues
5. Names and affiliations of participants:

Barrett, Robert	JPL	Participated
Fleischut, Steve	Penn State	Participated
Heise, Cliff	Odetics	Participated
McCreery, Daniel	NEMA	Participated
McQueen, Bob	PBS&J	Facilitator Participated Recorder Participated
Nussman, Dale	Mitretek	
Parsons, Bob	Parsons Transp.	Participated
Taylor, Russ	Lockheed Martin	Participated

1.a. What level of compliance testing is warranted?

In response to the above question, a participant asked “What is meant by level?” The Moderator addressed this question by drawing a diagram of a subsystem consisting of three components a, b, and c. The group then discussed what type (level) of testing would be required.

Several participants came from DoD environments where the government looked after certification. This brought up a second question: “Who do we think is responsible for ITS certification?”. It was suggested that perhaps we should consider the DoD model, where there is one big customer - the DoD, who leads test & certification. A comment was made that the ITS doesn’t have one big customer. A suggestion was made that perhaps we should look to large customer groups such as E-Z Pass to address compliance testing.. It was mentioned that there is pending legislation to reduce the amount of ongoing government and government requested testing, which is an effort to back the government out of testing.

Group consensus: We should consider two extremes, with different flavors. Model 1 = Government Certification (N/A to ITS); Model 2 = supplier driven testing/certification; Model 3 = Independent agency.

The Moderator asked the group “Is it possible to specify a level of conformance for ITS? To help answer this question, the Moderator drew a diagram that showed a Communications line between a Control Center and a Sensor. The group was asked “Should we do certification for the whole system or do each separately? A comment was

made that we don't care about each parts of the system, as long as the system meets our requirements. A comment was made that this product-oriented approach had the difficulty of very few products standards in existence.

The Moderator asked the group if we should concentrate on how an entity performs a function or should we concentrate on what it does for us? Two approaches were proposed:

Approach 1: gate - comply with product level standards: has everyone implemented the standard in the same way?

Approach 2: test for integrated performance

Consensus was reached on the above two -step approach, i.e. Products A & B would first be product tested and then tested together.

A comment:was made that there is a need to receive feedback from test/certification to standards maintenance (ref. Mike Schagrin Standards Life Cycle chart in Workshop Binder).

1.b. Unit product tests, subsystem tests, tests of an entire ITS user service, or testing of multiple user services?

This question was addressed in the above discussions.

2. How should buyers be protected when buying ITS Products? Should manufacturers be required to self certify or should there be an independent monitoring system of compliance?

The group discussed the level of trust in buying products and decided that protection was needed. *Approaches that were considered were:* Self certification w/ single vendor - or use vendor consortium supported by independent testing cooperation. Possibly supply some government support for this activity. A question was asked on who has legal liability relative to product testing. A comment was made that SDOs very concerned about this. It was pointed out that there are also political implications.

The Moderator asked the group if the public had voiced that they need protection in this area? Most thought not. A comment was made that much of the impact falls upon the implementers (e.g., having to write more code). *There seemed to be consensus that users may not be close enough to the equipment to recognize potential interoperability problems.*

The Moderator asked if we can say that Approach 1 (product) is vendor led and Approach 2 (performance) is buyer led. *Consensus was reached in this area.* A participant described a current situation in Washington where 30+ buyers are looking for similar transportation equipment. A question was asked as to who needs protection in this case? It was agreed that everyone from manufacturers, to implementers, to government representatives, to the public needed protection. A comment was made that a minimum of amount of "confidence testing" was needed for all equipment.

The Moderator noted that the group had talked of the government as a buyer and as a standards developer. Should we also consider the government as a tester? There was consensus that it would be cheaper for vendors to self-certify.

3. How can the ITS community set up a testing approach that minimizes overall costs and encourages larger supplier markets (to bring down unit costs.)?

A comment was made that self certification or a certification consortium would drive down costs (less hoops to go through). Presently, multiple users of products place their own (often unique) test requirements on vendors and this raises costs. It was noted that agencies in California have teamed together on testing to save costs.

There was consensus that buyers testing and performance testing are both required.
A comment was made that there's been a repeated problem in the conduct of tests due to incorrect test specs and test set up.

4. What is the best strategy to implement an ITS Compliance program to ensure we gain interoperability? Who should lead this effort? What should be the roles of the various players?

Part a. Best strategy? . . . See responses to above questions.

Parts b & c: Who should lead this effort? *Vendors have the first vested interest and Buyers have the second vested interest.* Also, see responses to above questions.

SESSION 2.3, BREAKOUT GROUP TWO

1. Date and time of session: Thursday, December 18, 1997 10:00AM - 12:00PM
2. Name of facilitator: Ray Starsman
3. Name of recorder: Judy McQueen
4. Assigned topic: Interoperability Testing/Certification Issues
5. Names and affiliations of participants:

BREAKOUT GROUP 2

-ROOM 423

Cox, Chris	I-95 Coalition	
Crabtree, Joe	U of Kentucky	
Eisenhart, Bruce	Lockheed Martin	
Kronenberger, Bill	Houston Metro	
Lowe, Doug	TX DOT	
Lam, Eva Lemer	Palisades Group	
McQueen, Judy	Coherence Inc.	Recorder
Onder, Mike	USDOT	
Saxton, Lyle	Consultant	
Schagrin, Michael	USDOT	
Seymour, Ed	TTI	
Starsman, Ray	ITSA	Facilitator
Tate, James	NY Thruway	
Wright, Jim	MN DOT	
Yuan, Ray	APL	

1. **What level of compliance testing is warranted? Unit product tests, subsystem tests, test of an entire ITS user service, or testing of multiple user services?**

The answer concerning the level of compliance testing needed depends upon whether you are buying a component or an entire system. In general, products must be tested at the unit, the interface, and at the system level to ensure end-to-end functionality.

2. **How should buyers be protected when buying ITS Products? Should manufacturers be required to self certify or should there be an independent monitoring system of compliance?**

In addition to self-certification and independent testing, the buyers may test their own products. But this could be very expensive as most buying agencies or individual consumers don't have the technology or skills to perform their own tests. Breakout session 2 cited several examples in which self-certification didn't work for new products due to different interpretations of a standard by the vendor and the procuring agency. It was concluded by the breakout session that an accepted, standardized test procedure is required for any of the above three methods of testing. The remaining questions, left unanswered, are who writes the test procedures and who runs the test. Some suggested ways of addressing these questions are proposed in question 3 below.

3. **How can the ITS community set up a testing approach that minimizes overall costs and encourages larger supplier markets (to bring down unit costs.)?**

Breakout session 2 suggests four ways of reducing the cost of testing:

- a. An exerciser or simulation model may be used as a tool for analytical assessment of a standard.
- b. Disparate agencies could pool their resources for testing and all would agree to accept the results.
- c. A national testing organization could be employed to provide certification and
- d. Organizations could share field test results. For this last method of testing to work, the field test results have to be publicized and the purchasing organizations have to accept those results as valid.

If a test facility is used, it has to be accredited through a process that tests the tester.

4. What is the best strategy to ensure interoperability? Who should lead this effort.? What should be the roles of the various players?

Breakout session 2 concluded that the answers to the above question would be different depending upon in whose interest it was to achieve interoperability. The answer would be different if the interest was: national, regional, agency, vendor, individual. It was concluded that there was insufficient time to answer the question for each of the above, but the first one, national interest, would be taken as an example. In order to obtain public benefits such as reduced price through economies of scale and more convenient, safer and less congested national travel and at international borders, selected ITS functions should be interoperable. These functions are primarily those that interface directly with the traveling public. The following have been identified, but not prioritized: Emergency Medical Services, Incident Management, Traveler Information, Fare and Toll Payment Systems and CVO regulation. At the end of the Breakout Session the group concluded that it was necessary to examine each of the functions to determine who should lead the effort to ensure interoperability. Having run out of time it was concluded that the continuation of this effort is important and is a proper task for the Interoperability Subcommittee chaired by Bob Parsons.

SESSION 2.3, BREAKOUT GROUP THREE

1. Date and time of session: Thursday, December 18, 1997 10:00AM – 12:00PM
2. Name of facilitator: Shelley Lynch
3. Name of recorder: Susan Scott
4. Assigned topic: Interoperability Requirements
5. Names and affiliations of participants:

BREAKOUT GROUP 3

-ROOM 424

Figueredo, Jorge	OOCEA	
Gray, Neil	IBTTA	
Hogan, Mike	NIST	
Ice, Ron	Odetics	
Jacobson, Leslie	Wash DOT	
Karoly, Al	NY State DOT	
Lister, Mac	USDOT	
Lynch, Shelley	USDOT	Facilitator
Mauer, Donald	NJ Turnpike	
Okunieff, Paula	Cambridge Sys.	
Phillips, David	Chicago Trans.A	
Schoene, George	USDOT	
Scott, Susan	JPL	Recorder
Strickland, Bo	Consultant	
Tadej, Peggy	Kaman	
Obenberger,Jon	USDOT	

1. What should be the definitions of ITS Interoperability, Compatibility, and Product Conformity? (review those recommended by the Interoperability Subcommittee)

There was a discussion of the definition of interonerability. It was suggested that the term “other systems” be changed to “different systems.” It was suggested that interoperability is more than just exchanging services - all the functions and features of one system can be used by the other system. Merely being able to plug one component into another system with limited functionality is plug comnatibility or interchangeability. Interoperability goes beyond the mere exchange of data - the data must be useable by the other systems.

Implementers at the local level do not have a good understanding of what to expect from interoperability. In some cases, they have a limited view of interoperability as plug compatibility. In other cases, they have expectations that interoperable systems will allow remote operation of one system by another system’s operators. The degree to which data from one system should be immediately usable by another system is not clearly defined. There is a need for “plug and play” compatibility. It is not useful to rewrite the definition until actual user requirements for interoperability are better understood. Something could meet a one-sentence definition of “compatible” or “interoperable” and not truly serve user needs for interoperability. The goal should be meeting user needs, not developing the best academic definition.

2. Is interoperability required for all 30 user services? What 5 services need interoperability most?

Some user services will take place largely within a single company, such as CVO administration processes, so full interoperability may not be the first priority. Similarly, services which involve a few highly customized local systems rather than 5000 local systems with similar functionality will be at a lower priority for interoperability for both software vendors and users. The highest priority items will be services that involve end-user consumer products with near-term market deployment. The highest priority items would also be services involving communication between systems. For example, autonomous route guidance would not meet that criteria but dynamic route guidance would. Largely autonomous systems/services including all the advanced safety systems would be low priority for that reason. Public sector “foundation” services should be high priority for interoperability, particularly in terms of providing data in common formats for dissemination to the public and sharing between public agencies

The user services are not very useful for defining interoperability. The issue for interoperability is interfaces BETWEEN user services and between pieces of equipment. The group identified the highest priority interfaces for interoperability, noting that many of the key interfaces fit into a larger general category of “center to center” communications. The group chose five high priority interfaces and two medium priority interfaces for interoperability.

High priority interfaces:

ISP to device

Transit Vehicle to Transit Management Center (TrMS)

Electronic payment (transit, toll)

DSRC

the overarching set of Center to Center communications

 TMC to ISP

 Traveler Information Center to Traveler Information Center (ISP to ISP)

 TMC to TMC

 Transit Management Center to Transit Management Center

 Emergency Management to Traffic and Transit Management

 ISP to ISP

 Transit Center to ISP

Medium priority interfaces:

Field Device to Traffic Management System

Center to ISP

3. How and who should define interoperability requirements? Review the recommended process offered by the Interoperability Subcommittee and then determine which organizational approach is best - ITS technical committees, special consortia, the CSO, or other.

It would be helpful to let actual users draw the end-to-end diagram from which interoperability requirements are defined. Several users disagreed with the ETTM/DSRC diagram in terms of identifying key functions and interfaces. It is not possible to usefully discuss technical requirements for interoperability with such a simple chart.

The actual placement of readers in the roadside is a safety issue - true interoperability is not just communications; it also includes issues such as safe placement of new devices within the existing highway context. None of the three categories of interoperability address this safety issue, although it may be an institutional or technical issue.

The question about whether interoperability is required for new systems versus legacy systems is not helpful in defining interoperability requirements. The decision on whether or not to provide backwards compatibility is a business model issue. Some technologies can be made backwards compatible, which others cannot.

Interoperability on a regional or national issue should be divided into communications device issues versus data content issues, because in some cases several communications devices or protocols can deliver nationally standardized data content or format.

This approach would not be useful for creating a memorandum of understanding between different agencies. It is not detailed enough. It doesn't get at the details of what the interfaces need to do.

It is not clear what the results would be used for or what the desired end product is. What is the end product supposed to be USED for?

The analysis should not be top-down. It should be bottom-up, from a user perspective. It needs to be specific to a particular application.

This process is not useful on getting actual implementation agreements. It isn't useful at defining interoperability requirements.

There is a need to deal with institutional issues of interoperability, which is not being adequately covered by the standards process. There needs to be a process for helping agencies apply standards to their systems. Those issues need to be dealt with, but this isn't the right process.

This process may be a useful high level screening tool for discussing interoperability, but it isn't the complete process needed. The questions don't address very clearly the goal of the process, which is presumably deciding what needs to be interoperable and testing for interoperability.

There was not sufficient time for discussion of which organizational approach is best.

4. How should the different interoperability attributes be expressed? These are safety, security, privacy, performance, etc.

"Safety" needs to be more clearly defined as to what is a direct safety implication versus an indirect safety implication.

There was not sufficient time to discuss this question.

5. How should interoperability requirements be enforced? Should there be an endorsement program and who should be the monitor of products that comply?

New standards will not be used unless people have strong incentives. There are significant costs and risks in being an "early implementer." On the other hand, a lot of public agencies are eager to use standards to avoid proprietary equipment (some agencies are more eager than others).

Several years before enforcement, DOT should try voluntary compliance and education, so that the eventually enforced standards end up being what 85% of agencies were planning to

do anyway. Given that early standards will require revisions and maintenance, it is inappropriate to enforce these standards right away.

On the other hand, enforcement is often the only effective tool for promoting safety, such as the case of crash-tested guardrails. Crash-testing for guardrails was understood, but was not widely implemented until there was a federal mandate.

Agencies should have the opportunity for voluntary acceptance and compliance before enforcement is even considered. Some ITS standards do not have safety implications, so the safety justification cannot be used for enforcement. In an ideal world, there needs to be a critical mass of people to “pull” use of a standard forward. There have to be significant incentives for implementation, given the risks and costs.

Devices interoperability is easier to mandate and enforce than institutional interoperability. However, institutional interoperability is the more serious issue.

SESSION 2.3, BREAKOUT GROUP FOUR

1. Date and time of session: Thursday, December 18, 1997 10:00AM – 12:00PM
2. Name of facilitator: Allan Kirson
3. Name of recorder: Alex Lopez
4. Assigned topic: Interoperability Requirements
5. Names and affiliations of participants:

BREAKOUT GROUP 4 -ROOM 426

Brooke, Ken	Mitretek	
Chen, Kan	KCI	
Cunningham, Ron	Lockheed Martin IMS	
Greene, Ed	Ford Motor Company	
Jaffe, Rob	Jaffe Engineering Development Ind.	
Jones, Bill	USDOT	
Kirson, Allan	Motorola	Facilitator
Kissinger, Peter	HITEC - CERF	
Lopez, Alex	ITS America	Recorder
Mammano, Frank	Consultant	
Price, Loria	TIA	
Rosenblatt, Gerry	TIA	
Schnacke, Dick	Amtech	
Schopp, Bruce	NEMA	

1. What should be the definitions of ITS Interoperability, Compatibility, and Product Conformity? (review those recommended by the Interoperability Subcommittee)

Interoperability:

The word, “systems” does not necessarily imply “products”, such as user equipment. The definition should be expanded to include this.

The phrase, “other systems” should be expanded to include “same products from one or more manufacturer or different products from one or more manufacturer”

The phrase “operate effectively together” is vague. Does “effectively” mean from a perspective of performance, completeness, efficiency, or other?

Interoperability Type:

The three level model is fine. The definition of Institutional should include “between operators and other operators” as well as “between operators and users”, and include perhaps “at the application layer”, in both procedural and institutional.

System Architecture Attributes:

The group felt that “Attributes” apply to Services, not Architecture, so did not know how to address this question.

Compatibility: OK

Conformity: OK

The group discussed the need for a new attribute, “Consistency.” This is something other than conformance, compliance, etc., and may relate to the relationship with the National Architecture as in, “being consistent with the architecture.” We were not sure how to articulate the difference between this and conforming to the architecture, but a few group members felt, intuitively, that there is a difference. An example might be in the case where a “mixed” system is deployed, i.e., including legacy and new components. Consistency with the national architecture might apply if true conformance is unachievable. Consistency may also be used as a step to minimize obstacles to achieving interoperability in cases where specific requirements cannot be identified.

2. Is interoperability required for all 30 user services? What 5 services need interoperability most?

The group had trouble addressing this question. The general feeling was that it might be better to use market packages instead of user services. Once this has been done, then we should address any interactions among them.

The requirement for interoperability may depend on implementation, i.e., how functions are physical distributed, geographical scope, interoperability type (technical, procedural, or institutional), time frame, etc.

To a certain extent, the funded standards are an indication of importance, since these were chosen by the ITS community. On the other hand, the priorities were set by “urgency” rather than “importance”, so critical interfaces that might only be needed a few years from now were not funded.

What are the criteria to use in determining requirements for interoperability? Some include potential market size, personal safety and security, equipment safety or security, etc. It may be useful to ask what drives the need for interoperability, especially for the funded standards that are currently underway. The general consensus of the group was that the market is the driver, based on what can be sold today, and the services most desired include those related to personal and vehicle safety.

Another way to analyze the user services might be to group them into services that are wholly within a vehicle, wholly outside the vehicle, or spanning the space between the vehicle and the infrastructure/roadside. The highest priority might then be the last group.

We did finally take a stab at picking the top five: three members picked their top five, and the only major overlap was Electronic Payment Services. Others included the CVO group, Emergency Management, and six from Transportation Management, viz., En-Route Driver Information, (Multimodal) Route Guidance, Traveler Services Information, Traffic Control, Incident Management, and Pre-trip Travel Information).

3. How and who should define interoperability requirements? Review the recommended process offered by the Interoperability Subcommittee and then determine which organizational approach is best - ITS technical committees, special consortia, the CSO, or other.

In general, the group agreed with the process outlined. There were some specific recommendations:

The process needs to address actual transactions, not just “interfaces of all transactions.”

In process step 2 it says, “. . . at each interface within this user service.. .” – in some services, there are interoperability requirements for interfaces with other systems outside the user service, e.g., interoperability with the banking industry for Electronic Payment Services. A question should be added to determine interoperability requirements with systems **outside** the user service.

In question 2c add “availability” (up time).

An additional question should be added to determine the need for international interoperability, and that should be further broken down into “continental” and “global”, e.g., NAFTA related cross border CVO functions.

A question should be added to address the need for interoperability with legacy systems, and at what level, technical, procedural, or institutional.

There are cases when systems are deployed alongside legacy systems with no need for interoperability. In these cases, questions should be added to deal with “peaceful co-existence” and “optional” features of a standard. Peaceful coexistence means that the systems are physically or logically close, and should not interfere in any way with each other, e.g., different physical layers or different message sets that are mutually exclusive. Optional features of a standard may be adopted by some manufacturers but not others. When these features are invoked, no damage to any product should be caused. The only effect should be the failure of that feature to operate.

4. Can Interoperability be achieved after standards are written? How would one accomplish this with the least effort?

It was felt that if standard-conforming systems were not interoperable, then the standard is flawed, e.g., incomplete or ambiguous. If the non-interoperability is at the technical level, then it would depend on which layer of the OSI model was the root cause, e.g., air interface vs. message set. Procedural and institutional improvements can (technically) be “retrofitted” quite easily.

It would also depend on the nature of the non-interoperability – to correct it may require extensions to standard, or modifications to the standard. To aid in the improvement of a standard, and to help avoid the need for too much retrofitting, public sector procurements should include in their contracts a requirement for providing feedback to standards bodies on the experience in applying the standards.

5. How should the different interoperability attributes be expressed? These are safety, security, privacy, performance, etc.

We had trouble understanding this question. A simplistic response was to rank each attribute’s importance on scale of 1-10.

6. How should interoperability requirements be enforced? Should there be an endorsement program and who should be the monitor of products that comply?

Standards compliance is voluntary unless it is required in specific contracts. To enforce interoperability after a standard has been written (assuming the standard is complete and unambiguous), public sector procurements can require interoperability in their contracts.

The only drivers are market forces. User groups/consortia can provide significant impetus by providing endorsement (through trademark management), testing, monitoring, and other support services.

The self certification processes used by other industries should be reviewed, e.g., ISO 9000, where independent auditors certify that a company/organization is ISO 9000 certified, which then gives the company/organization the right to claim compliance in all their products.

SESSION 2.3, BREAKOUT GROUP FIVE

1. Date and time of session: Thursday, December 18, 1997 10:00AM – 12:00PM
2. Name of facilitator: Roy Courtney
3. Name of recorder: Karyl Irion
4. Assigned topic: Interoperability Requirements
5. Names and affiliations of participants:

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Armstrong, Lee	Armstrong Consul.	
Courtney, Roy	ITSA	Facilitator
Glass, Bob	JPL	
Gordon, Steve	SAE	
Greene, Edward	Ford	
Irion, Karyl	ITS A	Recorder
Kipreos, Thanos	TIA	
Mills, Dwight	ITSA	
Oyama, Satoshi	Hitachi	
Pickford, Andrew	Combitech	
Rokitansky, Karl-Herbert	U Achen	
Schoka, Andy	Mitretek	
Tsuda, Hiroshi	ITSA-Nissan	
Weiland, Richard	SE1	
White, Chip	UofM	

1. What should be the definition of ITS interoperability, interchangeability and product conformity?

Several attempts were made to define ‘interoperability’ with the conclusion that any definition may not capture the diversity of communications transport media or perspectives from the different levels of interoperability. A proposed definition related to the DSRC link but was found to be too restrictive:

“The term ‘interoperability’ at the DSRC level implies that different manufacturers’ products can communicate with each other at specified interfaces, without modification of the products, to produce a specified result”.

The included suggestion from ISO TC204 Doc N271 was too broad to be directly useful. An example of the NATO definition of ‘degrees of interoperability’ was also mentioned.

An attempt was made to define ‘compatibility’ and it was found that the group was naturally focusing on the technical interface in the 3-layer interoperability heirachy.

Overall it was agreed that in guiding the group to answer the remaining questions the perspective of the user with the objective of increasing the mobility of the user would be used in the absence of agreed definitions of ‘interoperability’ and ‘compatibility’.

2. Is interoperability required for all 30 user services? what 5 user services need interoperability most?

The 30 applications recommended by the Interoperability Subcommittee were reviewed and each participant selected the 5 application that were felt to provide the most potential to benefit users by ensuring interoperability.

The following categories were selected as offering the greatest potential (in decreasing order of consensus):

1. Electronic Payments Services
2. En Route Driver Information
3. Route Guidance
3. Emergency Notification & personal security
4. Emergency Vehicle Management
4. Incident Management
4. Traveler Services Information
4. Longitudinal Collision Avoidance
4. Traffic Control
4. AHS

It was perceived that the following application areas would benefit minimally (or not at all) from an interoperability initiative:

Emissions Testing and Mitigation
Ride Matching & Reservation
Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspection
Commercial Vehicle Administration Processes
Hazardous Materials Incident Response
Freight Mobility
Lateral Collision Avoidance
Intersection Collision Avoidance
Vision Enhancement for Crash Avoidance
Safety Readiness
Pre-Crash Restraint Deployment

3. How and who should define interoperability requirements? Review the recommended process offered by the Interoperability Subcommittee and then determine which organizational approach is best - ITS technical committees, special consortia, the CSO's. [WAG2] or other.

With the limited time available this issue was not discussed.

4. How and who should the different interoperability attributes be expressed? These are safety, security, privacy, performance etc.

A two dimensional matrix was used to guide the discussion based on:

- a. the information chain from the vehicle, through the ETTM reader to the service providers local center of operations to other operators
- b. the 3-layer heirarchy (contractual/institutional, procedural and technical)

The additional attributes were felt to lie along a third dimension but, with the limited time available, these were not related to the matrix.

Interoperability at the 'procedural' level was felt to be a function of the individual elements themselves rather than the interfaces between the elements, Technical-level interoperability was felt

to be most important for the DSRC link and connection between the ETTM reader and service provider's operation center. Overall 'contractual'-level interoperability was believed to be most important to the interface between service providers. Finally the contractual link between the service provider and a user was recognised and added as a 'feedback' element.

Finally, the example of EFC (Electronic Fee Collection) was discussed as an example of where interoperability specification/requirements would provide the most benefit. A typical fee payment transaction requires 4 subsystems (DSRC communications, tag localisation, vehicle detection & classification and enforcement/exception handling). It was proposed that of the subsystems only the DSRC link warranted any interest relating to interoperability. The other subsystems could be proprietary or specific to the service provider since interoperability would not directly benefit the user.

5. How should interoperability requirements be enforced? Should there be an endorsement program and who should be the monitor of products that comply.

With the limited time available to the Group this issue was not addressed fully and no conclusions were drawn.

4.0 Summary of Breakout Sessions and Possible Actions

Bob McQueen

4.0 Summary of Breakout Sessions and Possible Actions

(by Bob McQueen)

4.1 Introduction

This short document is intended to provide an ultra brief encapsulation of the essential points raised and discussed at the Standards and Interoperability Workshop in Arlington Virginia on 17-18, December 1998. Interpretations of the discussion notes and derivation of Possible Actions are solely based on the author's personal opinions.

4.2 Summary of Standards Issues Raised

- 1) Changes to the ITS standards process.
- 2) Standards development constrained by available 'people' resources.
- 3) Several stakeholder are missing or under-represented in the standards development process.
- 4) Identifying key standards players.
- 5) Need for a process for helping agencies apply standards to their systems.
- 6) Information required by standards users.
- 7) Standards pioneer costs.
- 8) Standards 'pull' instead of 'push.'
- 9) Buyer Pull & Procurement Push.
- 10) Standards enforcement or incentive?
- 11) International standards harmonization.

4.3 Summary of interoperability Issues Raised

- 12) Interoperability definition
- 13) Interoperability testing and certification.
- 14) Interoperability priorities.
- 15) Interoperability from an institutional perspective.

4.4 Standards Issues and Possible Actions

Issue 1 - Changes to the ITS standards process

There are a lot of stakeholders not at the table.

Limited people resources available for standards development.

We have a good process for developing single standards, but there is an urgent need for synchronization between individual standards development efforts.

Council of Standards Organizations is an appropriate mechanism for coordination

Where would the dollars come from to pay for standards development work.

Disconnect between ITSA cmtes and SDOs.

Need for a feedback loop between implementers and standards developers/maintainers.

Feedback is happening but it is inconsistent across SDOs.

Maintenance & development are very closely linked - same people

Possible Actions

Define a 2 step testing and certification process.

Step 1 at the unit or equipment level with vendors leading the initiative through self certification.

Step 2 at the integrated or system level with buyers leading.

Use existing vehicles such as SDO's and CSO to test utility and credibility of process.

Disseminate information on the process to implementers and vendors.

Reduce cost of testing and certification through use of vendor consortium approach.

Increase level of buyer confidence in self-certification through use of independent testing agency in oversight role for vendor consortium.

Encourage feedback from testing/certification to standards maintenance.

Issue 2 - Standards development constrained by available 'people' resources

- . Our ability to effectively produce relevant standards may be "sapped" by the fact that only a few people are really qualified to develop the standards.

Possible Actions

- . Review program and ensure that current key players are deployed as effectively as possible.
- . Maybe re-configure standards development organizationally to enable key players to direct small teams of less experienced 'workers.'

Issue 3 - Several stakeholder are missing or under-represented in the standards development process:

- . Automobile manufacturer,
- . Depts. of motor vehicles (tags).
- . Incident management organizations, including those involved after an incident.
- . Police
- . Fire
- . Sheriffs
- . APCO
- . Ambulance
- . EMS directors
- . FCC and common carriers
- . Banking industry and financial industry.
- . The consensus standards process allows any interested party to participate.
- . This requires that standards efforts are well advertised, so that the various affected groups are at least aware of the activity and decide consciously not to participate.

Possible Actions

We should develop a systematic learning process to learn what the Europeans and Japanese are doing to address legacy systems. There are more legacy systems in other parts of the world that have been integrated into new systems.

Issue 4 - Identifying key standards players

- Lab technicians
- Managerial personnel
- Traffic operations personnel
- Maintenance personnel
- From a transit perspective
- The schedule department
- Department assigned to implementing AVL technologies (which may be operations or engineering).
- The system integrators for both hardware and software - may be vendors.
- The systems designers
- If a planning department exists, that department needs to be involved, because in some cases the planning department controls capital investment.
- The system administrators, board of or other public oversight board, and legal staff also have to be involved in the case of toll administration.
- Executive staff and the finance director have to be involved in the case of toll administration, but not necessarily for traffic or transit management.
- Programming structure differs widely from agency to agency, so there isn't a good general rule on who should be involved.

Possible Actions

None proposed

Issue 5 - Need for a process for helping agencies apply standards to their systems.

- . Looking beyond standards development, how do agencies and user organizations make good use of the emerging standards.
- . If we look at this issue now rather than wait until the problem is upon us, we may be able to engage users and agencies in the development process and create a smooth transition from standards development to application and use.

Possible Actions

- . Identify, define and develop standards application process
- . Communicate the process with the standards users
- . Get the standards users actively involved now

issue 6 - Information required by standards users

- . Traffic system managers or system engineers - whoever makes the decision on what standard to use - need to know the details of the standards. They need to have an understanding of the technical standard itself and all of the documentation, including test performance results. If there is standards training available, this is the target audience.
- . Executive-level managers that approve the decision of the technical decision-makers need awareness-level information on what the standards do. They need information on why the standard is being used, and the fiscal impact. They need information on how the standard compares to alternative approaches, including other standards, and the broader context into which those standards fit.
- . Implementers - those who put the system into place (designers, project managers) - need the technical definition of what the standard is and how to test compliance. The technical decision makers and/or the implementers make decisions on which elements of the standard are applicable to a particular existing system. The project manager needs a detailed implementation schedule and what impact it will have on operations.
- Supporting elements such as purchasing people and administrators need information on what standard has been chosen and why. If this requires new procurement procedures, they will need a high-level justification of why the standard is being implemented. They may need information on what text to put in legal boilerplate for procurement (i.e. - "equipment must be stamped standard XXX compatible and must have passed certification text y").

- . Maintainers of the systems need technical information on what the standard is and how to do compliance testing. For data dictionary and message set standards, they need the technical details.

Possible Actions

- . Clear identification of intended audience for standards: who will use them
- . Identify and confirm standards requirements with intended audience: what will they use them for? and why?
- . Demonstrate that the standards being developed will meet the requirements.
- . Communicate with audience during the standards development process.
- . Manage a smooth transition from standards development to application, maintenance and revision.
- . Provide guidance documents and workshops to explain standards to local implementers who may not involved in the standards development process.
- . Provide financial support to help local agencies make the transition to standardized systems.
- . Mandate some minimal compliance to standards in order to level the playing field.
- . Provide guidance on the desired outcome and what level of standardization is the “end goal.”
- . Develop standards education program
- . Develop standards utilization guidelines.

Issue 7 - Standards pioneer costs

- . Risk and cost involved in being pioneer in standards application could be unfairly spread.
- . A few early adopters may pay the price for the followers to gain the benefit of established standards.

Possible Actions

- . May need to set up a mechanism to compensate pioneers through shared costs.
- . An MDI for standards application could be a possibility.

Issue 8 - Standards 'pull' instead of 'push'

- . Voluntary adoption and use of standards rather than federal mandate.
- . Development of a critical mass of implementers desiring to use the standards.

Possible Actions

- . Establish consortium of buyers and implementers prepared to mount standards usage trials and share the results and experiences.
- . Use consortium as vehicle to promote peer-to-peer marketing of standards.

Issue 9 - Buyer pull & procurement push

- . When buyers of new equipment require conformance to new standards, then manufacturers will implement the standards.
- . Procuring authority will have a direct effect on the development of conforming products by requiring conformance in their procurement contracts.

Possible Actions

- . New and improved marketing approaches should be explored during standards development.
- . Standards developers should think about how they are going to "market" the standard during its development to gain broad participation and awareness.
- . Then consider how they will "sell" the standard once it is complete.

Issue 10 - Standards enforcement or incentive?

- . New standards will not be used unless people have strong incentives
- . There are significant costs and risks in being an "early implementer."
- . On the other hand, a lot of public agencies are eager to use standards to avoid proprietary equipment (some agencies are more eager than others).

Possible Actions

- . Before enforcement, DOT should try voluntary compliance and education, so that the eventually enforced standards end up being what 85% of agencies were planning to do anyway.

- . Agencies should have the opportunity for voluntary acceptance and compliance before enforcement is even considered.

Issue 11 - International standards harmonization

- . Some ITS standards may need to be harmonized at the international level for optimum effect.
- . We might be missing ideas and experiences from other countries
- . Others may be learning valuable lessons that we can also learn from.

Possible Actions

- . Joint coordination with ITS partners on interest in U.S. standards for the international community, e.g. Coordinate with Europe and Japan on the use of ISO Fasttrack for NTCIP International coordination of various stages of standard development process.
- . Use European model for US DSRC analysis

Data Registry

- . Consider the acceptance of international tests, analyses, field trials, etc.
- . Create a Central Forum for developing U.S. role in international ITS standards. For example: Information Infrastructure Panel re: NII,GII issues. This Forum would be above any one SD0 or current consortium. Currently, the approach is fragmented and sporadic. The Forum would provide coordination of objectives, priority-setting, strategy development relative to international development.
- . For example, Japan is planning the development of a steering committee for coordinating Japan's role in all international ITS Standards arenas, e.g. DSRC and ITU and ISO/TC204/WG15.

7.5 Interoperability Issues and Possible Actions

Issue 12 - Interoperability definition

- . User awareness and understanding of interoperability is weak.

Possible Actions

- . Use existing committees to develop consensus on what is meant by interoperability
- . Develop interoperability definition on 'user driven' basis.

- . Tests for interoperability need to be defined.
- . Benefits of interoperability need to be identified and described
- . Buyers
- . Vendors
- . Federal

National interest

Issue 13 - Interoperability testing and certification

- . Who should be responsible for testing and certification?
- . Where does legal liability rest?
- . Buyer confidence in vendor self certification.
- . Cost of duplicated effort if all vendors have own self certification process.
- . How to specify level of conformance for ITS.
- . The level of compliance testing needed depends upon whether you are buying a component or an entire system.
- . Products may need to be tested at two levels to ensure end-to-end functionality.
- . The unit level
- . The system level
- . Focus on what the equipment does or how it does it?
- . Need for feedback from test/certification to standards maintenance.
- . Buyers may not be close enough to equipment characteristics to recognize needs for interoperability.
- . Self certification may be the most cost effective route.
- . In many cases self-certification doesn't work for new products due to different interpretations of a standard by the vendor and the procuring agency.

- . Who writes the test procedures ?
- . Who runs the test ?

Possible Actions

- . Paid standards development work instead of voluntary.
- . Task force to consider changes to the current process
- . Maybe need a system integrator with a clear task to pull elements together into a single picture.
- . CSO could play coordination role.
- . The national arch team did this type of program mgmt. role well for the architecture so this may be model.
- . Ensure SDO cmtes have implementers, users, product developers.
- . We need proactive experience seeking.
- . Introduce federal requirement for feedback from ITS projects to SDOs.
- . Include this feedback in ITS evaluation contract activities (MDI).
- . Ensure feedback is supported.
- . Raise awareness of feedback through careful guidance.
- . Revise 'Life cycle' diagram to show feedback from 'ITS implementation' to 'standards maintenance' and 'standards development.'
- . Bring standards writers, developers, and implementers together in a forum.
- . Provide real world MDI-like laboratory to test a suite of related standards and demonstrate that they work together interoperably.
- . Deploy beyond the MDI test site only after the demonstration successfully shows that the goals have been achieved and guidance, training and operational concepts are firm.
- . Standards developers should think about how they are going to "market" the standard during its development to gain broad participation and awareness.

- . Then consider how they will “sell” the standard once it is complete.

Issue 14 - Interoperability priorities

- . High priority interfaces.
- . ISP to device
- . Transit Vehicle to Transit Management Center (TrMS).
- . Electronic payment (transit, toll).
- . DSRC
- . The overarching set of Center to Center communications.
- . TMC to ISP
- . Traveler Information Center to Traveler Information Center (ISP to ISP).
- . TMC to TMC
- . Transit Management Center to Transit Management Center.
- . Emergency Management to Traffic and Transit Management.
- . ISP to ISP
- . Transit Center to ISP
- . Medium priority interfaces
- . Field Device to Traffic Management System.
- . Center to ISP

Possible Actions

- . Develop guidelines for interoperability prioritization.
- . Use high priority interfaces to focus development of standards guidance documents and standards requirements analysis with users.

Issue 15 - Interoperability from an institutional perspective

- . Institutional aspects of interoperability are not being adequately covered by the standards process.

Possible Actions

- . Collect more data on likely institutional impacts of interoperability.
- . Develop guidance materials on managing institutional aspects.

Appendix A: Workshop Agenda

Appendix B. Workshop Presentation