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**FOT-Net
Field Operational Tests Networking and Implementation**



Report of the first International Workshop

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1 PRESENTATIONS and DISCUSSIONS:

2 Session 1: Field Operational Test challenges

2.1 *Maxime Flament - ERTICO-ITS Europe*

Maxime Flament introduces FOT-NET which helped to organize this meeting. FOT-Net is a support action under contract of the European Commission (i.e. a fully funded activity) to network *Field Operational Test* activities at European, national and international levels.

Various activities are organized in the framework of this European Commission supported project. One action is to network FOT activities at International level. This workshop aims to bring international FOT stakeholders together to discuss common working items and possible cooperation.

This week, an International Collaboration Agreement has been endorsed between US DoT RITA and the European Commission DG INFSO. The agreement will unlock funding opportunities supporting, among other topics, international FOT cooperation. Concretely, European activities will be funded by DG INFSO and US activities funded by US DoT under a joint project. Also, other possibilities do exist such as additional funding for existing activities.

The objectives of this workshop are to:

- Identify the relevant international working items supporting FOT activities
- Identify possibility to create a common initiative between regions
- Getting to know each others interest for international cooperation

2.2 *Fabrizio Minarini- European Commission*

FOT-Net is a European Commission funded project intended to coordinate, network and exchange ideas about Field Operational Tests in Europe, the US and Japan.

The purpose of Field Operational Tests is to assess the impacts of ICT –based applications for transport. A significant number of these applications have been developed in recent years in Europe through collaborative research projects, but testing in EU has generally been carried out on a limited scale and in closed environments. The time is now mature to launch field operational tests, assessing the impact of these applications on a larger scale, in real world driving conditions and with real drivers. In Europe, FOTs have the objective to evaluate driver short and long term behavior, potential system design improvement and provide early publicity and awareness of ICT-based systems for transport to make better informed decisions.

Various steps have been taken to start collaborative FOTs at European level. FESTA was a short term action setting a base to the methodology to be adopted in European FOTs. Currently, two European funded FOT projects are running: euroFOT (on Active Safety Systems) and TeleFOT (on nomadic devices) and FOT-Net is consolidating the network by facilitating discussions among stakeholders on common issues. The EC has also planned to launch collaborative FOT projects on cooperative systems to start over the summer 2010.

Activities for international cooperation have been included on the work program 2009-2010:

1. An implementation agreement with the US, covering various activities on ICT applications for transport. The agreement was endorsed on Monday 17 November with USDOT (RITA). It will be signed at the beginning of January. This agreement forms a concrete basis for cooperation between RITA and DG INFSO. Funds will be allocated to EU and US partners accordingly.
2. Project to project cooperation will be funded as well through the usual international cooperation calls – which opened on 18 November.

International cooperation for FOTs is relevant for issues such as data exchange. FOTs are resource intensive projects, the scope of projects is often limited for this reason. Moreover, FOT organizers are facing similar problems, and have similar objectives. Bringing resources together and sharing knowledge could leverage the impact of FOTs on a global level.

2.3 Ray Resendes - US DoT

A large number of FOTs have been performed or are currently running in the US. The definition of FOTs in the US is similar to the European concept: FOTs are testing programs with real drivers, on real roads, aiming to assess the effectiveness of the systems on, for example, road safety or traffic efficiency.

The performance and benefits of several functionalities have been or are currently being tested such as Automatic Collision Warning Systems, Adaptive Cruise Control, Forward Collision Warning, Lane Departure Warning, Hazard Warning, Drowsy driver alert, etc... Examples of FOTs include ACAS, RCDW, 100 Car Naturalistic Driving Study, IVBSS and more.

FOTs are an important tool for regulators and for the private sector, in order to deploy marketable products. However, there are some barriers and limitations. Firstly, FOTs are expensive undertakings, especially in the current economic context. Secondly, practical implementation of FOTs is facing several problems, such as how to measure safety impact without crash events. The US DoT welcomes cooperation at international level to leverage global competitiveness, especially in current difficult economic context.

International cooperation topics could focus on the experimental design of FOTs. Learning from other regions' experiences can contribute to better results.

3 SESSION 2: Needs for international cooperation

3.1 Methodology

Moderators: Jim Sayer - UMTRI and Maxime Flament- ERTICO-ITS Europe

3.1.1 Proposed discussion items:

- How to make sure FOT results are comparable?
- Is there a need for a common methodology across the regions?
- Commonalities and differences of the methods across the regions – Should we agree on a common method?
- Are the research questions similar? Should we have a common set of research questions?
- Should we synchronise Performance indicators?
- What is the validity of FESTA across the regions? Who is using FESTA?

FOT are assessment programs for advanced vehicle technologies, testing functionalities as opposed to final market products. In the US, "safety-benefit" FOTs are carried out mostly on prototypes, whereas in Europe (mainly in the euroFOT project), the focus is on functionalities which are already on the market, or close to market introduction, because many legal issues arise from systems not on the

market yet. Also, the Europe FOTs have the ambition to study the long term behavior of the drivers which is not a main issue in the US with prototype studies.

The US FOT involving prototypes are mostly targeting the safety applications. It should be noted that the US DoT is also involved in other FOTs studying on-the-market solutions to assess for example benefits on traffic efficiency.

3.1.2 Data comparison

Setting up an international data sharing platform could raise certain issues related to IPR or to the different parameters used of FOTs eg. differences of population chosen, the existence of combined functionalities (eg. FCW and ACC), regional differences such as road infrastructures road use, different accident typologies, etc.

Data cannot be shared without the context. Any data shared should respect a given methodology and be documented with strict information on the way the FOT was prepared and conducted. If we do not do this we risk identifying differences without being able to identify the reasons and even worse we might accidentally find similar results based on different original assumptions.

Any comparison attempt will have to be carefully done otherwise this might discredit the FOT as a useful tool to make “informed decisions”.

3.1.3 Common methods

In the US, the methodology for FOTs is relatively different according to the type of FOT that you measure. As an example, an FOT studying impact of a system on safety or mobility might use a different methodology. The most successful tests in the US have been designed on very specific research questions to support policy and/or investment. Instead of a common methodology, it could be envisaged to formulate shared research questions.

As the research questions influence the type of data collected and the way you collect them, sharing data and post-processing data does not seem relevant. Therefore, forward thinking is also needed when defining research questions and type of data to be collected, as FOTs are expensive undertakings.

In Europe, the FOT methodology has been discussed in the FESTA project among a large research and industry community based on national and international experiences. This has created a framework that is being applied to most of the FOT being launched. The EU methodology starts from the principle that the functions tested could have a broad impact on safety, efficiency and environment and therefore the collected data should contribute to a wide range of research questions detailed in a series of hypotheses. During the preparation of the FOT, each hypothesis is carefully considered and performance indicators are proposed to answer the hypotheses with quantitative (or subjective) figures. Therefore, EU FOTs (following the FESTA methodology) are usually designed to answer a broad set of questions related to a function. This would in fact help any further socio-economic assessment of the system and lead to “Informed decisions” based on many factors.

Note: “Performance indicators” are defined in a practical way that can be measured and is comparable to “surrogate measures” used in the US FOTs.

It is agreed that methodologies should also encapsulate the decision criteria leading to deployment and what to do in case of negative outcomes/results meaning that it is considered to be very important to learn from systems that do not work.

3.1.4 Synchronisation of performance indicators

Performance indicators are high level measures upon which you evaluate your research questions, which follow a rigorous process. They strongly influence the data collection. Generally, PI are not well known and are not shared, this area of research would therefore benefit all regions.

Due to the high cost of large field tests, the US FOTs have gained a good experience in the definition of surrogate measures (similar to the European Performance indicators) to derive exposure to very unlikely events. As an example in the US, these surrogate measures have been used within the SHARP2 project, a FOT on naturalistic driving whereby a number of safety surrogate measure have been defined. A comparison of surrogate measures and performance indicators should be a good action point in order to improve the comparability of the results.

3.1.5 Conclusions:

International cooperation on methodology items could focus on the following points:

- Formulate shared research questions (according to the type of results expected)
- Exchange of surrogate measures (performance indicators) which are used in current FOTs
- Investigate a formal way for cooperation on research questions, surrogate measures (performance indicators), hypothesis etc. Concretely, a list of performance indicators is being prepared in euroFOT and TeleFOT, it could be envisaged to extend this list at international level. – at least UMTRI is involved as an external advisor in euroFOT.

3.2 Data handling and analysis

Trent Viktor (SAFER-Chalmers) and David Leblanc (UMTRI)

3.2.1 Proposed discussion items

- Relevance and willingness to establish a data exchange platform? How?
- What are relevant topics for joint analysis?
- How can analysis of FOTs be improved?
- What are the differences in data handling in different types of FOTs?
- How can joint analysis and data sharing be best supported? What factors influence ease of joint analysis and data sharing?

3.2.2 International data exchange platform

The exchange of data between researchers and scientist is an important item for cooperation. Sharing of knowledge and data is a scientific endeavour which can help to leverage the impact of FOTs in all regions.

However, the exchange between data of different FOTs can pose many practical problems, as each individual FOT uses its own data format and defines its ownership of data. If there is a willingness to cooperate, a public data exchange platform could be set up using shared resources, and standardised FOT data format would have to be defined. However there is no direct reason for doing this as data is often collected to answer specific research questions. At US level, this issue still needs to be addressed at national level as no formal cooperation exists.

As an example: the ACAS database exists and is accessible to the public with a large amount of data. However, experience shows that the data is not used by other institutions or industry, as the data mining and analysis is very complex. Even if the data is available, researchers need the specific analysis tools (and permissions to access the database) for mining the relevant data. Standardised formats would hence also require an open and standardised tool to analyse the data. It is not clear whether an open tool development is possible as the respective institutes who developed this kind of tools are not necessarily ready to share their hard work.

The definition of a Minimum Set of Data (MSD) could help the exchange of data and should be explored. Note: In Europe, discussions are currently in progress to host the data of European FOTs in a common large database at the European Commission Joint Research Centre (JRC).

3.2.3 Data sharing

The discussion showed that there is a misunderstanding on what data would be needed to share. Some vehicle manufacturers are reluctant to release raw data about system close to be launched, as they fear that the public release of the results could spoil the market. The closer a technology gets to market, the more reluctance there will be to share and/or release data.

It is agreed that this kind of data is not needed for the needs of the scientific community to assess safety, efficiency and environmental benefits. A filtered set of data or even better a pre-agreed set of data could be shared for other research purposes.

In Japan, previously and mainly for autonomous systems, the OEMs have carried out individual FOTs. For the first time, Japanese OEMs have worked on a common methodology for the ITS safety 2010 which will be launched in February. Results of Japanese FOTs will be published but sharing of data is very restricted.

The establishment of a bank of data is a complex issue and cooperation is important in the current context. Coordination efforts should be done to achieve common (meta-)data definition rather than a common platform. This would lead to more flexible solutions but at the same time guarantee that part of the data could be reused for other eventual research purposes.

3.2.4 Joint analysis

International cooperation of the analysis of FOTs would cause certain problems, as OEMs or suppliers might not all be willing to share their methods and/or insights with competitors.

Stakeholders wonder when FOT analysis reaches the level of convincing authorities, industry and consumers. The set-up of a global working group on analysis of data was suggested, focussing on the stakeholders' interests and needs (Authorities, industry, and users). A more ambitious idea necessitating strong involvement from the experts across the regions would be to develop guidelines for data sharing, and develop an open tool project for data analysis.

In Japan, an open and common database and joint analysis would be considered as too risky for OEMs, especially for FOTs on autonomous systems as this is very competitive. Maybe FOTs on cooperative systems will be the opportunity to share data at international level. Cooperation will focus on the outcomes of the analysis rather than on the analysis itself.

Note: The funding amount and the funding source of FOTs is an important factor that influences the analysis. The funding body of the FOT is, in principle, the customer, and the data analysis should be focussed on the FOT "customer" (governments, marketing, research...). However, using a common methodology as a base with a good level of transparency and documentation might resolve this issue.

3.2.5 Conclusions

International cooperation on data handling and analysis could focus on:

- Agreement on a minimum set of data to be collected in an FOT
- Define a structural (meta-)data format for FOTs. The FESTA manual could be the base for discussions
- Definition/guidelines for or even development of a set of open tools for data analysis
- Set-up of a global working group on analysis of data focussing on the stakeholders' interests and needs (Authorities, industry, and users).

3.3 Deployment issues

Moderator: Gerben Bootsma, Dutch Ministry of Transport

3.3.1 Proposed discussion items

- What are the tools to accelerate deployment after an FOT?
- What are the decision criteria leading to Policy or market driven deployment?
- Is there a need to compile a handbook with concrete deployment examples and eventually the best practices?

The analysis of FOTs is not only focussed on the assessment of the technology, but also on the assessment of the organisational aspect and the way stakeholders work together.

In the Netherlands, FOTs are proof of concept before making final decision for deployment. In principle, positive outcomes of FOTs should result in triggering tax cuts/ incentives and/or the marketing of the final products.

Similarly, in the US, FOT results are used for generating “informed decisions”. However, FOTs are not used as an advocacy or marketing tool.

To reach this goal of deployment, the methodology of FOTs should already include a deployment plan: What to do with positive results? Successful FOTs can also lead to negative results and do not always lead to deployment, but to system improvement and development. Cooperation on deployment issues could focus on the development of a set of strategic paths charting the deployment possibilities that can be done with FOTs results, based on concrete best practices or on very specific business case study with few example cases.

These “paths towards deployment” should become a kind of compilations of possible methods considering FOTs as one tool among many others to reach faster deployment. Among them:

- Demonstrations of technical and economical feasibility;
- Assessment of benefits using Socio-economic analyses, Macro- and Micro- Simulations, and of course, Field operational tests);
- Assessment Ranking programmes (Star programs such as Euro-US-NCAP, Euro-US-RAP, Energy or fuel consumption labels);
- Awareness campaigns (wide public or targeted group demonstrations and exhibition, documentaries, advertising, etc...);
- Incentive programmes (Insurances premium reduction, tax incentives, etc...);
- etc...

3.3.2 Conclusions

International cooperation for deployment issues could focus on

- Shared questions: are FOTs enough to trigger deployment? When did we reach enough evidence to trigger the decisions leading to deployment?
- FOTs are one tool among others to lead to deployment
- Working on a compilation of “Harvard” business case studies could illustrate how FOT should be part of a bigger deployment strategy and provide best practices.
- In addition it would be valuable to evaluate the effectiveness of FOTs as a tool for deployment

4 SESSION 3: Wrap up discussion and Conclusions

Generally, there is a need for cooperation on data handling and sharing, methodology and deployment issues. However, there are limitations for this cooperation due to inherent differences between regions.

Firstly, cooperation on methodology items could focus on the formulation of shared research questions including their surrogate measures and the definition of structural (meta-)data formats for exchange of data.

Secondly, the exchange of data as a scientific endeavour was largely approved. However, practical implementation of this data exchange poses many limitations. International cooperation could focus on the definition of a Minimum Set of Data and definition standard tools to analyse this data.

Thirdly, deployment issues vary from region to region and FOTs are used for different purposes, depending on the funding source. However, cooperation across regions could focus on comparing and exchanging specific and successful examples and business cases of FOTs and how they led to deployment.

To conclude, there is a need for discussions between people who have the practical experience of implementing FOTs to share experiences and solve common problems. The exact way how to finance this cooperation is still unclear. The organisation of some more concrete workshops at international level could be a way to cooperate on more specific well defines items. European stakeholders have initiated this process with the in the FOT-Net seminars. These seminars could be scaled at international level.

Annexes

Annex 1 – List of participants

Unfortunately, the list of participants circulated during the meeting has disappeared. Please let us know if this list is complete.

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