GIROADS
GNSS Introduction in the ROAD Sector

GNSS APPLICATIONS IN THE ROAD SECTOR

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Spanish Road Association

6/4/06 PORTUGUESE ROAD CONGRESS
ROAD APPLICATIONS DEVELOPMENT

● APPLICATIONS SURVEY.
  ● Identification of GNSS applications in the road domain.
  ● Analysis of cohesion criteria and application grouping.

● SERVICE ENABLER ANALYSIS.
  ● Technological enablers.
  ● Non-technological enablers.
  ● Feasibility analysis.
  ● Open issues and main risks.

● ACTION PLAN AND RECOMMENDATIONS.
  ● EU perspective.
  ● China perspective.
GNSS APPLICATIONS IN THE ROAD DOMAIN – IDENTIFICATION

- Research projects.
  - Gala, Galilei, Advantis,…

- Interviews with key stakeholders.
  - Highway operators, technology producers, disabled associations, specialized lawyers, urban transport Administrations,…

- Partners’ contribution.
- Internal discussion.
## GNSS Applications in the Road Domain – List

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
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<tbody>
<tr>
<td>Road charging</td>
<td>Accident reconstruction</td>
</tr>
<tr>
<td>On-street parking pricing</td>
<td>Traffic management</td>
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<tr>
<td>Legal speed &amp; environmental enforcement</td>
<td>Infrastructure management</td>
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<tr>
<td>Passenger transport management</td>
<td>Fleet management</td>
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<tr>
<td>Management and tracking of special vehicle classes</td>
<td>Emergency services</td>
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<tr>
<td>ADAS</td>
<td>Navigation and in-car information</td>
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<tr>
<td>Traffic information</td>
<td>Recovery after theft</td>
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<tr>
<td>Taxi service pricing</td>
<td>Road lighting management</td>
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<tr>
<td>Pay-per-use insurance pricing</td>
<td>Transport on demand</td>
</tr>
<tr>
<td>Tax collection</td>
<td>Car rental pricing</td>
</tr>
<tr>
<td>Livestock transport management</td>
<td>Transport and traffic monitoring for planning and research purposes</td>
</tr>
<tr>
<td>Information for vulnerable road users</td>
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</tbody>
</table>
Objective: to find a criteria to group applications with common characteristics.

Analysis of applications:
- Existing provision of service for application and sub-applications.
- Stakeholders.
- Legal, commercial and safety implications.
- Critical issues: technological, commercial, financial, institutional-political, social-cultural and legal.
- GNSS technological requirements; communication requirements.
APPLICATION GROUPS

- **AG Safety-of-Life.**
  - Any safety implication.

- **AG Liability-Critical.**
  - Any legal or commercial (pay per use) implication.

- **AG non-safety-of-life & non-liability-critical.**
  - Non safety, legal or commercial implication.
Safety-critical:

- ADAS.
- Emergency services.
- Information for disabled road users (blind).
AG LIABILITY-CRITICAL

- Road charging.
- On-street parking pricing.
- Taxi service pricing.
- Pay-per-use insurance pricing.
- Legal speed enforcement and environmental enforcement.
- Tax collection.
- Car rental pricing.
- Accident reconstruction and identification of responsibilities.
- Management and tracking of special vehicle classes.
- Livestock transport management.
- Recovery after theft.
AG:
AG NON-SAFETY-OF-LIFE & NON-LIABILITY-CRITICAL

- Navigation and in-car information.
- Traffic information:
  - Road lighting management.
  - Infrastructure management.
  - Transport and traffic monitoring for planning and research.
- Information for vulnerable road users (not disabled)
- Traffic management.
- Fleet management.
- Passenger transport management.
  - Transport on demand.
AG SAFETY-OF-LIFE.
Example: ADAS

- Collision warning systems, ISA, Lane Keeping, Automatic guidance,…
- Existing technology: GPS, radar sensors, ultrasonic sensors, camera,…
- Possible migration to GNSS due to safety implications (safety critical).

- Some opinions from interviews:
  “It will probably take a long time to develop some of this applications”
- Existing technology: man-made, DSRC, GPS, ...
- Migration to GNSS due to commercial implications (liability critical).
- Advanced charging strategies.
- Stringent technological, legal, financial, commercial, ... requirements.
- Legal framework partly available.
- Some opinions from interviews:
  “In some countries, charging based on DSRC has been recently installed, meaning a great investments which operators wants to recover”
AG NON-SoL & NON-LC.
Example: NAVIGATION AND IN-CAR INFORMATION

- Existing technology: GPS, GSM, RDST-TMC,...
- Possible migration to GNSS
  - Better performance for dynamic navigation.
  - As a result of “one OBU-multiple service”.

- Some opinions from interviews:
  “Navigation already works quite well, although in some countries is not dynamic”
  “Public-private partnership is not always possible”
**MAIN OPEN ISSUES/RISKS**

- Lack of certification for Galileo SoL Service.
- OBU capabilities to ensure position integrity.
- Lack of data error detection mechanisms.
- Standardization aspects.
- Possibility of loosing data due to OBU’s malfunction.
- Interoperability with existing systems.
- Variability in Administrations support.
- Lack of definition about financial support.
- Lack of coordination between stakeholders.
- Ensure data privacy.
- Acceptance of GNSS position as legal proof.
- Liability scheme under negotiation.
- EU legislation to ensure across border enforcement.
- OBU factory installation.
- Availability of reliable and cost-efficient communication links.
- ...

*GNSS APPLICATIONS IN THE ROAD SECTOR*
## ACTION PLAN – AG SoL

<table>
<thead>
<tr>
<th>Level</th>
<th>Actions</th>
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</thead>
<tbody>
<tr>
<td>Technological level</td>
<td>Ensure availability/ integrity/ accuracy.</td>
</tr>
<tr>
<td></td>
<td>Design efficient OBU</td>
</tr>
<tr>
<td></td>
<td>Implementation of data error detection mechanisms.</td>
</tr>
<tr>
<td></td>
<td>Improve availability of communication links.</td>
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<tr>
<td>Institutional – political level</td>
<td>Technical investigation for interoperability</td>
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<tr>
<td></td>
<td>Provide Administration support</td>
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<tr>
<td>Commercial level</td>
<td>Promote standardization activity and define legal framework</td>
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<tr>
<td></td>
<td>Coordinate stakeholders activity</td>
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<tr>
<td></td>
<td>Ensure compatibility with current systems</td>
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<tr>
<td>Legal level</td>
<td>Development of certification legal framework</td>
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<tr>
<td>Financial level</td>
<td>Set up a financial framework</td>
</tr>
<tr>
<td>Socio – cultural level</td>
<td>Ensure privacy guarantees</td>
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<td></td>
<td>Provide a satisfactory quality level</td>
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</table>
## ACTION PLAN – AG LC

<table>
<thead>
<tr>
<th>Level</th>
<th>Actions</th>
</tr>
</thead>
</table>
| **Technological level**      | - Definition of EGNOS/Galileo capabilities.  
- Promote and develop research to define technological enablers.  
- Design OBU in coherence with Directive 2004/52/EC  
- Consider insurance companies requirements. |
| **Institutional – political level** | - Technical investigation for interoperability  
- Provide Administration support. |
| **Commercial level**         | - Promote standardization activity and define legal framework  
- Coordinate stakeholders activity  
- Ensure compatibility with current systems  
- Develop market analysis activities  
- Establishment of contractual information system to prevent fraudulent use of OBU  
- Guarantee of standardization and multi-functionality for insurance pricing applications. |
| **Financial level**          | - Set up a financial framework |
| **Legal level**              | - Promote standardization activities.  
- Development of certification legal framework. |
| **Socio – cultural level**   | - Ensure privacy guarantees  
- Provide a satisfactory quality level |
## ACTION PLAN: EU PERSPECTIVE

<table>
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<tr>
<th>FIELD</th>
<th>ACTION PLAN</th>
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<tbody>
<tr>
<td>Technological</td>
<td>Definition of EGNOS / Galileo technical capabilities.</td>
</tr>
<tr>
<td></td>
<td>Consolidate Galileo products.</td>
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<tr>
<td></td>
<td>Consolidate regional integrity concept.</td>
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<tr>
<td></td>
<td>Establish a technical solution to get a satisfactory service availability and accuracy.</td>
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<tr>
<td></td>
<td>Ensure GNSS interoperability.</td>
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<tr>
<td></td>
<td>Promote and develop research to improve the availability of communication links.</td>
</tr>
<tr>
<td></td>
<td>Guarantee EGNOS qualification for liability-critical and safety-of-life services.</td>
</tr>
<tr>
<td>Institutional - political</td>
<td>Promote technical investigation to identify interoperability requirements.</td>
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<tr>
<td></td>
<td>Promote acceptance of GNSS technology.</td>
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<tr>
<td></td>
<td>Provide administration support for the development of gnss based services.</td>
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<tr>
<td>Commercial</td>
<td>Promote integration of GNSS technology in vehicles.</td>
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<tr>
<td></td>
<td>Coordinate stakeholders activities.</td>
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<td></td>
<td>Ensure compatibility with current systems.</td>
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<td></td>
<td>Standardisation and certification.</td>
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<td></td>
<td>Establishment of a European contractual information system to prevent fraudulent use of OBU.</td>
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<tr>
<td>Legal - regulatory</td>
<td>Development of legal framework that recognises data as evidence in courts of law and against fraudulent claims.</td>
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<td></td>
<td>Undertake regulatory actions required for specific applications.</td>
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<tr>
<td>Financial</td>
<td>Secure funding for Galileo and EGNOS.</td>
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<td></td>
<td>Set up a financial framework, considering public and private support</td>
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<td></td>
<td>Enable distribution of infrastructure costs.</td>
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<td></td>
<td>Promote the advantages of the single device / multiple services concept.</td>
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<tr>
<td>Socio - cultural</td>
<td>Consider users’ demands in the definition of services.</td>
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<tr>
<td></td>
<td>Ensure the provision of a satisfactory quality level for services.</td>
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</table>
Interviews with relevant stakeholders in Beijing.

Road and legal framework available.

Applications map in China.
  - Many services already provided.
  - Others almost nonexistent (insurance,...).

Feasibility analysis: some differences (banks, private property, external companies,...)

Recommendations:
  - Enhance cooperation Europe-China.
  - Support research, development and application.
  - Establish standards.
  - ...
CONCLUSIONS

- Improvement of existing applications; new applications, in many cases not possible with the existing technologies.

- Enablers are more stringent for AG SoL & AG LC.

- Similarities in recommendations and action plans.

- Consider users’ demands (users packages) for market analysis.

- Similarities in China (technology); differences in institutional and legal framework.
Thank You for Your Attention!

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