

2013 Report to the US Secretary of Transportation

United States Department of Transportation 2013 Intelligent Transportation Systems Program Advisory Committee

20 December 2013

ITS PAC CHARTER

Section 5305(h) of the Safe, Accountable, Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU, P.L. 109-59) of 2005 directs the U.S. Department of Transportation (USDOT) 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 (ITS) Program. The ITS Program Advisory Committee (ITS PAC) provides input into the development of the ITS aspects of the Department's strategic plan and review ITS research being considered for funding.

USDOT is also directed to submit an annual Report to Congress in February of each year which includes:

- All recommendations made by the ITS PAC 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 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 2012-2013

The Committee met four times in its 2012-2013 session and conducted two meetings by webinar. Besides its primary mission of generating advice memoranda to the JPO and Secretary of Transportation, the Committee also found it prudent to comment on other closely related developments during the course of its activities, since the Committee's final recommendations would not be submitted, reviewed and commented upon until early in 2014.

Specifically, the ITS PAC submitted comments to the FCC on their proposed rulemaking to permit unlicensed national information infrastructure devices to operate in and share the 5.9 GHz band originally designated on a co-primary basis for exclusive use for vehicle communications. The Committee submitted its recommendation to the FCC in May of 2013 that no change be made unless thorough data-driven review testing

demonstrated that no harmful interference would occur to the existing frequency allocation. We hope that the US DOT and the FCC will collaborate in decision making on this matter.

Similarly, since the NHTSA decision on passenger car vehicle communications rulemaking was scheduled for end of 2013, before the ITS PAC's recommendations would be finalized, the Committee felt compelled to address this plan as well. To this end, the Committee deliberated and composed a letter that was delivered to NHTSA through the JPO in August of 2013. In this letter, the Committee urged NHTSA to proceed with the rulemaking process that will lead to widespread deployment of vehicle-to-vehicle communications.

The submission to the FCC and the letter to NHTSA are both included here as appendices.

The ITS PAC produced additional items requested by the JPO Director. These included comments on the new Strategic Plan and a memo on Deployment Incentives. The Committee members reviewed the Strategic Plan outside of its regularly scheduled meetings, and then commented in a special session at its August 2013 meeting. JPO representatives engaged in this discussion and compiled notes on the Committee inputs. The Deployment Incentives memo was submitted in a meeting on November 18, 2013.

The Transportation and Communications Technology Market Convergence

As the previous Committee noted, the automotive industry and the telecommunications industry have experienced dramatic evolution and convergence in recent years. Not only has the automotive industry deployed substantial active safety features with a rapid proliferation of road environment sensors, but most automobile manufacturers and their industry partners have created Internet connectivity and other cutting edge functionality in their vehicle platforms providing a variety of consumer location-based services such as hands-free smartphone integration, Internet radio, navigation, real-time traffic information, weather and even some eco-driving and safety aids.

The communications industry has continued to advance with faster data transfer and more reliable connectivity that deliver streaming music and video in many locations. Demand for spectrum to meet consumer desires is partly what has driven competition for the currently transportation-exclusive 5.9 GHz band. And these developments have fostered some opinions about the future use of DSRC as the vehicle communications medium of choice. However, to date no workable solutions to vehicle safety critical needs of security, predictable low latency and privacy have emerged on these other networks. Of course, for non-safety functions, such as traveler information, the ubiquity of cellular communications and enormous breadth of innovators of cellular apps will likely be a major source for these functions.

And a new trend since the previous Committee is the incredibly rapid emergence of automated vehicles. Already are cars on the road that can park themselves, apply the

brakes prior to an imminent collision, and control brakes, accelerator and steering in low-speed traffic conditions. While automated vehicles do not necessarily impact considerations of vehicle communications, many experts believe that vehicle communication is an important, if not essential, component of an automated vehicle.

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 ITS. This combination 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. As with the previous Committee of 2010-2011, in 2012 this Committee created subcommittees to probe more deeply into the most critical aspects of the DOT ITS Program. After careful deliberation, the Committee formed five subcommittees:

- Global Harmonization of Standards
- Technology Strategy
- Security Framework
- Outreach Communications and Promotion Plan
- Implementation

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 developed recommendations that 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 require resources or actions beyond the access and authority of the JPO currently. Given the importance of these recommendations for success of the program, the ITS JPO should seek the budget, charter and authority to implement them. We note that some of these recommendations may be in various stages of implementation by the ITS JPO at this time, which we applaud.

RECOMMENDATIONS

Security Framework

Background: Communications security is a rapidly evolving challenge. Every day new viruses and new forms of attack are invented. It is critical that the security framework of Connected Vehicles allows for flexibility and evolution, and constant vigilance be exercised.

The Security Framework Subcommittee of the ITS PAC has become aware of independent research regarding potential vulnerability in the DSRC communications construct. While the committee's scope and expertise does not allow us to assess the validity of the research or the severity of the vulnerabilities, we believe that it is important for the ITS JPO to similarly be made aware of this research.

Specifically, the ITS PAC Security Subcommittee has received independent research on the proposed IEEE1609.2 Security Services for Applications and Management Messages. This research found several potential opportunities to improve the system's performance and security. First, the current protocol lacks support for a mechanism to allow root authorities to change keys, as well as for the Security Credentials Management System (SCMS) Manager to change signature algorithms. Developing a solution to this finding should be high priority due to its impact on the scale of the SCMS. In addition, the research finds that this protocol may be subject to misbinding attacks, which should be considered a practical attack and the protocol revised to enhance resiliency much like other similar protocols such as TLS, IPsec. In addition, the research finds a potential susceptibility to worm-hole attacks, which also should be studied.

Recommendation 1

The ITS JPO should establish a mechanism to allow entities not directly involved in Federal or automaker developments in the security aspects of DSRC to be able to provide input to the JPO process. This input could be in the form of a briefing request from the ITS JPO or RITA, a solicitation for comments, a public forum for discussion, contractor analysis, public-private partnership, or other means the ITS JPO deems appropriate.

Background: The United States does not have a specific federal regulation establishing universal implementation of privacy policies. Congress has, at times, considered comprehensive laws regulating the collection of information online, such as the Consumer Internet Privacy Enhancement Act and the Online Privacy Protection Act of 2001, but none have been enacted. The United States prefers what it calls a 'sectoral' approach to data protection legislation, which relies on a combination of legislation, regulation, and self-regulation, rather than governmental regulation alone. Privacy, at both the federal level and state levels, is regulated by specific industry and type of use in 23 areas, with non-mandatory guidelines that recommend industry self-regulation.

Recommendation 2

The ITS JPO should work with industry and policymakers to develop a Privacy Guideline for Vehicle Data and Content, utilizing best practices from other sectors where appropriate. However, there may be a number of fundamental issues that must be addressed first such as data ownership, metadata policies, and self-regulation, among others.

We recommend outreach and collaboration with automotive, telecommunication and computation industries, consumer and motorist organizations, and other potential stakeholders and experts to provide input and/or review of the guideline.

Technology Strategy

Background: The communication of trusted data between vehicles of all types on the nation's roadways is a basic tenet of a successful Connected Vehicle safety system deployment. Data from misbehaving vehicles, or roadside equipment that causes or initiates the possibility of inappropriate driver responses could damage the trustworthiness and effectiveness of the system to avoid crashes. For example, with inaccurate GPS positional reporting from one or more vehicles in a region, false warnings indicating phantom slowing or stopped vehicles in a lane could result. On the other hand, an inaccurate report of the lateral position of a stopped vehicle may prevent the appropriate warning in a following vehicle. Many instances of such behavior would lose trust from the participating drivers and the effectiveness of the system would be significantly reduced.

There are at least two significant operational modes for misbehavior: one would be operational deficiencies in the installed equipment (non-malicious) and another would be the purposeful injection of messaging that indicates inaccurate description of the true physical scenario (malicious).

Recommendation 3

The ITS JPO should conduct a study to determine the likelihood of false detections given the minimum positioning performance requirements set in place for a possible regulation or New Car Assessment Program (NCAP) certification, and quantify statistical anomaly vs. misbehavior which should be flagged.

Recommendation 4

In the case where a detection of misbehaving devices occurs, the ITS JPO should identify the technical and policy actions to be taken to keep the user trust at a level that supports the benefit/cost ratios calculated for deployment.

Background: This topic concerns commercial vehicle regulations and is not directly within the ITS JPO's responsibility, but the Committee chose to comment on this broader USDOT issue under its extended charter provisions.

In 2014 NHTSA and FMCSA will consider the same vehicle safety message communication rulemaking for interstate commercial vehicles. There are definite advantages to deploying in the commercial vehicle environment. After initial implementation, within a few years many commercial vehicles, including retrofitted existing vehicles, could provide data on performance, robustness, security and viability to support evaluation of passenger vehicle efficacy. Commercial vehicle interior space for device placement, and antenna shape and placement are not as constrained as they are for passenger vehicles. And with V2X implemented in commercial vehicles, the incremental cost to include vehicle diagnostics, driver behavior monitoring, trailer integrity, road condition, weather and traffic awareness is now a simpler business decision, and we

should see a broad adoption of those capabilities. Suitable *quid pro quo* arrangements with commercial vehicle operators are then possible for USDOT, state and local agencies to harvest the mobility information. Meanwhile, public awareness, technology refinement, value proposition and ability to address security issues are now accelerated in a controlled environment of long haul truckers.

Recommendation 5

FMCSA and NHTSA should pursue Interstate Commercial Vehicle Rulemaking for both V2V Safety Messages and V2X capabilities.

Background: Positioning system performance, accuracy and reliability, will be critical to Connected Vehicle operations. While the Committee understands that extensive testing has been done on positioning, the ITS JPO needs to ensure that this technology will not affect successful deployment and operation and be achievable at acceptable cost.

Recommendation 6

The ITS JPO should ensure that adequate testing of positioning system performance is conducted in all expected conditions and that cases where positioning performance will not be adequate are well understood and their likelihood of occurrence calculated and potential impact on vehicle interactions understood. Furthermore, successful positioning performance must be achievable at acceptable component costs and the performance/cost tradeoffs should be analyzed.

Global Harmonization of Standards

Background: The Global Harmonization of Standards Subcommittee was formed to provide recommendations on effective ways to ensure that ITS standards are harmonized globally in order to promote the efficient and rapid deployment of ITS technologies and to minimize the cost and complexity of maintaining those standards once they are deployed. The Subcommittee agreed that a wide range of stakeholder groups will need to work together to ensure that a necessary and beneficial level of harmonization occurs; including governments, vehicle manufacturers, other ITS-related industries, trade associations, and relevant standards organizations. The Subcommittee recognizes that significant progress has been made in harmonization since the last ITS PAC report in 2011. However, continued strong leadership to encourage harmonization is needed to enable the use of common hardware and/or software modules across multiple regions, and in this area technology expertise is critical. The Subcommittee believes that standards need not be identical for there to be tangible benefits and that not all standards need to be globally harmonized, only those where there are common international markets.

The following obstacles to global harmonization have been identified:

- Competition among certain standards organizations working to develop similar standards.
- European governments, automobile manufacturers and infrastructure suppliers/operators are driving short initial deployment timing with significant voluntary resources from the European manufacturers and financial support from the European Union on standards development. The US must fortify their international standardization participation to mitigate the risk that early stage technologies based on non-harmonized standards be adopted locally in Europe, which may make the adoption of harmonized multiregional standards more difficult in the longer term.
- Although multiple forums with interests in harmonized standards exist and some progress has been made towards this end, sufficient cohesive processes and/or appropriate integrative forums to facilitate harmonization of specific standards are currently lacking.
- Lack of agreement among vehicle manufacturers and governments concerning the scope and timing of harmonization needs.
- Lack of understanding of the level of harmonization necessary to be beneficial.

Recommendation 7

ITS JPO and other organizations within USDOT should continue to identify harmonization of ITS standards as a critical priority in their public communications about ITS technologies and continue to include it in their strategic plans. While ITS JPO has in the past made such statements as part of its outreach programs, reinforcement from higher levels within USDOT, the Department of Commerce, and the White House would be of substantial value. Other regions are invested at these levels of authority; the U.S. government should be as well.

Recommendation 8

ITS JPO should continue to adequately fund organizations and programs acting to harmonize ITS standards. Sufficient funding should be made available to effectively deploy US experts from the US Government, automobile manufacturers, and relevant organizations to the appropriate forums working on ITS standards. In the case of federally funded organizations, the ITS JPO should fully exercise contractual/grant authority to encourage harmonization.

Recommendation 9

The ITS JPO should assure that the US – EU Standards Harmonization Working Group and any future US–regional collaborations working on harmonized standards are properly supported by both US government and industry personnel who are actively engaged in standards work. Further, these groups should meet face-to-face on a frequent basis and for periods of sufficient duration to allow thorough discussion and resolution of pertinent issues. Additionally, the US should work to consolidate the various regional groups with interests in standards harmonization into a single global working group.

Recommendation 10

The ITS JPO should cooperate with industry and others to develop a list of key Connected Vehicle interfaces and standards required to support broad Connected Vehicles deployment and identify and aggressively pursue beneficial harmonization and multiregional joint standards development opportunities. 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 and the development of redundant standards discouraged.

Recommendation 11

The ITS JPO should ensure that the intellectual property and patent right embedded in existing and emerging standards are clearly understood and develop a plan to mitigate the impact of these issues on Connected Vehicle implementation.

Recommendation 12

The ITS JPO should continue to consider the relationship between Connected Vehicle standards and emerging standards for new technologies, including machine-to-machine communication, necessary to support automated/autonomous vehicle deployment to ensure that Connected Vehicle standards evolve to meet the needs of these developing technologies as well.

Recommendation 13

The ITS JPO should continue efforts to pursue global harmonization of 5.9 GHz radio spectrum standards to meet the needs of low-latency, secured Connected Vehicle communications. The ITS JPO should closely monitor and participate in spectrum usage testing to ensure that that no changes are made unless thorough data-driven review testing demonstrates that no harmful interference would occur to the existing frequency allocation. The US DOT and the FCC should collaborate in reaching the right decision on this matter.

Outreach Communications and Promotion Plan

Background: Success of Connected Vehicle deployment is inextricably linked to consumer awareness of and buy-in to the benefits of the new technology. Such awareness, acceptance and enthusiasm will be a key factor in the speed of deployment, whether that is replacing older, non-equipped vehicles or buying and installing approved aftermarket devices. This program starts with developing a broad-based communications plan targeting multiple areas including stakeholders and audiences, internal, external, public, private, and multiple levels of government. This plan is needed considering the NHTSA rulemaking decision in 2013 and the FCC decision on spectrum sharing. Implementation solutions, particularly regarding possible aftermarket solutions, will need to be clearly described along with implementation benefits.

Recommendation 14

The ITS JPO should engage communication professionals to develop an overarching communications strategy, and aggressively launch an effective public communications campaign.

Recommendation 15

NHTSA should create a comprehensive document on safety benefits, particularly as new technologies are being introduced that improve the safety of vehicles. NHTSA cited such a document on Connected Vehicle benefits when voicing support for Connected Vehicles in May 2012.

Implementation

Recommendation 16

The ITS JPO should create a Glossary of Terms as part the Strategic Plan. The ITS Connected Vehicles program would benefit from greater attention to nomenclature. Activities, programs, and technologies should be identified with unique terms that have clear and stable meanings. Every attempt should be made to use terms consistently and to encourage consistent use in the ITS community.

We identify two general areas where nomenclature is especially important. The first is in technology. Terms like “V2V”, “automated vehicles”, “autonomous vehicles”, “driverless cars”, etc. should be defined and used consistently.

The second area is in deployment. Terms like “adoption”, “implementation”, and “deployment” should also be clearly defined and consistently used. Clarity of terms may make clearer how new technologies will transition into use.

Since there is widespread use of these various terms by different sectors such as academia, industry, the press, the public and others, it not likely that the ITS JPO can drive a common lexicon, but at least for the purposes of its own generated documents this glossary can serve to clarify the discussion.

Recommendation 17

USDOT should encourage and incentivize additional DSRC pilot deployments at the state and local level (rural, urban and regional). Such DSRC pilots would educate local officials and local publics about the benefits of DSRC-based systems. Multi-modalism is a desirable feature of such pilots.

Background: Implementation – be it of ITS or any other innovation – involves an understanding of local operating conditions. Innovation studies have identified two models of innovation: a *local/incremental* model and a *laboratory/advanced* model. Both models are important.

The federal ITS program excels at the laboratory/advanced model. Yet many ITS implementations are local in origination. An example of this might be electronic toll collection. USDOT should develop mechanisms to support the local/incremental model of innovation.

Recommendation 18

The ITS JPO should continue its efforts to connect Federal and state and local agencies. Given their key role in ITS implementation, state and local officials should have the most effective voice possible in USDOT technology programs. Hierarchical federal program

structures should be complemented by peer-to-peer program structures (AASHTO, TMC operators association, etc.), and both types of programs should connect.

Federal programs should continue to seek ways to connect with state and local peer-to-peer associations and with non-traditional stakeholders (e.g. National Association of Counties, Conference of Mayors, League of Cities, Governors Association). Outreach to deployers should focus on ready-to-deploy technologies.

Background: NHTSA rule-making procedures offer an excellent framework for continued progress towards Connected Vehicles implementation. The Connected Vehicles program has gone from the lab to the field test, and now the challenge is to advance it to widespread implementation. Although initial development has been led by the public sector, final implementation will occur in the private sector. The NHTSA proceedings provide a useful venue for all stakeholders to interact and to articulate and evaluate their commitment to Connected Vehicles implementation.

Recommendation 19

USDOT should further its capacity to identify and to promote local innovations. USDOT should provide seed grants and other support for successful innovations, even if they originate outside of the federal program.

Background: The best-known DSRC-necessary Apps are those in the Safety Pilot demonstration. We believe there are additional DSRC-necessary apps that will yield additional benefits. By identifying as many apps as possible in this category, the JPO will more fully identify the benefits of DSRC. Moreover, by identifying DSRC-necessary Apps that function even without significant market penetration, JPO can highlight applications with nearer-term benefits than some of the safety apps.

Recommendation 20

When reporting on the Connected Vehicle program the ITS-JPO should use the analytical category “DSRC-necessary Apps”. DSRC-necessary Apps are application-layer programs whose functioning demands the characteristics of the DSRC network (high speed, security, privacy, no subscriber fee, no opt-in, etc.)

JPO should identify all known or planned DSRC-necessary apps. It should seek to stimulate further development of such applications. DSRC-necessary apps that can operate in (near) stand-alone mode should be identified.

CONCLUSION

This concludes our report and 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 we hope that we provided valuable, useful and actionable recommendations to the recipients of this document.

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