Road to Vehicle Communications via DSRC: the AIDA system
AIDA / MARTA : a success story

• AIDA : a 4 years technological research project
  – partners : COFIROUTE, RENAULT, PSA, CSSI
  – support of Ministry of Industry
  – 100 km of network equipped, 30 vehicles
  – 2 awards winner : PREDIT “Innovation for NTIC” 2001
    IBTTA “Toll innovation and Excellence” 2001

• MARTA : a 3 years harmonisation project
  – 9 partners, 5 countries, support of European Commission
  – interoperability tests in Wales
  – Project Conference in Cardiff (25/10/01)
The characteristics of DSRC

• Two-way short range communication from vehicle to infrastructure (in Europe at 5.8 GHz)
• Communication standard dedicated to any road telematics application (CEN TC 278, ISO TC204)
• First application available:
  – Electronic Toll Collection (ETC)
• Future value added services:
  – Traffic and Travel Information, Emergency Warning, Incident and Traffic data collection, Intelligent Speed Adaptation, Electronic clearance, etc.
ADASE 2

Information, safety, data collection

AIDA antennas

- Road information
- Safety messages
- Traffic and weather data collection
- Incidents detection
AIDA: principles of data transmission

Data processing and transmission to the vehicles

Communication with the vehicles
The AIDA services

**AIDA** : an on-board system providing real time information dedicated to safe and comfortable highway driving

<table>
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<tr>
<th>Traffic conditions</th>
<th>Road information</th>
<th>Weather conditions</th>
<th>Personalised traffic information</th>
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<td>• sorties conseillées</td>
<td>• fog</td>
<td>• tourist information</td>
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<td>• distance to next exits</td>
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<td>• service and rest areas</td>
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<td>• traffic jams</td>
<td>• relief routes</td>
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**Interactive services**

• incidents signalling
Traffic data collection, incident detection

- **Travel times on motorway between 2 beacons**
  - anonymously = without identification of the driver
- **Statistic traffic data: origin / destination matrix**
- **Weather events: fog and hard rain**
  - automatically = switch of the wind screen wipers or fog lights
- **Slowing down ( --> traffic jams)**
  - measurement of a strong deceleration
- **Interactive service: incident detection**
  - accident, stopped vehicle, item on the road, bad weather
Improving safety: alert functions

- Automatic processing and transmission to the upstream beacons (in both directions) of the warning information collected by the vehicles
- On-board unit with screen:
  - spontaneous display of the safety messages on the screen + activation of the buzzer (or synthesised voice)
  - nature of the event and location
- ETC transponder:
  - activation of the buzzer and/or LED: immediate danger ahead
Display examples: safety services

Alert message corresponding to a traffic incident

Checking the list of incidents (here weather incident)
An “interactive” safety service

The interactive service...

... gives the possibility to inform the Traffic Information Centre of an incident that was seen on the motorway
Display examples: comfort services

Distances to the exits, travel times, traffic conditions

Information on rest and service areas
Cofiroute test site: 100 km / A10

Existing beacons
Phase 1 = 18
Phase 2 = 27
Types of evaluation

• Man-Machine Interface and driver behaviour aspects carried out by INRETS in 1998
  – legibility of text and icons displayed,
  – no interference with the driving task

• Assessment of some AIDA functions by simulation
  – traffic simulation + individual driver behaviour + AIDA model

• Field trials in real traffic conditions
  – qualitative evaluation through questionnaires and enquiries
  – quantitative evaluation through data records in the TIC and in the on-board units (smart card)
Field Trials

- **Duration**: from May to July 2001
- **Location**: a section of 100 km (A10 motorway of COFIROUTE network between Paris and Orléans)
- **30 vehicles fitted with AIDA devices**
- **Several thousands of vehicles equipped with ETC tags**
First results of qualitative evaluation

- Safety services are considered the most important
- The driver becomes an actor in the improvement of road safety through incident signalling (as a witness)
- Accurate and local information received
- Complementary media with motorway advisory radio (107.7 MHz)
- Liability of the system to be improved
- Integration of On-board unit in the vehicle expected
Transmission of events

Breakdown of the events transmitted by the AIDA vehicles

- Slow down (vehicle sensor) 11%
- Fog (vehicle sensor) 6%
- Hard rain (vehicle sensor) 6%
- Bad weather (interactive) 4%
- Item on road (interactive) 6%
- Accident (interactive) 7%
- Stopped vehicle (interactive) 55%
Traffic simulations (1)

Case 1: Average speed against time; 1 km before incident (flow of 1275 veh/h)
Traffic simulations (2)

Case 2: Average speed against time; 300 m before incident (flow of 1275 veh/h)
Lessons learned from evaluations

• Accuracy of probe-measured travel times within motorway traffic management and control
• Impact of AIDA equipment rate on average speed of the whole traffic (avoid pile-up accidents)
• Potential reduction of detection time to improve the incident management chain
The MARTA project

- Co-ordination between the test sites (AIDA, RTA), from a point of view of functional specifications and test methods
- Definition of common applications on the test sites in the framework of traffic and travel information and specification of guidelines of common use
- Development of a European draft standard in the framework of the CEN TC278 - WG 4, WG9
- Demonstration of interoperability between the AIDA and RTA systems
- Ensure that the existing standards are taken into account and contribution to standardisation work within the TC278 WG4.2
The DELTA project

- Integration of the DSRC tag in the vehicles, at the factory
- A European project of the FP5 (DG INFSO)
- An answer to the non compatibility between the ETC systems and the metallised windshields (attenuation of 7 dB)
- Development of a standardised interface between the DSRC tag and the other vehicle equipment
- Determination of the optimum location of the tag antenna in the vehicle
DELTA = integration in the vehicle

Objective: Integration of the DSRC as standard equipment in the vehicle
The TRAVIATA project

- An attempt to perform a vehicle to vehicle communication using the same DSRC systems
  - emergency warnings between vehicles
- Results did not meet the expected level
  - good communication at 20 m
  - probability of good communication at 50 m if messages repeated 100 times
  - communication not possible at more than 100 m
- Vehicle equipment will remain too expensive for large market introduction
**Inter-Vehicle Hazard Warning (IVHW)**

- Transmission of alerts between vehicles
- Communication: up to 1 km
- System activated manually or automatically in case of airbag release
- Alerts can be transmitted to/from the road operator, thanks to IVHW systems installed in the emergency call boxes