GC.SST.2011.7-2.
Specific safety issues of electric vehicles

Electric Vehicle Alert for Detection and Emergency Response (eVADER)

An EARPA Project Initiative for FP7
A significant growing in the EV sales is expected

The objectives of the eVADER projects are to improve the pedestrian safety without to increase of noise pollution for the next EV generation
• **Project Objectives**

- Investigate the Interior and Exterior Sound Scape of Electric vehicles for safe operation, considering Driver’s feedback, feasible pedestrian reactions, driver and pedestrian warning systems and Pedestrian Safety.

- To get a comprehensive knowledge of the sound criteria for interior and exterior noise of EV with special emphasis on driver’s feedback and pedestrian safety.

- To achieve a high level of pedestrian safety in terms of the additional risk associated to the low exterior noise of EV.

- Integration of IVSS data with warning signals for close-to accident pedestrian safety.

- The knowledge gained to be used for future applications on real traffic conditions.
• Project Innovations

• The eVADER consortium wants to provide all users (children, elderly, blind,…) a positive and concrete answer to highly reduce the safety risk that electrical and silent vehicles might cause for pedestrians

• Project developed thinking in user’s needs

• Project based on jury tests results and IVSS testing

• Search of optimal warning signal

• Optimisation of warning signal performance v.s. acoustic landscape

• Integration between IVSS, environment information and acoustic warning signal
• PARTNERS – Consortium as a whole

Current partners

- IDIADA
- LMS International
- AIT
- TNO  
  R&D Centers

- INSA-Lyon
- Technical University of Darmstadt  
  Universities

- RENAULT
- NISSAN NTCE
- PSA  
  OEM’s

- CONTINENTAL  
  Tier-1’s

- European Blind Union  
  End users
Project structure

RTD

Phase 0: Concept
- WP 1: Concept definition and System requirements

Phase 1: Enabling Technologies and methodologies
- WP 2: Psycho-acoustic principles
  - Warning signals
  - Characteristics
  - Threshold definition
  - Human reaction
- WP 3: Warning signal generators
  - State of the art
  - Spatial characteristics
  - Sound level characteristics
  - Spatial directivity and physical limitations
  - Advanced technologies for high directivity devices
  - Definition of technical specs
- WP 4: Algorithms and strategy definitions for in-vehicle intelligent system data and warning system integration in EV
  - Applicability to interior & exterior warning sound analysis in EV

Phase 2: System integration
- WP 5: Designing and construction of acoustic warning devices
  - Applications of in-vehicle intelligent systems with warning actuators (Hardware & Software)
  - Prototype building
  - Assessment of technical specifications
- WP 6: Vehicle implementation (EV)
  - Validation

WP 8: Demonstration
Some effects of eVADER

Figure 12: Contour plot of figure 11. Reduction of VRU accidents as a function of ($\%_{EV}$) and ($\%_{EV} + eVADER$) for $K = 2$

Noise level

Adaptive & Intelligent !!

Optional warning signal

Environmental Electric vehicle noise

Cardioids sound pattern

Lobed sound pattern
Thank you very much for your kind attention