The ADASE project

- A European research project, for the promotion of introduction and deployment of active safety systems
- 10 partners: car manufacturers, equipment suppliers, road operators, public authorities
- Coordinator: DaimlerChrysler
- Duration: 3 years (August 2001 – July 2004)
- Funding: EC DG-Infso: 1,2 Mio € / IST FP5
The ADASE framework

White paper Transport Europe 2010

42 000 fatalities and 1.6 million injured / year is too high!
   – reduction of fatalities by 50 %
   in the next 10 years.

Action Plan

The passive safety systems will have only a marginal additional impact.

Objective: active safety systems made of on board equipment communicating and interacting with the infrastructure.
A global safety approach

Vehicle safety standards are already very high!

- A significant increase in safety will be achieved by the consideration of all involved system components:
  - Driver – Vehicle - Infrastructure
ADASE objectives

- Identification of main technological requirements / gaps
- Preparation of architectures, road maps, functions and interfaces standardization
- Communication system specification, harmonization of active safety functions

ADASE partners: DaimlerChrysler (leader), BMW, CETE Med, CLEPA, Cofiroute, Fiat CRF, Jaguar, PSA, Renault, RWS
Integrated safety

Level of critical safety situations

Active Safety

Crash Probability

Passive Safety

1. Normal Driving
2. Warning Systems
3. Assistance Systems
4. Crash Probability
5. Safety Systems soft level
6. Safety Systems hard level
7. Safety Systems after Crash

Collision Avoidance

Pre-Crash Phase

Basic Vehicle Safety

ACC
S&G etc
Lane departure warning
Brake assistant
Emergency braking system, Collision avoidance
Pedestrian airbag

Occupant Protection

crash severity sensing for ignition levels and belt tension
Emergency/ Mayday Systems
The ADASE Road Map

- Night Vision
- Lane Departure Warning
- Curve Speed & Speed Limit Info
- Near field Collision Warning
- Extended ACC
- Stop & Go
- Lane Keeping Assistant
- Roll Stability Control in Trucks
- Obstacle & Collision Warning
- Rural Drive Assistant
- Urban Drive Assistant
- Platooning
- Obstacle & CA

Complexity

Contribution

Safety Enhancement
Political and Societal Aspects
Legal Aspects
Degree of Driversupport
Infrastructure
Sensor Aspects
System Aspects

VSC - 03.09.03
ADASE - Advanced Driver Assistance Systems in Europe
Expert workshops and concertation meetings

- Architecture and technology roadmap (Paris – March 2002)
- Legal aspects and Human machine interface - HMI (Brussels – October 2002)
- Vehicle to vehicle and vehicle to infrastructure communications, systems and applications (Paris - February 2003)
- Sensor technologies -> Brussels - December 2003
- Effects on safety, throughput and comfort -> The Netherlands - April 2004

- Annual concertation meetings -> Brussels - Dec. 2003
  - presentation of the work progress and results of Technological R&D projects
  - discussions et exchange of information between projects and ADASE
The ADASE thematic network

Vehicle-Vehicle
Vehicle-Infrastructure Communication

ADASE Functions
(ACC, S&G, Emergency braking etc)

SAVE-U

Basic Vehicle Functions
(longitudinal-, lateral control )

VEESA

Engine Mgmt
ESP
ASC

Vehicle Sensors

E-Throttle
E-Brake
E-Steering
E-Gear Box
ABS

Vehicle Actuators

Infra sensors
Travel management center
Road Provider
Emergency services
Vehicle cluster Management

Smart Road

Smart Vehicle

Environment Sensors incl. map

Emergency services

Vehicle cluster

Road Provider

Travel management center

Vehicle-Vehicle

Vehicle-Infrastructure Communication

ADASE - Advanced Driver Assistance Systems in Europe

VSC - 03.09.03
Need for a ADASE global open architecture

Board autonomous function

- E/E architectures
- Dedicated Bus systems
- Sensing systems

+ vehicle-vehicle communication

- Communication system
- Frequency
- Protocols

+ vehicle-infrastructure communication

- Communication system
- Frequency
- Protocols
- Services
- Responsibility/Liability
- Costs sharing
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 UK (Wales) : AIDA / RTA
  – Project Conference and demo 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 widely implemented:
  - 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.
Information, safety, data collection

• Road information
• Safety messages
• Traffic and weather data collection
• Incidents detection

AIDA antennas
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

**Traffic conditions**
- accidents
- perturbances
- road works
- traffic jams

**Road information**
- sorties conseillées
- distance to next exits
- estimated time of arrival
- relief routes

**Weather conditions**
- fog
- low temperature
- heavy rain

**Personalised traffic information**
- tourist information
- petrol stations with brand and price
- service and rest areas

**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, obstacle 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, time to destination, 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): 4%
- Bad weather (interactive): 6%
- Item on road (interactive): 11%
- 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 project supported by the European Commission
• 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
IVHW

Inter-Vehicle Hazard Warning

- 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