

International Deployment of Cooperative Intelligent Transportation Systems –

Bilateral Efforts of the European Commission and United States Department of Transportation

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Research and Innovative Technology Administration (RITA)

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16. Abstract The United States and European Union (EU) share many of the same transportation research issues, challenges, and goals. They also share a belief that cooperative vehicle (also termed connected vehicle) systems, based on vehicle-to-vehicle and vehicle-to-infrastructure communications, can deliver significant societal benefits for all road users in terms of safer, more energy-efficient, less congested, and environmentally friendly transportation. Thus, in January 2009, the U.S. Department of Transportation Research and Innovative Technology Administration (RITA) and the European Commission Directorate General for Communication Networks, Content and Technology (CONNECT; formerly Information Society and Media) signed an Implementing Arrangement to develop coordinated research programs, specifically focusing on cooperative vehicle systems. Both recognized that coordinated research can preclude the development and adoption of redundant standards, provide significant cost savings, and support and accelerate the deployment and adoption of cooperative vehicle systems. An EU-U.S. Steering Group, Technical Task Force, and Working Groups, co-led and staffed by representatives of RITA, CONNECT, and appointed industry experts, are conducting the work for the EU and U.S. bilateral activities. Representatives from the Japanese Ministry of Land, Infrastructure, Transportation and Tourism participate in these groups as official observers.					
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Message from the European Commission and U.S. Department of Transportation

Dear Colleagues,

The United States Department of Transportation Intelligent Transportation System (ITS) Joint Program Office and the European Commission Directorate General for Communication Networks, Content and Technology have been working together on mutual ITS challenges and opportunities related to connected vehicles as they are known in the United States, or cooperative ITS, as it is known in the European Union (EU). Our goals for this collaboration are to increase the value of our regions' research by creating a joint framework for field operational tests and evaluation tools; collaborate on cooperative vehicle safety, mobility, and sustainability application research projects; and internationally harmonize cooperative ITS standards to support cooperative ITS.

We have made good progress in our bilateral endeavor. Together, we have embarked on a disciplined and structured approach to identifying topics of shared interest within our programs. To date, one of our most significant accomplishments is the development of a substantially harmonized core safety message set, as a result of cooperation between EU and U.S. industry, governments, and standards communities. The revised planned contents of the EU Cooperative Awareness Message (CAM) have been harmonized with the contents of the currently adopted U.S. Basic Safety Message (BSM). While the messages are not identical, they are now sufficiently harmonized to require only simple software reconfiguration for systems to use both messages nearly interchangeably. This will enable the use of common hardware and substantially common software for products destined for both regions, reducing both cost and complexity to manufacturers and, ultimately, to consumers. The harmonized content is expected to be incorporated into the final version of the CAM standard currently being completed via the European Telecommunications Standardization Institute's processes, with adoption expected in the near future. We will display this harmonized content in a joint exhibit showcasing our bilateral efforts at the ITS World Congress in Vienna, Austria, in October 2012.

This report highlights these and other joint accomplishments and our future plans in the areas of connected vehicle safety, standards harmonization, sustainability applications, assessment tools, and driver distraction and human-machine interaction. We are pleased to report that the U.S. and EU have been joined in several of our working areas by representatives of the Japanese Ministry of Land, Infrastructure, Transportation and Tourism who endorse the importance of international research collaboration and harmonized standards.

We look forward to seeing you at the ITS World Congress.

With our best regards,

USDOT RITA

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EXECUTIVE SUMMARY

The United States and European Union (EU) share many of the same transportation research issues, challenges, and goals. They also share a belief that cooperative vehicle (also termed connected vehicle) systems, based on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications, can deliver significant societal benefits for all road users in terms of safer, more energy-efficient, less congested, and environmentally friendly transportation. Thus, in January 2009, the U.S. Department of Transportation (USDOT) Research and Innovative Technology Administration (RITA) and the European Commission (EC) Directorate General for Communication Networks, Content and Technology (CONNECT; formerly Information Society and Media) signed an Implementing Arrangement to develop coordinated research programs, specifically focusing on cooperative vehicle systems. Both recognized that coordinated research can preclude the development and adoption of redundant standards, provide significant cost savings, and support and accelerate the deployment and adoption of cooperative vehicle systems.

An EU-U.S. Steering Group, Technical Task Force, and Working Groups, co-led and staffed by representatives of RITA, CONNECT, and appointed industry experts, are conducting the work for the EU and U.S. bilateral activities. Representatives from the Japanese Ministry of Land, Infrastructure, Transportation and Tourism (MLIT) participate in these groups as official observers.

The current Working Groups include:

- **Safety Applications Working Group** -- Supports the development and deployment of cooperative safety applications in Europe and the United States by collaborating on and, to the extent possible, harmonizing over-the-air data and communication interfaces. The results can then feed into the ongoing industry standards processes in which these representatives participate. This approach will reduce costs for the development of cooperative safety systems and accelerate deployment by enabling the use of common vehicle hardware and firmware in both regions.
- **Sustainability Applications Working Group** -- Identifies, researches, quantifies, and evaluates the environmental benefits of an intelligent transportation system (ITS) application or scenario that would improve the operation and performance of an environmentally optimized transportation network. The Working Group's specific activity goals are to define and develop an operational concept for an environmental signal phase and timing (SPaT) application and to focus on the development of joint standards for a possible "environmental message set" to support this application.
- **Standards Harmonization Working Group** -- Fosters the development and adoption of globally harmonized standards for cooperative ITS. The EU and U.S. agree that harmonized ITS standards can result in faster realization of the cost-effective safety, mobility, and sustainability benefits afforded by the worldwide deployment of interoperable ITS. In addition to accelerating the societal benefits of ITS, standards

harmonization will increase innovation and competition among ITS equipment manufacturers and service providers, reduce development and deployment costs for ITS stakeholders and consumers, and promote a vibrant international market for ITS products and services. The Standards Harmonization Working Group is coordinating with standards development organizations (SDOs) to ensure timely realization of these benefits while avoiding the development and adoption of redundant standards and efficiently using the collective expertise available in both regions.

- **Assessment Tools Working Group** -- Establishes a common level of analysis capabilities, common field operational test (FOT) methodology and design practices, and shared data formats and parameters for testing and evaluation of cooperative systems. The Working Group focuses on safety, sustainability, and mobility applications and coordinates these with the Safety and Sustainability Applications Working Group.
- **Driver Distraction and Human-Machine Interaction (HMI) Working Group** -- Identifies opportunities for research collaboration, aligns research, and identifies differences in the areas of driver distraction and HMI. The Working Group was created in response to the importance of driver distraction in the political discussion of road safety in both regions.
- **Glossary Working Group** -- Establishes and publishes the common working definitions for key terms and concepts to facilitate mutual understanding in ongoing discussions within the EU-U.S. Task Force. Task Force members choose and vet the content.

The Working Groups have made good progress in our bilateral endeavor. Together, we have embarked on a disciplined and structured approach to identifying topics of shared interest within the programs. One of our most significant achievements is the development of a substantially harmonized core safety message set. Through the collaboration of EU and U.S. industry, governments, and SDOs, the revised planned contents of the EU Cooperative Awareness Message (CAM) have been harmonized with the contents of the currently adopted U.S. Basic Safety Message (BSM). While the messages are not identical, they are now sufficiently harmonized to require simple software reconfiguration for systems to use both messages. This will enable the use of common hardware and substantially common software for products destined for both regions, reducing both cost and complexity to manufacturers and, ultimately, to consumers.

Going forward, the EU and U.S. bilateral efforts will continue to focus on international standards harmonization as a key outcome of our collaborative work. We will also build on our respective agreements with Japan to foster collaboration on international standards harmonization, probe data usage, and evaluation.

In addition, the Safety and Sustainability Applications Working Groups will identify critical technical issues, and the Driver Distraction and HMI Working Group will continue to gain knowledge in safe HMI design. We also anticipate that by sharing the results of each region's individual demonstrations (such as the U.S. Connected Vehicle Safety Pilot and the EU CAR 2 CAR Communication Consortium demonstration at the 2012 World

Congress); we will maximize our overall knowledge and research. Ultimately, our goal is that our efforts will accelerate the deployment of cooperative vehicle systems worldwide.

OVERVIEW

Transportation is a global industry. It is an essential part of economies worldwide and has a significant impact on quality of life, mobility, and the environment. Thus, its livelihood is critical. Over the last decade, in the United States, the USDOT has been actively researching ways that information and communications technologies can improve surface transportation safety and mobility and contribute to economic growth. Similarly, in Europe, the EC together with the Member States has been pursuing transportation policies aimed at improving safety and mobility and reducing the environmental impact of transportation.

The two regions share many of the same transportation research issues, challenges, and goals. They also share a belief that cooperative vehicle (also termed connected vehicle) systems, based on V2V and V2I communications, can deliver significant societal benefits for all road users in terms of safer, more energy-efficient, less congested, and environmentally friendly transportation. Thus, in January 2009, the USDOT/RITA and CONNECT signed an Implementing Arrangement to develop coordinated research programs, specifically focusing on cooperative vehicle systems. Both recognized that coordinated research can preclude the development and adoption of redundant standards, provide significant cost savings, and support and accelerate the deployment and adoption of cooperative vehicle systems.

The regions' commitment was further affirmed in an EU-U.S. Joint Declaration of Intent on Research Cooperation in Cooperative Systems, signed in November 2009. RITA's and CONNECT's goals and anticipated benefits for the entire bilateral cooperation and, in particular, the collaborative research activities are to:

- Reduce cost and increase research efficiency by working together to identify and collaborate on a common list of technical issues
- Increase the power of findings and outcomes through the development of complementary FOTs and comparable test data
- Provide comparable value to both regions in the research agenda
- Promote international standards harmonization
- Improve market opportunities for development of services and products and leverage private and public sector deployment (e.g., economies of scale).

Sharing many of the same transportation challenges and goals with Europe and the United States, Japan is similarly engaged in research to improve safety, reduce environmental impact, and increase efficiency. Recognizing these common challenges and opportunities and building on long-established research exchange activities, CONNECT, RITA, and the MLIT completed two parallel Memoranda of Cooperation in 2011, similar to the EU-U.S. Implementing Arrangement, to facilitate official participation among the three regions in shared

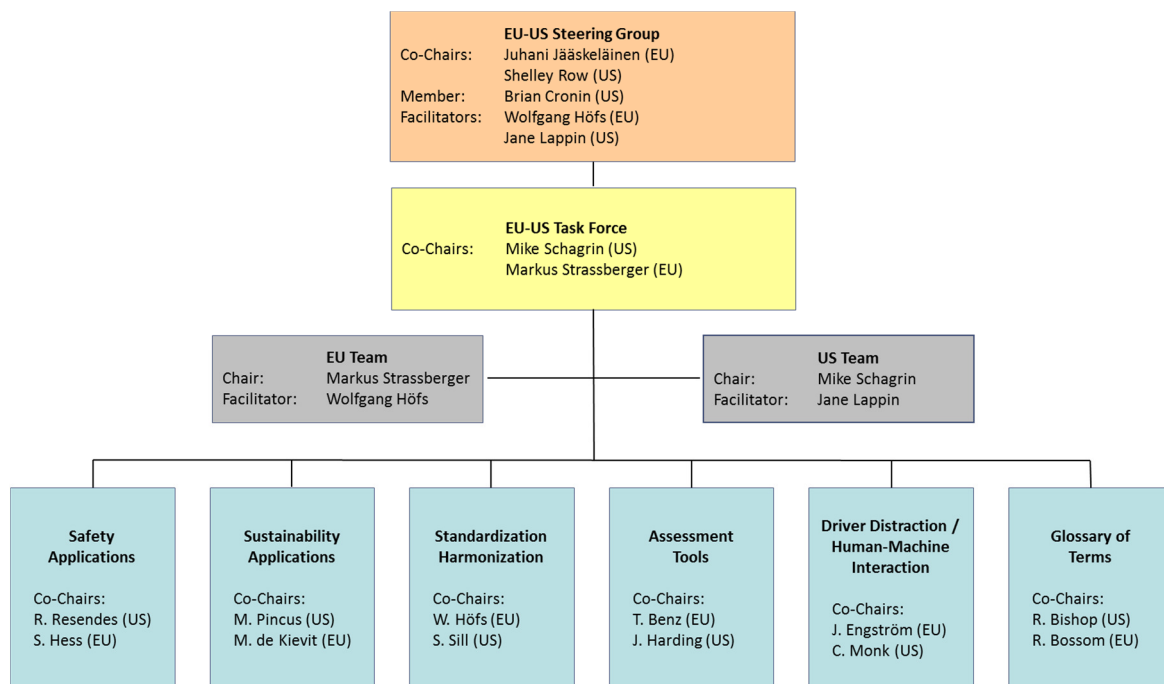
research and standards harmonization activities. This report focuses on the bilateral achievements of the EU-U.S. cooperation; however, it also notes MLIT’s participation in activities of shared interest.

STRUCTURE AND GOVERNANCE

An EU-U.S. Steering Group, Technical Task Force, and Working Groups, co-led and staffed by employees of RITA and CONNECT and appointed industry experts, are conducting the work for the EU and U.S. bilateral activities. MLIT representatives participate in these groups as official observers.

The Steering Group was created to provide direction to and oversight of the activities authorized in the bilateral Implementing Arrangement. The Technical Task Force performs as the coordinating body for establishing Working Group activities and identifying and addressing cross-cutting requirements. Working Groups were established within the Technical Task Force to address key areas of shared interest. The current Working Groups are listed below (and illustrated in the following organizational chart):

- Safety Applications Working Group
- Sustainability Applications Working Group
- Standards Harmonization Working Group
- Assessment Tools Working Group
- Driver Distraction and Human-Machine Interaction Working Group
- Glossary Working Group.



New Working Groups likely will be established in the future, in response to shared program priorities.

To enhance coordination among the three regions, MLIT representatives actively participate as official observers in the EU-U.S. Steering Group, Technical Task Force, and Working Group meetings. On the basis of the U.S.-Japan Memorandum of Cooperation, three Working Groups have been established between the MLIT and RITA to address International Standards, Evaluation Tools and Methods, and Probe Data. The International Standards and Evaluation Tools and Methods Working Groups are addressing issues similar to their equivalents in the EU-U.S. collaboration, and they are coordinating their work—making it a truly tri-lateral effort. The Probe Data Working Group is developing a collaborative U.S.-Japan research agenda, and the EU is investigating the possibility of joining this work.

REPORT PURPOSE AND ORGANIZATION

RITA and CONNECT have made good progress in our bilateral endeavor. Together, we have embarked on a disciplined and structured approach to identifying topics of shared interest within the programs. This report highlights our joint accomplishments and future plans in the areas of connected vehicle safety, standards harmonization, sustainability, driver distraction, and research tools.

The remainder of the report describes the mission, achievements, and future plans of each of the Working Groups.

WORKING GROUPS

Safety Applications Working Group

Mission Statement

The Safety Applications Working Group supports the development and deployment of cooperative safety applications in Europe and the United States by collaborating on and, to the extent possible, harmonizing over-the-air data and communication interfaces. The results can then feed into the ongoing industry standards processes in which these representatives participate. This approach will reduce costs for the development of cooperative safety systems and accelerate deployment by enabling the use of common vehicle hardware and firmware in both regions.

Membership in this Working Group comprises both government and industry representatives. In Europe, the EC is working with the private-sector CAR 2 CAR Communication Consortium (C2C-CC), representing major European automobile manufacturers and suppliers. In the United States, the USDOT is working with the Crash Avoidance Metrics Partnership (CAMP), which similarly consists of private sector automobile manufacturers and includes U.S.-based Japanese and European manufacturers.

Achievements

Preliminary Application Definition

The Working Group's initial work focused on creating shared functional definitions of cooperative safety applications, as a basis for identifying collaboration and harmonization items. The safety applications defined were forward collision avoidance and traffic signal violation.

Harmonization Activities

One of the Working Group's key events was the EU-U.S. V2V Safety Applications Harmonization Workshop, held in summer 2011 in Böblingen, Germany. This workshop was the first gathering of European and U.S. original equipment manufacturer (OEM) representatives pursuing cooperative safety applications. Other participants included the USDOT, the EC, and the MLIT. Over the course of 3 days, workshop participants discussed the technical elements relating to emerging standards. Through demonstrations and discussions, the Working Group achieved an in-depth, shared understanding of EU and U.S. approaches to V2V safety. Understanding that not all aspects need to be harmonized, the group agreed to leverage current opportunities and harmonize items deemed appropriate and of considerable value.

OEMs value common hardware with the same chipsets and security foundation. If different platforms are required for multiple regions, development time and cost increase substantially to provide often very similar capabilities via very different means. Conversely, if the associated standards are as similar as possible recognizing unique regional requirements (i.e., *harmonized*), overall development time and cost can be substantially reduced. The ability to use common hardware allows a single version of a technology implementation to be manufactured for multiple regions, reducing both time to market and cost, while increasing manufacturing flexibility. While the cooperative vehicle software will consider the specific characteristics of the regions, it is critical to align the data elements within the message sets as much as necessary.

Working in conjunction with the Standards Harmonization Working Group, the Safety Applications Working Group identified key technical areas within the two safety applications to investigate for collaboration and possible harmonization. These areas include:

- Safety message sets and minimum performance specifications for over-the-air data elements critical to V2V crash-imminent safety applications
- Common strategy for message security and similar security profiles for similar safety applications
- Effective strategies for message congestion management
- Harmonized test procedures for device- and component-level validation of safety application devices.

To date, significant progress has been made in aligning both the U.S. message set (SAE J2735 BSM Part 1) and the European message set (CAM and the Decentralized Environmental Notification Message (European Telecommunications Standardization Institute TS 102 637-2 and TS 102 637-3)). While these message sets are not completely harmonized, they are close enough to enable easy adaptation of a common hardware platform to accommodate either message set. The USDOT and the EC are hosting a showcase at the 2012 ITS World Congress in Vienna that will provide a live demonstration of how a common hardware platform on a U.S. and an EU vehicle enables this communication.

Work is still ongoing for each of the other areas. In many cases, both regions' work is evolving and needs to stabilize before assessing the ability to harmonize. Nonetheless, collaboration and information sharing continue and are of great value in keeping partners abreast of outcomes and progress.

A second harmonization workshop was held in March 2012 in Wolfsburg, Germany. This workshop advanced the work items previously identified, focusing on standardization, human-machine interfaces, applications, and test tools. The workshop also addressed channel issues, common hardware, safety message sets, performance requirements, congestion control, certification, security, and message sets other than safety messages. In particular, thorough discussions on message sets, test procedures, certification, and liability established new

common ground. Finally, the workshop established a detailed roadmap for spring and summer 2012 to ensure results were available for further discussion during the ITS World Congress in Vienna.

2011 International Workshop on Vehicle Communications for Safety and Sustainability

Members of the Safety Applications Working Group are centrally involved in the development of the annual International Workshop on Vehicle Communications for Safety and Sustainability, held in cooperation with the ITS World Congress. The USDOT and the EC-funded COMeSafety2 project initiated the workshop in 2005 as a global venue for vehicle safety communications developers to discuss issues of shared interest. Sustainability was added to the workshop agenda in 2010 based on the agenda of the newly formed EU-U.S. Sustainability Applications Working Group. Sponsored by the C2C-CC, the seventh annual workshop was held in October 2011 in Orlando, Florida. The COMeSafety2 project led the workshop, with support from the EC, the USDOT, and the Japanese MLIT.

The full-day workshop included five sessions, corresponding to the five critical collaboration areas identified by the EU-U.S. Safety Applications, Sustainability Applications, and Standards Harmonization Working Groups. The sessions were global vehicle safety; sustainable driving; security, privacy, and certification; global standards harmonization; and stakeholder requirements and involvement. Each session included industry panelists from Europe, Japan, and the United States. Presentations and minutes from the workshop can be found on the COMeSafety2 website (www.comesafety.org).

Future Plans and Dates

A joint showcase at the 2012 ITS World Congress will demonstrate the level of harmonization achieved through the EU and U.S. bilateral discussions and standards activities. The showcase will consist of a live (static) demonstration of European and U.S. vehicles exchanging data using one another's message sets with a common hardware platform, as well as explanatory literature and Congress sessions.

The 8th International Workshop on Vehicle Communications for Safety and Sustainability will be held in Vienna, in conjunction with the 2012 ITS World Congress. This workshop will provide the opportunity to coordinate the accomplishments of the EU and U.S. Working Groups with the global cooperative vehicle community.

Safety harmonization activities will continue across all topics. Relevant results from FOTs and other projects will be shared as they become available.

The Safety Applications Working Group will hold a meeting in early 2013 in the Detroit area, enabling C2C-CC members to tour the U.S. Connected Vehicle Safety Pilot Model Deployment, which will be the largest test to

date of cooperative vehicle technology in a real-world, multimodal operating environment, and to continue face-to-face discussions for advancing work on the technical agenda items.

Sustainability Applications Working Group

Mission Statement

In the context of cooperative vehicle systems, *sustainability* can be defined as the real-time management of trade-offs between mobility, environment, and societal impacts, both at a vehicle level and a system/network level, to optimize transportation's societal and economic benefits and minimize environmental impacts both in the near and longer term. Thus, the vision of the Sustainability Applications Working Group is to conduct joint research on the development and eventual deployment of cooperative transportation and communication technologies to achieve a balance among the system performance goals of reduced negative environmental impact, improved mobility, and enhanced net societal benefit.

The group's objective is to identify, research, quantify, and evaluate the environmental benefits of an ITS application or scenario that would improve the operation and performance of an environmentally optimized transportation network. The Working Group's specific activity goals are to define and develop an operational concept for an environmental SPaT application and to focus on the development of joint standards for a possible "environmental message set" to support this application.

Achievements

In 2011, the Sustainability Applications Working Group developed a white paper entitled "EU-U.S. Joint Research on Cooperative Vehicle Systems in the Context of Sustainability." The paper details the Working Group's proposed objectives, approach, and possible candidate applications for joint research activities.

In the paper, the Working Group proposes to develop a common use case and related applications that reduce energy consumption, vehicle emissions, and environmental impacts at intersections in an urban and/or interurban environment by deploying V2V and V2I communications, as well as advanced traffic signal control algorithms to model and quantify mobility/economy, environmental, and societal benefits and performance tradeoffs at a vehicle and system-wide level.

Four SPaT applications have been proposed for joint research:

- **Smart Start/Stop Assistant:** Broadcasts information from the traffic controller to the vehicle (e.g., current status of the traffic light; cycle time to the next status change) to optimize the automatic start/stop assistant in vehicles in a transparent way to the driver.

- **Energy-Efficient Intersection Control:** Intended to reduce the number of stops at controlled intersections and to avoid unnecessary acceleration and deceleration.
- **Traffic Information and Strategic Routing:** Allows reduced congestion and travel times, optimizes the network load, and aligns individual route guidance and navigation to infrastructure systems to avoid conflicting driver information.
- **Eco-Driving Support:** Assists a driver with information to make better decisions about driving behavior and/or vehicle operation in support of environmental goals (whether personal or system-wide).

The Working Group has not yet defined which application to pursue, but it will likely be some variation of one of those proposed.

The Working Group also developed a detailed list of important research questions to jointly address as activities progress. Answering these questions together will leverage research currently being undertaken and future activities of both the United States and EU. The Working Group expects to prioritize these research questions in the near future.

In parallel with the Safety Applications Working Group's development of the BSM, the Sustainability Applications Working Group is hoping to develop a similar message set that will support environmental applications. To begin development of this environmental message set, the Working Group is looking at the data contained within the BSM to assess which elements are applicable to environmental applications and whether more or different data are needed. The Working Group aims to leverage the operational scenarios developed in the USDOT's AERIS program (Applications for the Environment: Real-time Information Synthesis), as well as the applications developed in similarly focused EU projects such as eCoMove, to define the common data needs from both perspectives. In addition, the group expects to eventually work together to develop joint EU-U.S. data standards for this environmental message set.

Future Plans and Dates

The Working Group aims to complete the following by 2013:

- Choose a SPaT-related application for joint research and develop a detailed description of the application
- Identify, categorize, and prioritize research questions and knowledge gaps
- Develop a hypothesis to facilitate modeling, evaluation, and testing of the application
- Develop a concept of operations (as part of a system engineering approach to define user needs, data requirements, etc.) for the application
- Compare environmental data needs requirements for the U.S. and EU message sets

- Work with the Standards Harmonization Working Group to define an environmental message set for the chosen application and develop a joint data set for the environmental SPaT application
- Possibly demonstrate the environmental SPaT application.

Standards Harmonization Working Group

Mission Statement

The Standards Harmonization Working Group was established to encourage and foster the development and adoption of globally harmonized standards for ITS cooperative systems.

The EU and U.S. agree that harmonized ITS standards can result in faster realization of the cost-effective safety, mobility, and sustainability benefits afforded by the worldwide deployment of interoperable ITS. In addition to accelerating the societal benefits of ITS, standards harmonization will increase innovation and competition among ITS equipment manufacturers and service providers, reduce development and deployment costs for ITS stakeholders and consumers, and promote a vibrant international market for ITS products and services. The Standards Harmonization Working Group is coordinating with SDOs to ensure timely realization of these benefits while precluding the development and adoption of redundant standards and efficiently using the collective expertise available in both regions.

The official membership of the working group is limited to the EC and USDOT co-chairs and other governmental members of the EU-U.S. Task Force. When necessary, the EC and USDOT obtain participation from appropriate parties via their own contractual and other processes to complete specific required tasks. Such participants include representatives from vehicle manufacturing and ITS infrastructure industries, the standardization community, and other subject matter experts. Observation of working group meetings is generally permitted on a space-available basis; although, in rare cases, some discussions may be limited to governmental participants.

Achievements

At the outset, the Standards Harmonization Working Group recognized that identifying the areas where harmonization offers the greatest potential societal benefit and focusing activities to achieve clearly defined outcomes are necessary for successful ITS global harmonization. Equally importantly, the group agreed that benefitting from global harmonization does not demand that all things be harmonized, nor does it mean that harmonized solutions must be identical. Building from this understanding, the Working Group developed a cooperative *ITS Standards Harmonization Action Plan (HAP)* to organize its activities. Published in June 2011, the HAP includes 10 principles that establish the framework for the EU-U.S. cooperation to achieve harmonized standards for ITS cooperative systems.

The Working Group determined that the highest priority areas for near-term standards harmonization activities included a core safety message set to support implementation of V2V crash-imminent warning systems and development of harmonized protocols, management procedures, and operational considerations to support V2V and V2I 5.9 GHz dedicated short-range communications (DSRC).

A major standards harmonization achievement, accomplished in partnership with the Safety Applications Working Group, is a substantially harmonized core safety message set between the CAM and the BSM. The CAM was developed for use in Europe and is being used in the C2C-CC demonstration at the 2012 World Congress; the BSM was developed for use in the United States and is being used in the U.S. Safety Pilot Model Deployment currently underway in Michigan. Through the collaboration of EU and U.S. industry, governments, and SDOs, the content of the CAM has been harmonized with the content of the BSM. While the messages are not identical, they are now sufficiently harmonized to require simple software reconfiguration to use both messages. This enables the use of common hardware and software to implement ITS in multiple locations worldwide, with the improved efficiencies resulting from increased market size. At the 2012 ITS World Congress, the EU-U.S. exhibit booth will display two vehicles that will use these harmonized core safety messages to exchange safety information over the 5.9 GHz DSRC communications link.

Additionally, two harmonization task groups (HTGs) were established to address the need for protocols/management/security to support V2V and V2I DSRC communications. HTGs are a flexible framework for conducting joint U.S.-EU development and/or harmonization work. Their participants, management, and execution are customized to complete each tasking in the most efficient manner possible. The HTGs often bring together a small group of experts active in ITS standards development to discuss and resolve key harmonization issues, although other organizational structures may be used as appropriate to complete the required tasks. Their work will result in harmonization guidance and supporting technical materials that SDOs can incorporate to achieve globally harmonized ITS standards. The work of the two HTGs addressing the 5.9 GHz DSRC communications and security protocols will be completed during 2012. A workshop is planned for November 2012 in Europe to further disseminate the results of these efforts and further define the means by which these results are best incorporated into SDO processes. If there is sufficient interest, a similar workshop will be held in the United States.

Future Plans and Dates

Planning is underway to extend the successful harmonization of the core safety messages to the harmonization of a broader and richer set of V2V and V2I messages that can be used to support safety, mobility, and sustainability applications. The proposed compilation of a harmonized ITS data dictionary by the Assessment Tools Working Group will complement this activity.

The use of SPaT information for intersection collision avoidance as well as optimized traffic flow promises substantial safety, economic, and environmental benefits. The Working Group is also evaluating the degree to which international harmonization of these SPaT standards is technically and institutionally feasible and is likely to be sufficiently beneficial to justify the effort and expense. These two initiatives are each considerably larger in scope than the ITS standards harmonization activities completed to date. Applying the lessons learned in the harmonization of the core safety message set and the V2V and V2I DSRC communications protocols currently underway will accelerate this important work.

Assessment Tools Working Group

Mission Statement

The goal of the Assessment Tools Working Group is to establish a common level of analysis capabilities, common FOT methodology and design practices, and shared data formats and parameters for testing and evaluation of cooperative systems. The Working Group focuses on safety, sustainability, and mobility applications and coordinates these with the Safety and Sustainability Applications Working Groups in the following areas:

- **Assessment Tools:** Sharing assessment tools, knowledge, and capabilities and identifying joint gaps
- **FOT Methodology and Design:** Developing a common FOT methodology and design practices
- **Data Formats and Parameters:** Developing a process to structure data collected to enable sharing and facilitate further research and analysis.

Exchanging evaluation data and related information enlarges the datasets available to each region and improves the quality of the overall evaluation process and findings. Combining evaluation data from similar FOTs in the EU with similar data from U.S. tests capitalizes on each region's investment and expands our overall understanding of the benefits and impacts of cooperative systems.

Achievements

The Working Group exchanged, compared, and discussed detailed information on data collection and assessment in selected vehicle safety projects—the Safety Pilot, DRIVE C2X, TeleFOT, and EuroFOT, thereby learning from one another's experience. The group also shared methodology information from FOT-Net and FESTA.

Assessment Tools

The Working Group created a combined assessment tools inventory document, which serves as a reference for the ITS community regarding assessment of cooperative systems. Currently, the Working Group is adding a

more comprehensive introduction to the document, which is scheduled to be complete before the Vienna ITS World Congress.

FOT Methodology and Design

The Working Group compared methods used and identified common principles in specific projects from Europe and the United States. The Working Group concluded that the FOT methodologies used in the United States and Europe are sufficiently similar to provide a good basis for joint analysis.

Because the definition of an FOT differed between the two regions, the Working Group developed a common definition:

FOT: A real-world test activity over an extended period of time conducted in real traffic not using professional test drivers and using near-production systems. The intent is to obtain empirical data on impacts, user acceptance, and technical performance, as well as an understanding of unintended consequences.

Data Formats and Parameters

The goal of these activities is to enable data exchange in a structure and format that can support research by either Europe or the United States in an effective and efficient manner. Projects like Drive C2X and the Safety Pilot have been used as case studies.

The Working Group held extensive discussions about various approaches to data exchange across projects. The group exchanged and discussed documents from Europe and the United States and exchanged samples of datasets.

The Working Group arrived at an approach for Cross-Project Database Interrogation. This consists of first defining terminology and performance indicators (PIs) specific to an individual FOT database. For an FOT database, a query is made regarding specific PIs, and the group responsible for that FOT queries its database and provides the PI information to the other party. In this way, the FOT owners remain in charge of querying their own databases, so there is no need for an outside party to gain access to and expend effort to understand another project's database.

Open questions relate to how this process can still operate after a project has ended, as funding is needed to support the data exchange process.

Future Plans and Dates

Further work focuses on defining the Cross-Project Database Interrogation approach, including using this approach on specific databases. The main focus will be on data generated by ongoing projects, mainly the Safety Pilot Model Deployment and DRIVE C2X.

Driver Distraction and Human-Machine Interaction Working Group

Mission Statement

The Driver Distraction and HMI Working Group was created in response to the importance of driver distraction in the political discussion of road safety in both regions. The general goal of the Working Group is to identify opportunities for research collaboration, align research, and identify differences in the areas of driver distraction and HMI. Current members include representatives of the EC, USDOT, academia, telecommunications industry, and automotive industry.

Most existing and foreseen ITS applications are intended to interact with the driver. HMI design determines the usability of a system and its effectiveness in eliciting appropriate behavioral responses, its user acceptance, and ultimately the successful adoption of ITS applications. However, the HMI also can constrain the deployment of ITS in several ways. First, integration of a large number of external applications into a common interface to the driver, with a limited number of displays and input devices, imposes substantial technological and HMI challenges. Moreover, inappropriately designed HMI solutions may induce unacceptable levels of driver distraction and workload. Thus, HMI design is key to the successful deployment of ITS applications.

Voluntary automotive HMI design guidelines, intended to promote safe interaction with in-vehicle systems, exist in Europe and the United States, as well as in Japan. The most recent development in this area was the release of the draft *Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices* in February 2012. While sharing a common basis, these guidelines differ in important ways from other published HMI guidelines, especially in terms of their scope, performance criteria, and level of restriction.

Moreover, the field of driver distraction and HMI lacks consensus on definitions of key terms such as driver distraction and driver inattention, which has hampered progress in research and countermeasure development. For example, without a clear definition of driver distraction, it is difficult to estimate the actual societal significance of the problem.

Thus, the initial efforts of the Working Group aimed to establish a common definition of driver distraction as well as a more general taxonomy of driver inattention. Building on this conceptual base, the next step will be to

develop a common view of safe interaction with automotive ITS applications, particularly in light of the existing EU and U.S. HMI guidelines.

Achievements

As a first step in harmonizing key terms relating to driver inattention, a focus group on driver distraction was held in Berlin, Germany, on April 28, 2010. Working Group leaders organized the focus group, which included leading experts on driver distraction and inattention from research institutes, academia, the insurance industry, and the automotive industry.

The focus group had two main goals: (1) agree on a common definition of driver distraction and (2) identify the 10 most important research questions in the area. The report *Driver Distraction: Definition and Research Needs* documents the results (http://ec.europa.eu/information_society/activities/esafety/intlcoop/eu_us/index_en.htm).

The focus group agreed on the following general definition of driver distraction:

Driver distraction is the diversion of attention from activities critical for safe driving to a competing activity.

However, the focus group also identified several key issues for further consideration, including precisely defining “activities for safe driving” and “competing activity.” The focus group concluded that driver distraction only represents one of several types of phenomena related to driver inattention. Thus, in addition to a definition of driver distraction, a more general, common *taxonomy* of factors related to driver inattention is necessary. Such taxonomy is needed to establish common definitions and categories of driver inattention and distraction for accident/incident analysis, in particular for detailed video-based analysis of naturalistic driving data. The taxonomy should also be applicable in the analysis of normal driving and in the context of safety system design.

To address this need, the Driver Distraction and HMI Working Group launched a common project in 2011 to define a common, general taxonomy of inattention-related factors. The Working Group also agreed that such taxonomy must be based on a common conceptual framework. Experts from the focus group on driver distraction were reconvened to obtain the required expertise for the project. The project has progressed through a series of working meetings at Olympic Valley, CA; Gothenburg, Sweden; and Washington, DC. To achieve optimum impact for the results, the Working Group will submit the final project report for publication in a peer-reviewed scientific journal.

The Working Group members have presented proceedings and findings at various international conferences, most notably ITS Europe in Lyon in 2011; the Driver Distraction and Inattention Conference in Gothenburg in 2011; and ITS World Congress in Orlando, Florida, in 2011.

Future Plans and Dates

While the efforts of the Working Group have mainly focused on establishing the conceptual basis for driver distraction and inattention, the Working Group plans to shift its focus to safe HMI design of automotive ITS applications. Other topics identified by the focus group include cognitive load, especially in relation to non-visual means of interaction (e.g., voice-based HMI), and a common definition of performance metrics. The Working Group agreed to develop a common presentation on cognitive load (also involving the focus group experts) at the ITS World Congress session devoted to cognitive load. Thereafter, the Working Group will discuss whether to develop the cognitive load topic into a project (similar to the Inattention Taxonomy Project).

Glossary Working Group

Mission Statement

The objective of the Glossary Working Group is to establish and publish the common working definitions for key terms and concepts to facilitate mutual understanding in ongoing discussions within the EU-U.S. Task Force. Task Force members choose and vet the content. The Working Group includes one representative from each region and meets as needed to review the terms chosen for inclusion, develop definitions, and send the revised glossary to the Task Force for review and approval.

Achievements

The first version of the definitions of key terms used by the EU-U.S. Task Force was published in Europe and the United States in 2010. It is available from the ITS America and EC websites at the following addresses:

- <http://connectedvehicle.itsa.wikispaces.net/Glossary+of+Terms+for+EU-US+cooperation+in+ITS>
- http://ec.europa.eu/information_society/activities/esafety/eu_us/index_en.htm.

An updated version is awaiting final clearance before release. This updated version contains additional terms and has been split into two parts—general terms (61 terms) and technical terms (135 terms).

Future Plans and Dates

Following publication of the updated version, the Glossary will only be updated when new terms come into use within the EU-U.S. Task Force.

SUMMARY

Cooperative systems have the potential to deliver significant safety, mobility, and environmental benefits. Through a system of vehicles in constant communication with each other and roadside equipment, we have the ability to transform transportation as we know it and reduce its impact on our global society. The EU and U.S. are joining together to fully explore the promise of such a cooperative system. The partnership increases the value of each region's research by creating a joint framework for FOTs and evaluation tools, collaborating on cooperative system safety applications research projects, and working to internationally harmonize cooperative system standards.

Going forward, the EU and U.S. bilateral efforts will continue to focus on international standards harmonization as a key outcome of our collaborative work. As a global industry, it is critical to reduce barriers to multiregional standardization and achieve broad agreement on harmonization that can benefit both the traveling public and the ITS and motor vehicle industries. Harmonization facilitates interoperability between products and systems, which can benefit transportation management agencies, vehicle manufacturers, equipment vendors, and others. We will also build on our respective agreements with Japan to foster collaboration on international standards harmonization, probe data usage, and evaluation.

In addition, the Safety and Sustainability Applications Working Groups will identify critical technical issues, and the Driver Distraction and HMI Working Group will continue to gain knowledge in safe HMI design. We also anticipate that by sharing the results of each region's individual demonstrations (such as the U.S. Connected Vehicle Safety Pilot and the EU C2C-CC demonstration at the 2012 World Congress); we will maximize our overall knowledge and research. Ultimately, our goal is that our bilateral efforts will accelerate the deployment of cooperative vehicle systems worldwide.

NEXT STEPS

Going forward, the EU-U.S. Working Groups plan to complete the following steps toward their bilateral effort to foster the deployment of cooperative vehicle systems:

- **Safety Applications Working Group** -- Hold a meeting in early 2013 in the Detroit area, enabling C2C-CC members to tour the U.S. Connected Vehicle Safety Pilot Model Deployment and to continue face-to-face discussions for advancing work on the technical agenda items
- **Sustainability Applications Working Group** -- Choose a SPaT-related application for joint research, develop the application's concept of operations, and work with the Standards Harmonization Working Group to define an environmental message set for the application and develop a joint data set for the environmental SPaT application

- **Standards Harmonization Working Group** -- Harmonize a broader and richer set of V2V and V2I messages that can be used to support safety, mobility, and sustainability applications
- **Assessment Tools Working Group** -- Focus on defining the Cross-Project Database Interrogation approach, including using this approach on specific databases
- **Driver Distraction and HMI Working Group** -- Shift focus to safe HMI design of automotive ITS applications
- **Glossary Working Group** -- Update the current version of the glossary during 2013.

WORKING GROUP MEMBERSHIP¹

Safety Applications Working Group

U.S.: Mike Schagrin (USDOT/RITA), Ray Resendes (USDOT/NHTSA), John Harding (USDOT/NHTSA), Steve Sill (USDOT/RITA)

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EU: Martijn de Kievit (TNO; co-chair), Thomas Benz (PTV), Knut Evensen (Q-FREE), Paul Kompfner (ERTICO), Hans-Joachim Schade (TSE Consulting)

Standards Harmonization Working Group

U.S.: Steve Sill (USDOT/RITA) and supporting parties

EU: Wolfgang Höfs (EC), Richard Bossom, Richard Bossom ITS Consulting Ltd., Knut Evensen (Q-FREE), Søren Hess (Hess-consult; co-chair), Hans-Joachim Schade (TSE Consulting), Andreas Schalk (IPTE), Markus Strassberger (BMW) and supporting parties

Assessment Tools Working Group

U.S.: John Harding (USDOT/NHTSA), Emily Nodine (USDOT/RITA/Volpe)

EU: Thomas Benz (PTV; co-chair), Tristan Gaugel (KIT), Daniel Krajzewicz (DLR), Ilja Radosch (Fraunhofer FOKUS), Isabel Wilmink (TNO)

¹ The official membership of the working groups is limited to the EC and USDOT co-chairs and other governmental members of the EU-US Task Force. When necessary, the EC and USDOT seek out and obtain participation from appropriate parties via their own contractual and other processes to complete specific required tasks. Such participants include representatives from vehicle manufacturing and ITS infrastructure industries, the standardization community, and other subject matter experts as may be appropriate. Observation of Working Group meetings is generally permitted on a space-available basis, although in rare cases, some discussions may be limited to governmental participants.

Driver Distraction and Human-Machine Interaction Working Group

U.S.: Chris Monk (USDOT/NHTSA; co-chair), Eric Traube (USDOT/NHTSA), David Yang (USDOT/FHWA)

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Glossary Working Group

U.S.: Mike Schagrín (USDOT/RITA)

EU: Richard Bossom, Richard Bossom ITS Consulting Ltd.

GLOSSARY/ACRONYMS

AERIS	Applications for the Environment: Real-Time Information Systems – Part of the USDOT Cooperative Research Program
BSM	Basic Safety Message
C2C-CC	CAR 2 CAR Communication Consortium
C2X	“Car to anything” communications, i.e. it covers Car to Car (C2C) and Car to Infrastructure, Car to Central Systems, etc.
CAM	Cooperative Awareness Message – It has the role of a heartbeat of the communications network, regularly providing key information to/from the ITS stations.
CAMP	Crash Avoidance Metrics Partnership
Certification	The process of assuring that a system component or interface meets an established standard.
Concept of Operations	A user-oriented document that describes a system’s operational characteristics from the end user’s viewpoint. ²
CONNECT	Communication Networks, Content and Technology
Cooperative Systems	An EU term for systems that can bring new intelligence for vehicles, roadside systems, operators and individuals, by creating a universally understood communications “language” allowing vehicles and infrastructure to share information and cooperate in an unlimited range of new applications and services.
Decentralized Environmental Notification Message	Provides information about a location based situation detected by vehicles or roadside units and distributed by store and forward mechanisms within the ITS ad hoc domain without a central control unit.
DSRC	Dedicated Short-Range Communications – These provide low-latency data-only V2V and V2I communications for use in applications such as such as electronic fee collection, crash avoidance, and in-vehicle signing.

² The Institute of Electrical and Electronics Engineers, Inc (IEEE) Std 1362-1998 - IEEE Guide for Information Technology System Definition - Concept of Operations (ConOps) Document

The term “DSRC” originally was used to refer to tolling systems at 5.8 GHz. Now the term is also used to refer to DSRC operation at 5.9 GHz under the IEEE 802.11p standard.

EC	European Commission
EU	European Union
Forward Collision Warning	This application issues a warning to the vehicle driver in case of an impending rear-end collision with a vehicle ahead in traffic in the same lane and direction of travel. It will help drivers avoid or mitigate rear-end vehicle collisions in the forward path of travel.
FOT	Field Operational Test – A real world test activity over an extended period of time conducted in real traffic not using professional test drivers and using near production systems. The intent is to get empirical data on impacts, user acceptance, and technical performance, as well as an understanding of unintended consequences.
HMI	Human-Machine Interaction
HTG	Harmonization Task Group
Infrastructure Device	Any piece of equipment connected to the cooperative system that is placed on the roads, bridges, rail lines, and similar public works that are on or near a transportation system or other public institution.
Interoperability	The ability of a system to communicate with other systems to provide the same service in different physical locations. It is also the ability of one system (or component) to replace another without degrading the service being provided.
ITS	Intelligent Transportation Systems – Applying Information and Communication Technologies (ICT) to the transport sector in an effort to manage factors that typically are at odds with each other, such as vehicles, loads, and routes to improve safety and reduce vehicle wear, transportation times, and fuel consumption
Latency	Latency is strictly defined as the time from the start of packet transmission on the originating node to the start of packet reception at the end node and may include time spent in relaying via an access point or a base station. This definition is

independent of the communications link throughput and the packet size and is the absolute minimum delay possible. Latency can be dependent on a number of installation specific factors and these should be stated when they apply.

MLIT	Japanese Ministry of Land, Infrastructure, Transportation and Tourism
NHTSA	National Highway Traffic Safety Administration – A major agency of the USDOT with the mission to save lives, prevent injuries, and reduce economic costs due to road traffic crashes, through education, research, safety standards, and enforcement activity.
OEM	Original Equipment Manufacturer
PI	Performance Indicators
Privacy	The ability of an individual or group to seclude themselves or information about themselves and thereby reveal themselves selectively.
RITA	Research and Innovative Technology Administration
Roadside Equipment	<p>A piece of ITS-related hardware that is located at the side of the road to exchange data with vehicles in its locality and in some instances provide an interface through which travelers can access ITS-related services, e.g. public transport schedules.</p> <p>It may be one piece of equipment or several pieces of equipment are packaged into a single physical entity.</p>
SAE J2735	This SAE standard “Dedicated Short Range Communications (DSRC) Message Set Dictionary,” supports interoperability among DSRC applications through the use of standardized message sets, data frames, and data elements.
Safety	The state of being “safe,” the condition of being protected against physical, occupational, psychological, or other types or consequences of failure, damage, error, accidents, harm, or any other event that could be considered non-desirable.
SDO	Standards Development Organization
Security	It is the degree of protection against danger, loss, and criminals (i.e., resistance to harm).

SPaT	Signal Phase and Timing – Refers to a message that conveys real-time information (including current signal indications) from a specific traffic signal device. In the USDOT Cooperative Research Program, the message is sent from the roadway infrastructure to an approaching vehicle.
Stakeholders	Person or group affected by a transportation plan, program, or project. Stakeholders include any person or group with a direct interest (a “stake” as it were) in the USDOT Cooperative Research Program system.
USDOT	United States Department of Transportation
Use Case	A description of the behavior that a system will exhibit as it responds to a request that originates from outside that system. A use case is a particular scenario in which initial conditions are defined and a desired system response occurs to achieve an expected outcome.
V2I	Vehicle to Infrastructure – One- or two-way communication between vehicle-based devices and devices in the roadway infrastructure.
V2V	Vehicle to Vehicle – One- or two-way communication between vehicle-based devices.
Vehicle Safety Communications	Low-latency wireless communications between vehicles or between vehicles and infrastructure that support crash avoidance safety applications.
Violation	A violation is operationally defined under Cooperative Intersection Collision Avoidance System – Violations as crossing the stopping location at a stop sign before stopping or as passing the stopping location on a red light for a signalized intersection although legal definitions may vary by locality.

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