SAFESPOT Integrated Project
Co-operative Systems for Road Safety “Smart Vehicles on Smart Roads”

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PRESENTATION OUTLINE

1. SAFESPOT Integrated Project introduction
2. SAFESPOT specific objectives
3. From autonomous vehicles to cooperative systems
4. Communication scenario and technologies
5. SAFESPOT applications based on V2V and V2I communications
6. Application scenarios: static and dynamic black spots
7. Main technological challenges
8. Improved competitiveness for all stakeholders
9. Breakthrough in road safety

SAFESPOT Integrated project introduction

Project type: Integrated Project (IP) 4th IST call of the 6th European Framework Program

Consortium : 51 partners (from 12 European countries)
OEM (trucks, cars, motorcycles)
ROAD OPERATORS
SUPPLIERS
RESEARCH INSTITUTES
UNIVERSITIES

Promoted by: EUCAR

Timeframe: 1/2006 – 12/2009

Overall Cost Budget : 38 M€ (European Commission funding 20.5M€)

IP coordinator : Roberto Brignolo
C.R.F. (FIAT RESEARCH CENTER – Italy)

The SAFESPOT Integrated Project aims to understand how intelligent vehicles and intelligent roads can cooperate to produce a **breakthrough for road safety**.

The aim is to **prevent road accidents** developing a **"Safety Margin Assistant"** that :

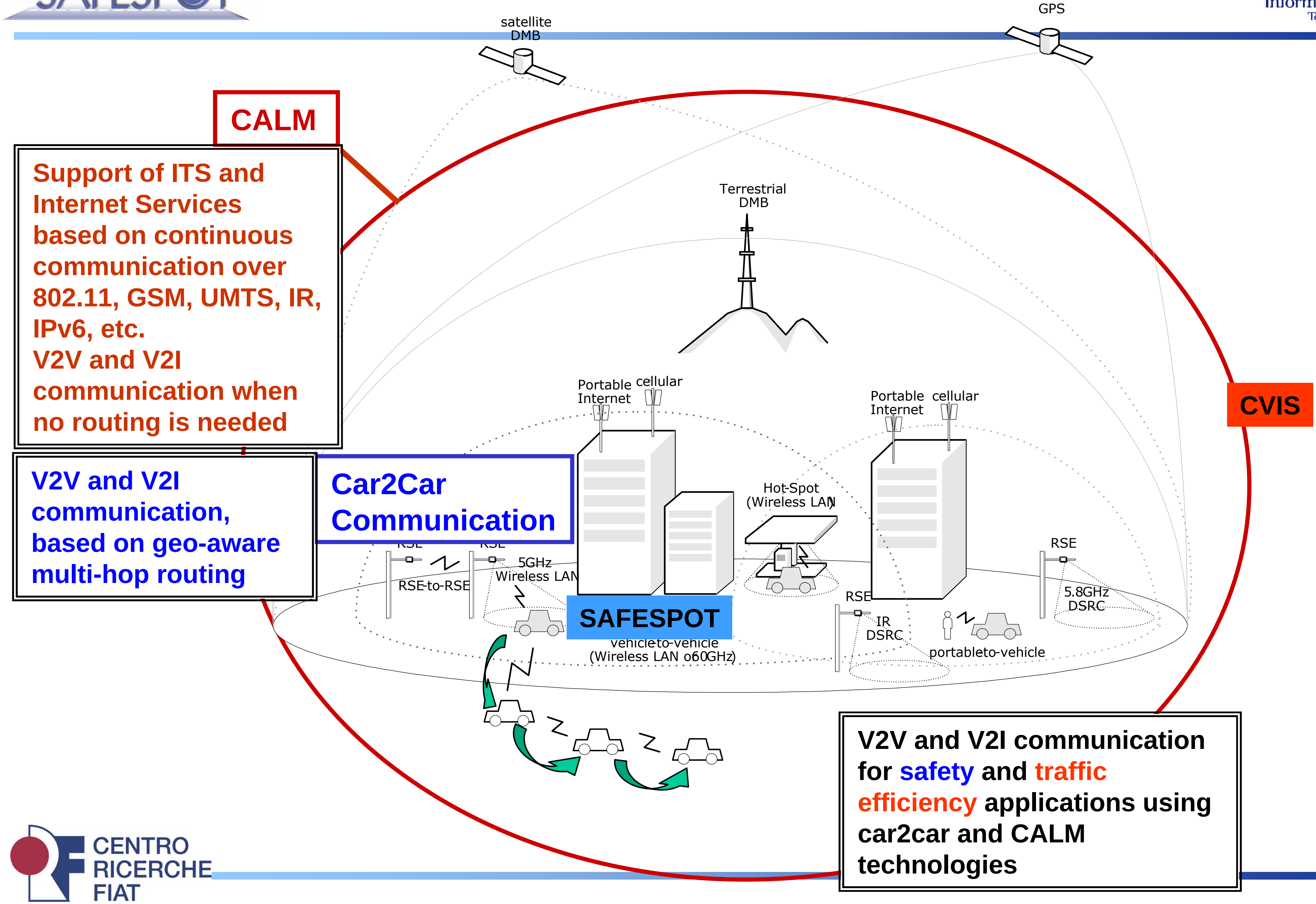
- detects in advance potentially dangerous situations,
- extends "in space and time" drivers' awareness of the surrounding environment,

The Safety Margin Assistant will be an **Intelligent Cooperative System** based on **Vehicle to Vehicle (V2V)** and **Vehicle to Infrastructure (V2I)** communication

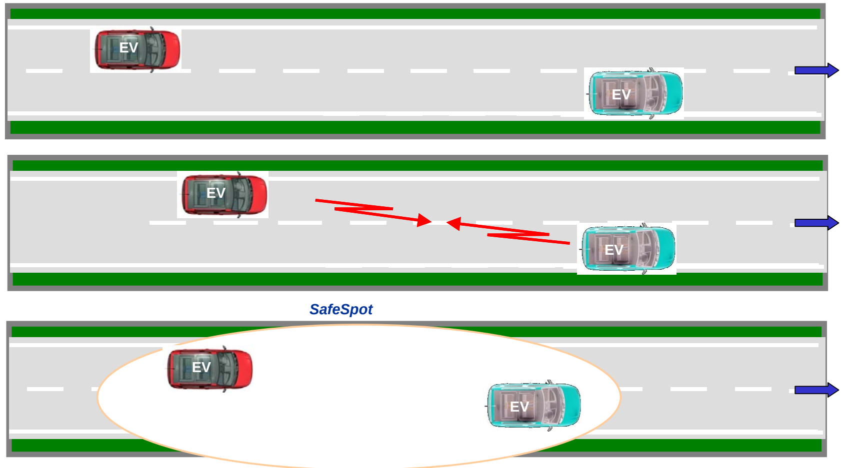
SAFESPOT specific objectives

- To **use both the infrastructure and the vehicles as sources (and destinations) of safety-related information** and develop an open, flexible and modular architecture and communication platform.
- To develop the **key enabling technologies**:
ad-hoc dynamic networking, **accurate relative localisation**, **dynamic local traffic maps.**
- To develop a new generation of infrastructure-based sensing techniques.
- To develop and test scenario-based applications to evaluate the impacts and the end-user acceptance.
- To define the practical implementation of such systems, especially in the initial period when not all vehicles will be equipped.
- To evaluate the liability aspects, regulations and standardisation issues which can affect the implementation: the involvement of public authorities from the early stages will be a key factor for future deployment.

SAFESPOT Integrated Project



SAFESPOT applications will allow the extension of the "Safety Margin" that is the time in which a potential accident is detected before it may occur (e.g. in static and dynamic black spots, in safety critical manoeuvres)



The **"dynamic vehicle net"** and the **"vehicle to infrastructure net"** extend the operative range of the actual on-board vehicle systems and allow the driver to receive the information on possible acceptable manoeuvre or to continue to maintain the same behaviour avoiding the critical situations.

SAFESPOT APPLICATIONS based on V2V and V2I communications

The objectives are:

- to improve the range, quality and reliability of the safety-related information available to 'intelligent vehicles' by providing **'extended co-operative awareness'** through the real time reconstruction of the driving context and environment.
- to support drivers preventively to the proper manoeuvres in the different contexts;
- to optimise the intervention of vehicle controls with respect to critical situations.
- to manage existing incidents to minimise further negative safety impact.
- to open the development of new safety applications based on the cooperative approach;
- to increase the safety for all road users (including pedestrians and cyclists)

From the network architecture standpoint, roadside components take part to the vehicle-vehicle-infrastructure communication network as "standing" nodes. This means not only to use the same communication platform, but also to be visible and recognisable by any V2V equipped vehicle.

APPLICATION SCENARIOS: STATIC and DYNAMIC BLACK SPOTS

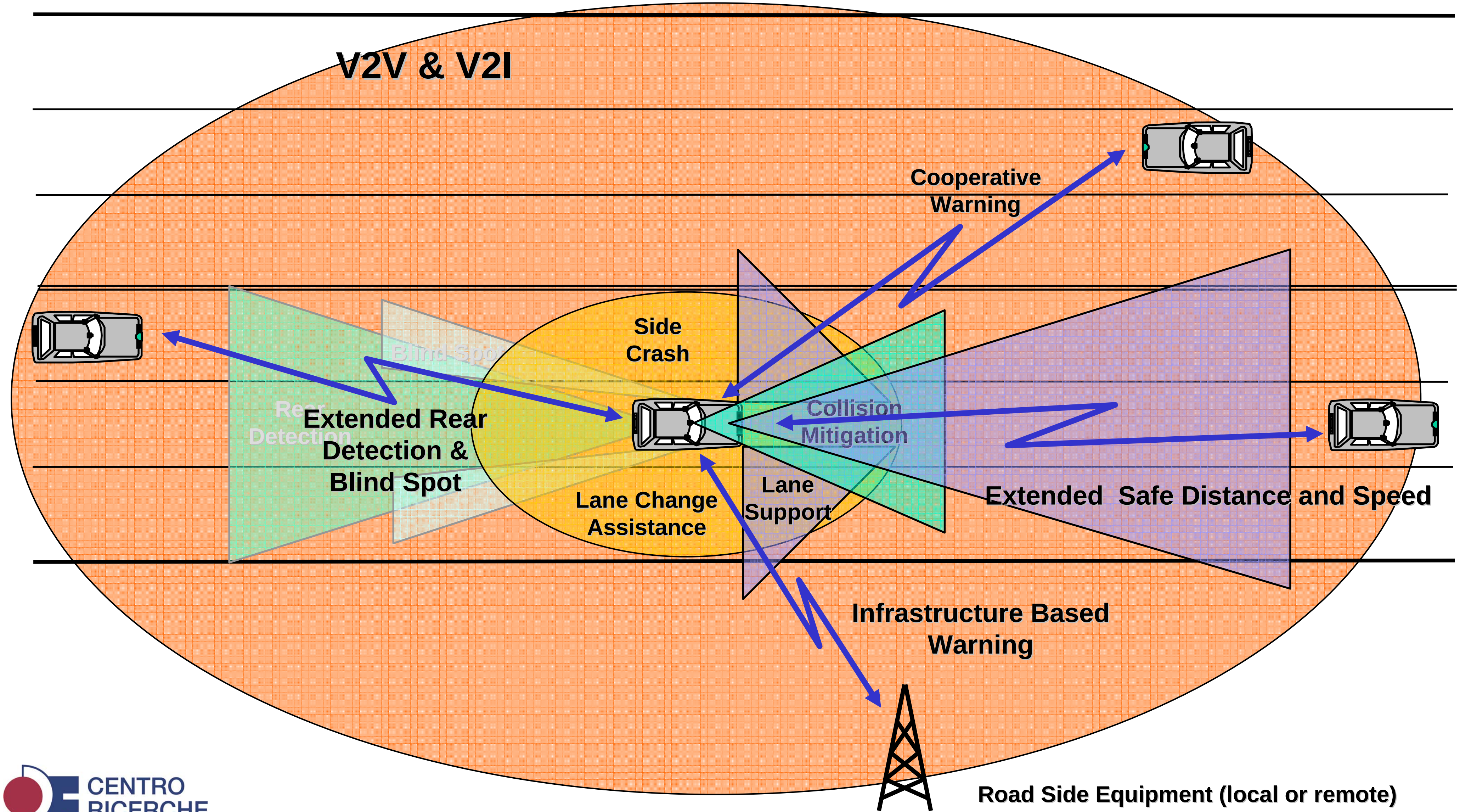
STATIC BLACK SPOTS or "static risky conditions" road scenarios intrinsically dangerous, whose dangerousness is evident in accidents statistics (e.g. narrow curves, tunnels, bridges).
Static black spots are the first addressed implementation areas for the infrastructure sensing for road safety.
These scenarios are typically addressed by V2I applications, the information will be also propagated via V2V multi-hop communication to extend the safety margin to all incoming vehicles.

DYNAMIC BLACK SPOTS or "dynamic risky conditions"driving scenarios that become unexpectedly and suddenly dangerous for adverse environmental conditions or for very critical traffic situations. (e.g. fog, ice conditions, a queue behind a curve, a vehicle that suddenly harshly brakes, presence of vehicles in blind spots, etc.)
These scenarios are both addressed by V2V and by V2I based applications.

The scenarios that are presenting **"quasi static risky conditions"** for most of the time (e.g ice on the road in Northern countries) will be treated mostly via V2I but also via V2V for the information propagation.

Information are provided to the drivers in a medium time-to-collision in case risky situations occur (from 1 to 10s before a potential critical event).

COOPERATIVE SITUATION AWARENESS AND EXTENDED COLLISION WARNING



APPLICATION SCENARIOS: some examples

The objective is to keep all vehicles in the "safety margin" that is to inform drivers about a potential risk sufficiently in advance to avoid emergency manoeuvres.

Safe lane change manoeuvres
Vehicles in the blind spots and vehicles that are intending to change lanes are detected in advance to promptly inform all drivers of relevant vehicles.

Road departure prevention
Information on recommended speed is sent from the infrastructure to the vehicles according to road geometry, surface status and traffic conditions.
Vehicles equipped with sensors measuring road friction communicate to the other vehicles the presence of slippery roads.

Cooperative manoeuvring (e.g. highway merging)

Vehicles calculate in real time their relative position and trajectories, when a risky situation and a potential collision is detected, drivers of relevant vehicles are promptly warned.

APPLICATION SCENARIOS: some examples

Cooperative tunnel safety

The infrastructure informs the vehicles about recommended speed and safety distance. The Safety Margin is calculated on the basis of the state and typology of the vehicle.

Hazard and incident warning

Transmission of warning messages to vehicles arriving on an area where an accident just occurred. The message can be issued from the infrastructure or from other vehicles and includes: type of hazard, current location and previous positions, speed, direction.

Safe urban / extra urban intersections

This application requires a very precise computation of the vehicles trajectories and local digital maps of the intersections. The infrastructure delivers information to the vehicles to recognize dangerous situations in time.

MAIN TECHNOLOGICAL CHALLENGES

(1) **Reliable, fast, secure,** potentially low cost protocols for local V2V and V2I **communication**

- Candidate radio technology: IEEE 802.11p
- Need for dedicated frequency band for secure V2V and V2I, avoiding interference with existing consumer links
- Aligned to C2C-C and CALM standardisation groups

(2) A reliable, very accurate (sub-meter), real-time **relative positioning**

(3) A real time updateable **Local Dynamic Map**

IMPROVED COMPETITIVENESS for all stakeholders

The cooperative approach will enable the optimal solution, in terms of cost/benefits ratio, for all involved players

Car makers will open new market opportunities offering on the market new functions for safer vehicles at sustainable costs as the "intelligence" will be distributed. The level of complexity of vehicles will be sensibly decreased, compared to autonomous solutions.

Suppliers will meet the challenge of new market opportunities: they want to be prepared to offer fully developed technical solutions and intend to actively drive the evolution in terms of concept generation, technical evaluation, standardisation, public work.

Road operators and public authorities will improve road safety on motorways and urban roads via a combination of infrastructure and vehicle systems, that will collect and transmit in real time traffic/weather and accident information to all road users and to traffic information centres.

BREAKTHROUGH in ROAD SAFETY

The cooperative approach will enable the possibility to face most of the road accident typologies also including those that are not yet covered by current systems.

YEARS	N	FATALITIES	INJURED
2000	229.034	6.649	321736
2001	235.409	6.691	335.029
2002	239.354	6.739	341660
2003	231740	6.065	327.324

Road accidents and fatalities in Italy in the recent years. [Source ISTAT]

Statistics in the EU-25 are comparable (and even worse in the new member states).
The trend through the years is positive, however numbers are still unacceptably high.

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