

2011 Report to the US Secretary of Transportation

United States Department of Transportation 2011 Intelligent Transportation Systems Program Advisory Committee

28 November 2011

ITS PAC CHARTER RENEWAL

Section 5305(h) of the Safe, Accountable, Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU, P.L. 109-59) directs the U.S. Department of Transportation to establish an Advisory Committee to provide advice to the Secretary of Transportation on the scope and direction of the Department's Intelligent Transportation Systems Program, by providing input into the development of the ITS aspects of the Department's strategic plan and reviewing ITS research being considered for funding. The Department also is directed to submit an annual Report to Congress in February of each year which includes:

- All recommendations made by the Advisory Committee during the preceding calendar year;
- An explanation of how the Secretary has implemented those recommendations; and
- The reasons for rejecting the recommendations not implemented.

In response to the SAFETEA-LU requirement, the Department established the ITS Program Advisory Committee (ITS PAC) in 2007. In 2010, new Committee members were recruited and this renewed Committee focused on the Strategic Plan of the ITS Program with particular emphasis on the program for Vehicle Communications.

ITS PAC Activities in 2010-2011

The Committee met six times in its 2010-2011 session. In addition to its regularly scheduled meetings at the DOT in Washington, D.C., notable meetings were held at the Metropolitan Transportation Commission in Oakland, CA, and in Ann Arbor, MI. The goal was to expose the Committee to more in-depth information on ITS activities and progress in transit operations (Oakland) and the private sector automobile manufacturer industry (Ann Arbor). These meetings were held in January and March of 2011, respectively. Unfortunately, a field vehicle demonstration of Ford's Corporate ITS initiatives at the Ann Arbor meeting had to be cancelled due to inclement weather.

The Evolving Transportation and Communications Market

Since the inception of the ITS PAC in 2007, both the automotive industry and the

telecommunications industry have experienced dramatic evolution. The automotive industry has deployed substantial active safety features and many automobile manufacturers have implemented vehicle communications for consumer location-based services. Nearly every automaker is offering hybrid electric vehicles and there are now full battery electric vehicles on the market. Some vehicles provide “eco-coaching” for drivers to operate the vehicle in a more energy efficient manner. The communications industry has seen the rapid deployment of high-speed wireless networks and widespread adoption of powerful smartphones in the US. This, in turn, has precipitated an explosion of innovative “phone apps” marketed by a large number of developers. In fact, the current business models and consumer appeal of mobile phone providers now seem heavily dependent on their volume, diversity and quality of these “apps” offered for their phones. In addition, commercial transportation and transit operators have adopted technology for mobility services and safety. Meanwhile, managers of highway systems are incorporating advanced traffic management systems and real-time transportation data are being made available for smarter, greener mobility initiatives in cities. There is a need for the ITS JPO to adapt its plans to this evolving eco-system, and this evolution and need for adaptation are likely to continue in the future.

This context change was very influential on the Committee’s evaluation of the ITS JPO’s strategy and plans. It appears that we are witnessing a blurring of the line between pure consumer devices and services, and automotive industry-specific technology along with government-sponsored technology. It is increasingly difficult to consider these formerly distinct markets in isolation, especially since current business models favor mass volume adoption by consumers. The intersection of these markets creates great challenges, however, such as how to achieve widespread consumer interest while still maintaining the level of quality, robustness and security that vehicle communications will need when applied to safety applications.

OVERVIEW OF THE ITS PAC PROCESS

This ITS PAC was fortunate to have both a high degree of individual expertise and a wide diversity of disciplines and involvement in aspects of ITS. This combination of in-depth expertise and diversity led to wide-ranging debates, often beyond the traditional boundaries of the DOT ITS program. The Committee believes that the recommendations that follow have benefited from this level of expertise and diversity.

In 2011 the Committee decided to appoint subcommittees to probe more deeply into the most critical aspects of the DOT ITS Program. After careful deliberation, the Committee charged three subcommittees:

- Technology Strategy
- Global Harmonization of Standards
- Program Evaluation and Strategy

These subcommittees were encouraged to engage additional outside experts as well as solicit further clarification of ITS JPO activities from the JPO staff as needed. The

subcommittees met and developed recommendations which they reported back to the overall ITS PAC. The consensus recommendations of the ITS PAC, derived from the subcommittee recommendations, are summarized in this report.

The ITS PAC recognizes that successful implementation of the recommendations in this report may well require resources beyond those to which the JPO currently has access. Furthermore, besides staffing and funding, some recommendations may imply authority to act that is beyond the charter and authority of the ITS JPO. However, that does not diminish the importance of these recommendations for success of the program. Indeed, implicit in these recommendations is the notion that JPO should seek the budget, charter and authority to implement these recommendations. We note that some of these recommendations may be in various forms of implementation by the JPO at this time, which we applaud.

RECOMMENDATIONS

Technology Strategy

The Technology Strategy Subcommittee developed recommendations designed to aid the JPO and, in general, RITA, in developing underlying technologies and systems management to accelerate the effectiveness of ITS and deliver national benefits in safety, mobility and the environment.

An important conclusion of the Subcommittee was that it was important to consider at least two levels of automotive safety systems that we call here “soft safety” and “hard safety”. In general, soft safety can utilize higher latency communications for primarily driver information. Hard safety deals with safety warnings and vehicle control that must be based on low latency, highly robust and secure communications such as from a dedicated short range communications (DSRC) network.

Hard Safety

It is clear that collision avoidance utilizing vehicle-to-vehicle (V2V) communications will require solutions and infrastructure which are specific to transportation, given the critical nature of the safety applications. These hard safety systems will be professionally integrated and installed in vehicles, most likely at the time of production. We are likely to see test fleets and low volume introduction of these technologies in the near future (sensor-based hard safety features are deploying today). However, the high-volume rollout of original equipment manufacturer (OEM) installations may be influenced by the schedule of potential NHTSA action (rulemaking or New Car Assessment Program - NCAP) which will see an appropriate notice of proposed rulemaking, solicitation of comments, phase-in for compliance, and then the time it will take for new vehicle production to achieve a significant penetration of the installed base of vehicles on the road. While the availability of approved and certified aftermarket devices will shorten this period of total fleet penetration, it is clear that reliance only on original equipment installations will mean a gradual penetration of V2V technologies over a period of

decades before full safety benefits are obtained. The intervening years are missed opportunities for improving safety and sustainability.

Soft Safety

Soft safety solutions include features such as notifications for traffic accidents, extreme weather conditions, adverse road conditions, and extending to amber alerts, terror notifications, etc. Similar solutions provide features which address trip efficiency and eco-driving, and are aimed at time and fuel savings. Such safety and efficiency solutions can be implemented outside of the automotive development cycle. The use of consumer devices, such as smartphones, and existing telecommunications networks, enable these applications sooner, and potentially for all vehicles on the road.

This is the key reason for maintaining two levels of safety or energy efficiency systems. The success of the JPO platform solution for vehicle communications in safety and energy efficiency will depend, in part, on the widespread adoption of the platform by the consumer. Even at these early stages, the innovation appearing from the consumer industry development of mobile smartphone applications, for example, is worthy of careful consideration as an intervening step. Any new network expands and flourishes only as a result of widespread utilization and embracing by the developer community and the consumers reacting to these developments. It is absolutely crucial that the DOT solution for vehicle communications earn consumer appeal, thereby attracting many from this fertile ground of applications developers. Of course, widespread use of an approach that adopts consumer technology carries risks related to the need for appropriate levels of security, standards, conformance and reliability, which must be mitigated.

Recommendation 1. Develop concepts for, promote and facilitate open platforms and standards for software developers that can be accommodated in the Connected Vehicle infrastructure architecture, to promote the development and incorporation of “soft safety” applications using consumer electronics devices, developer applications for those devices, and communications interfaces with existing cellular infrastructure or other consumer networks to enable near term and wide deployment.

Successful deployment of a Connected Vehicle system depends on widespread adoption by the user community so that the costs of system expansion can be shared with high volume consumer applications. This is essential for promoting consumer buy-in and for motivating the private sector investments that will drive costs down such that the necessary market penetration is achieved.

Recommendation 2. Promote, encourage, and use open systems that seek to maximize broad-based active developer communities.

Recommendation 3. Respond to the specific need for non-proprietary and/or license-free security, authentication, and API standards, which include data among vehicles and data transmitted between vehicles and infrastructure, as well as transit schedule-related data.

Recommendation 4. Rely as much as possible on communications architectures that promote flexibility and extensibility and can be used across multiple sectors, not just within the transportation sector.

Recommendation 5. Using the principle of driver opt-in, consider ways to make vehicle data available to developers who can then innovate applications serving individuals as well as applications generating information from the data across wider populations of drivers and vehicles.

Recommendation 6. Emphasize utilization of common, high-volume commercial sector components wherever possible to leverage cost curve advantages so that new solutions do not necessitate high-cost, low volume components. Where customization is required, attempt to utilize open, common hardware standards and customize with software for flexibility and lowered costs.

In addressing aggressive “hard safety” goals, the current Connected Vehicle system concept has certain technological limitations which should be thoroughly analyzed and evaluated. While active V2V and vehicle-to-infrastructure (V2I) programs need to be pursued in a timely manner, the Federal Government should continue to reassess its assumptions and be completely objective about the technology and its limitations. These limitations are noted in the following three recommendations.

Recommendation 7. Connected vehicle performance will be highly dependent on vehicle positioning performance. Ensure that lane-level positioning is feasible in most conditions, across all vehicle types, and at acceptable cost. For V2V communications, relative lane-level positioning is key, while for V2I, absolute lane-level positioning is critical.

Recommendation 8. Near-zero communications latency and packet loss is essential to V2V safety performance. Ensure that this is feasible under extreme communications loads and at acceptable cost.

Recommendation 9. Current DSRC 5.9 GHz communications have limitations in line-of-sight, range, and signal blockage and corruption. Ensure that this signal will be robust in all realistic intersection environments.

The potential gap between Federal Government platform initiatives and private sector deployments - the problem of “if we build it, will they come?” - needs to be monitored and addressed. The success of a Connected Vehicle Safety System will also require active participation at all levels of government; it is important to devise ways to speed state, regional and local adoption of technologies that meet safety goals.

Recommendation 10. Use leverage and incentives to maximize and strategically support a complex nationwide deployment for an extended period of years. While V2V capabilities may be mandated for the auto industry, potential actions affecting other sectors and industries (including the infrastructure sector) also need to be considered.

Recommendation 11. Communications with vehicles and with individuals will require applications at the device level (including in-vehicle) and the services infrastructure to deliver the required services and applications. Whatever part of that infrastructure is defined or implemented by the Federal Government should be delivered to state and local governments to reduce their required investment. This could be done via model deployments that are executed in such a manner that they can truly be replicated by other regions and organizations. In order for such model deployments to become permanent, operational solutions, it is essential to allocate the maintenance and operational expenses of the system after the termination of the model deployment.

Recommendation 12. Decide on where open standards are required and ensure that they are put in place, so that system solutions work in all locations and the operation of vehicles and experience of individuals is the same wherever they travel.

Recommendation 13. Monitor private sector developments in vehicle communications and safety technologies, to ensure that planned government systems will be compatible.

Recommendation 14. Ensure that the unique needs of full electric and hybrid electric vehicles are included in the Federal Government developments. Support and incentivizing of this rapidly emerging segment, which enjoys a large investment in technology, could assist rapid deployment of Connected Vehicle technology.

Recommendation 15. Ensure that vehicle drivers have control over their data and that adequate privacy safeguards are in place to prevent data breaches and to maximize participants' ability to exercise control over their information.

Recommendation 16. Encourage facilitation of multi-modal transport by investigating ways to publish transport schedule and price data so that it is searchable in real-time.

Global Standards Harmonization

The Subcommittee on Global Harmonization of Standards was formed to gather information, evaluate options and provide recommendations on effective ways to ensure that ITS standards are harmonized globally to promote the efficient and rapid deployment of ITS technologies and to control the cost and complexity of maintaining those standards once they are deployed.

The Subcommittee discussed the critical importance of globally harmonized ITS standards and the role they play in a more efficient and faster deployment of ITS technologies. The Subcommittee discussed the fact that quick action is needed to minimize the development of regionally-based standards that are inconsistent with standards developed in other regions. It was noted that the U.S. Government has reached agreements with the European Union (EU) and the government of Japan, acknowledging the benefits of developing harmonized standards. It was agreed that a wide range of groups will need to work together to ensure that a necessary and reasonable level of

harmonization occurs, including governments, vehicle manufacturers, other ITS-related industries, trade associations such as the regional ITS deployment groups in the US (ITS America), Europe (ERTICO – ITS Europe) and Japan (ITS Japan) and standards organizations such as the International Standardization Organization (ISO), the Society of Automotive Engineers (SAE) International, the European Telecommunications Standardization Institute (ETSI), the Institute of Electrical and Electronics Engineers (IEEE) and the International Telecommunications Union (ITU).

Significant work on the development of ITS standards currently is underway and rapidly moving forward. Absent strong direction and leadership to encourage harmonization, those standards will not likely be harmonized. The following obstacles have been initially identified for globally harmonized ITS standards:

- competition among certain standards organizations working to develop similar standards,
- a European directive (Mandate M/453) that is driving short completion timing with significant voluntary resources from the European manufacturers and financial support from the European Union on standards development in Europe,
- lack of identified forums to develop harmonized standards (similar to WP29 used to harmonize safety standards),
- technical incompatibilities between countries (e.g. US vs. EU frequency allocation), and
- lack of agreement among vehicle manufacturers and governments concerning the scope and timing of harmonization needs.

The Subcommittee agreed that not all standards need to be harmonized but an important first step is to identify and prioritize those areas that are critical for harmonization. It was agreed that it is more important to develop standards that are appropriate, accurate and harmonized than to rush to complete standards to an arbitrary deadline. The Subcommittee discussed the need to work with other organizations like ITS America, the Vehicle Infrastructure Integration Consortium (VIIC), OICA (the global alliance of Automobile Manufacturers) and others to develop a coalition to promote harmonization. In order to make a clear public statement, the JPO and other organizations within USDOT should identify harmonization of ITS standards as a critical priority in its written statements about ITS technologies and officially add it to its work plan.

Recommendation 17. The ITS JPO should make and periodically reinforce a clear public statement that globally harmonized ITS standards are critical to the efficient and rapid deployment of ITS technologies. Similar statements from the RITA Administrator, the USDOT Secretary and the Secretary of Commerce would add important emphasis. The statement should also make clear that the quality of standards and the degree to which they are harmonized is more important than arbitrary dates imposed for completing them. While ITS JPO has in the past made such statements as part of its outreach programs, clear single-purpose statements, and reinforcement from higher levels within USDOT, would be of substantial value.

In order to play a visible, leading role, the JPO should provide adequate funding to appropriate organizations to involve more US experts, develop harmonized standards and apply pressure where appropriate. The appropriate office/department within the US government should be identified to assume leadership of this important issue. It is also critical that this issue be given adequate senior level political support within US DOT, the Department of Commerce and the White House. The other regions are invested at the political level and the U.S. government should be as well.

Recommendation 18. The ITS JPO should seek to play a more visible leading role in encouraging the development of globally harmonized standards by adequately funding organizations dedicated to and programs designed to result in harmonized ITS standards, and applying strong political pressure to standards organizations and other stakeholders where appropriate. Sufficient funding needs to be made available to effectively deploy U.S. interests in harmonized standards. In the case of federally funded organizations, the ITS JPO should fully exercise contractual/grant authority to encourage harmonization. The JPO should make a commitment to ensure adequate funding in future years, reinforcing its commitment to harmonization. The ITS JPO should assure sufficient US Government staff are involved and encourage vehicle manufacturer participation in appropriate international standardization forums.

In order to further support the need for harmonization, the JPO should fund a detailed analysis that demonstrates the implications of non-harmonized standards and the obstacles to achieve harmonized standards. The outcome of such an analysis would be useful for all members of the standardization community worldwide. However, it is noted that if such analysis is not done quickly, its value will be diminished by the pace of standardization activities in many regions. The Committee recognizes that it will be challenging to find a means to credibly conduct such a study recognizing the competitive nature of industry and likely challenges in obtaining sufficient data of a type that is not normally publicly available.

Recommendation 19. The ITS JPO should fund an analysis of the costs and benefits of harmonized and non-harmonized ITS standards.

At present, the EU and Japanese participants to their respective regional Harmonization Working Groups with the U.S. are populated by a mix of government and industry personnel. This allows them to address harmonization issues at all levels. In contrast, official U.S. Working Group members are all U.S. government employees in order to assure compliance with legal requirements. Representatives from both the EU and Japan have stated that they would strongly prefer a mix of government and industry personnel and that without this mix the discussions are often inhibited in face-to-face meetings. Recent ITS JPO action to open Working Group meetings to additional participants is an appropriate course of action. In addition, until recently past meetings of the Working Group had been both infrequent and short. The expansion of participation and increase in length to 1.5 days of the most recent working group meeting in Vienna June 2011 is a welcome change. On this present course, the Plan will be completed well after the harmonization timeline has expired. The pace of Plan development, and therefore the

frequency and duration of development meetings, must be accelerated.

Recommendation 20. The ITS JPO should assure that the US – EU Harmonization Task Force and any future US – Japan Harmonization Task Force (and any other existing regional collaborations working on harmonized standards) are properly supported by both the US government and industry personnel who are actively engaged in standards work. Further, these groups should meet face-to-face more frequently and for longer periods than had been the case until recently in order to create a workable Harmonization Plan (Plan) early enough that it supports the aggressive timeline proposed for the creation of harmonized standards. Further still, the U.S. should work to collapse the various regional Harmonization Task Forces into one global Harmonization Task Force.

Presently, a variety of international and regional standards organizations are developing ITS standards that will impact the ability to efficiently and effectively implement V2X (collectively, V2V and V2I concepts are referred to as “V2X”). Absent strong leadership and commitment, these standards will be developed regionally and will result in inefficiencies and costly duplication of efforts, delaying deployment of V2X. The US government should play a key role in supporting the identification and prioritization of key standards and support harmonization of those standards. The U.S. government should continue to work with Europe and Japan as well as seek to engage with other major and emerging markets in this effort. While support for key “core” V2X standards is critical to the success of the V2X program, support for the broader range of ITS standards is also critical considering the breadth of V2X and the need to send a clear message to standards organizations that they need to work together to develop a full range of harmonized ITS standards.

Recommendation 21. The ITS JPO should work together with industry and others to develop a list of key V2X standards that should be prioritized for harmonization. Included in the V2X standards list should be a harmonized method to qualify any V2X system's performance and interoperability. Some work in this area has been done regionally but the regional data has not been aggregated and synchronized to create a global list. This final prioritized list should then be shared with governments in Europe and Japan and a consolidated multilateral prioritized list negotiated. The progress of these standards can then be tracked through the various standards organizations and pressure applied to ensure that they are being developed in a harmonized fashion. Since V2X will encompass a broad range of standards, the ITS JPO should work together with industry and others to promote expanded standardization of ITS standards so that a clear message is sent to standards organizations about the critical importance of harmonization. Consideration should be taken for patents that are embedded in the developed standards (for example, the IEEE 1609.2 standard and Certicom) and the associated licensing waivers and agreements.

Program Evaluation and Strategy

The Program Evaluation and Strategy Subcommittee focused on strategies to promote multi-modal coverage of the ITS program, strategies to promote accelerated deployment

of ITS technologies at the state and local level, and performance metrics to measure progress and achievement of ITS program goals in safety, mobility, and the environment. The Subcommittee dealt at the program level, and not the project level, concentrating on the evaluation of overall program outcomes.

Recommendation 22. In addition to making progress toward national deployment objectives, the JPO should provide an effective program and incentives to support system development, investment, and deployment by others such as state and local entities and private sector technology developers. The JPO should identify and quantify its investment in major program elements that are designed to support deployment such as prototype development, technical feasibility, demonstration pilots, evaluations, standards development, facilitation forums, etc. The JPO should measure how the ITS investment in each of the major program elements has resulted in deployment by others (e.g., deployment tracking).

Recommendation 23. The JPO should facilitate and accelerate institutional transformation among the US DOT modal administrations and through federal interactions with state/local governments and the private sector. The JPO should communicate transferable lessons across geographic areas where it is of fundamental value (or necessary) to achieve progress towards deploying transportation technologies.

Recommendation 24. The JPO should develop and execute strategies to support investments in modal technologies that are adaptable to other modes. The JPO should evaluate these strategies to determine the degree to which technology investments that are made primarily for a single transportation mode will be beneficial to other modes.

Recommendation 25. The JPO should work toward an ITS program that contributes to a sustainable transportation system that supports economic development, environmental protection, and social equity. The JPO should propose the key metrics for each of these sustainability objectives and the data collection required as technology deployment occurs. Measures should include the degree to which an integrated strategy of ITS investments at the regional/MPO level, as determined by the federally-required metropolitan planning process, results in achievement of a more sustainable transportation system.

Recommendation 26. The JPO should recommend program-level performance metrics, including metrics for the recommendations of the other two subcommittees, for review by the ITS PAC and implement them as an integral part of an ongoing independent evaluation to measure specific outcomes against expectations.

CONCLUSION

This concludes our report with a number of recommendations for the ITS JPO. This represents a hard won consensus of the ITS PAC, a diverse group of close observers and participants in the ITS program whose experience stretches over several decades.

We hope the JPO finds the recommendations of value and we look forward to JPO's response both to us and to Congress.

It has been a pleasure to serve on the ITS PAC and hope we provided valuable, useful and actionable recommendations to the recipients of this document.