SAFESPOT Integrated Project

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

Roberto Brignolo

Centro Ricerche Fiat

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)

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

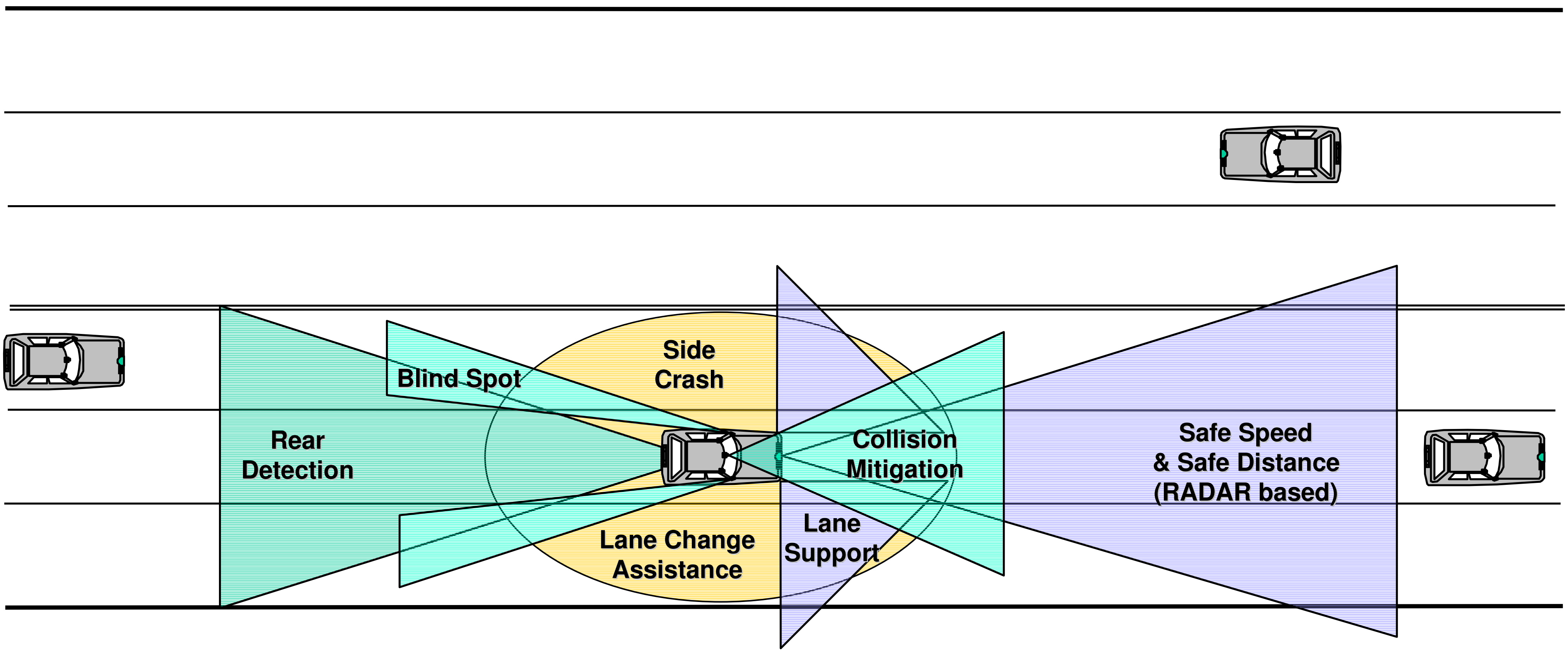
(*) Contract not yet signed

Participant #	Company	Short Name	Nationality
1	Centro Ricerche Fiat ScpA	CRF	IT
2	DaimlerChrysler AG	DC	DE
3	Renault FRANCE, REGIENOV	REGIENOV	FR
4	Volvo Technology Corporation	VOLVO	SE
5	Robert BOSCH GmbH	BOSCH	DE
6	SIEMENS AG	SIE	DE
7	ANAS SpA	ANAS	IT
8	Compagnie Financière et Industrielle des Autoroutes	COFIROUTE	FR
9	NETHERLANDS ORGANISATION for APPLIED SCIENTIFIC RESEARCH	TNO	NL
10	MIZAR Automazione S.p.A.	MIZAR	IT
11	Piaggio & C. SPA	PIAGGIO	IT
12	Continental Teves AG & Co oHG	CAS	DE
13	IBEO Automobile Sensor GmbH	IBEO	DE
14	Kapsch TrafficCom AB	KAPSCH	SE
15	LACROIX TRAFIC	LAC	FR
16	NAVTEQ Europe B.V.	NAVTEQ	NL
17	Planung Transport Verkehr AG	PTV AG	DE
18	Q-Free ASA	QFREE	NW
19	Siemens VDO Automotive AG	SVDO	DE
20	Tele Atlas NV	TA	NL
21	VTT TECHNICAL RESEARCH CENTRE OF FINLAND	VTT	SF
22	Autostrada Brescia Verona Vicenza Padova S.p.A.	BSPD	IT
23	CG Côtes d'Armor	CG22	FR
24	Swedish Road Administration	SRA	SE
25	CIDAUT: Fundación para la Investigación y Desarrollo en Automoción	CIDAUT	ES

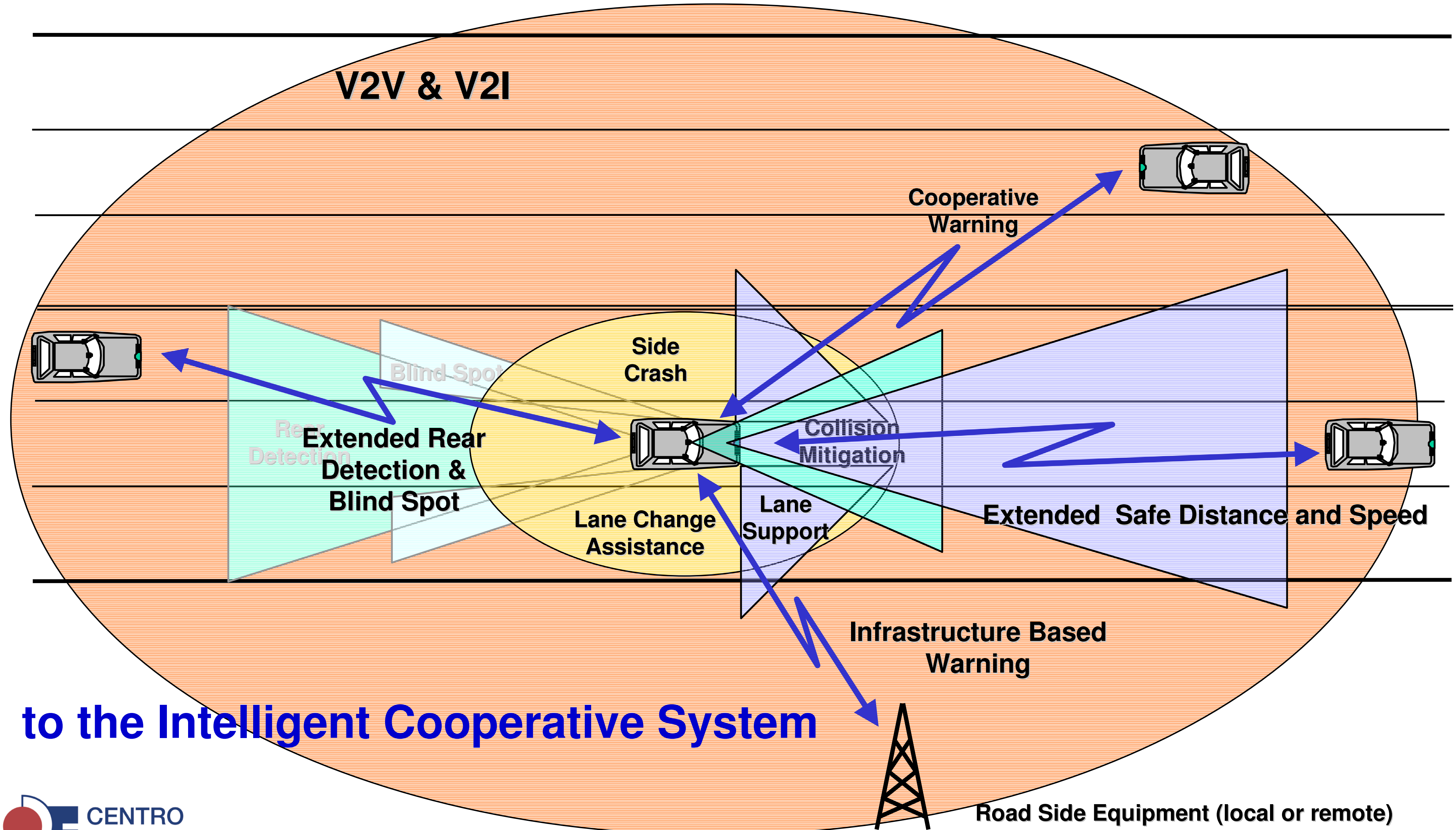
Participant #	Company	Short Name	Nationality
26	CENTRO STUDI SUI SISTEMI DI TRASPORTO	CSST	IT
27	Dipartimento di Ingegneria Biofisica ed Elettronica - Università degli Studi di Genova	DIBE	IT
28	CENTRE FOR RESEARCH AND TECHNOLOGY - HELLAS	CERTH	EL
29	Institute of Communication and Computer Systems	ICCS	EL
30	Laboratoire Central des Ponts et Chaussées	LCPC	FR
31	Istituto Superiore Mario Boella	ISMB	IT
32	MIRA Limited	MIRA	UK
33	Société pour le Développement de l'Innovation dans les Transports	SODIT	FR
34	Rijkswaterstaat	RWS	NL
35	Technische Universität Chemnitz	TUC	DE
36	Technische Universitaet Muenchen	TUM	DE
37	University of Stuttgart	USTUTT	DE
38	German aerospace center	DLR	DE
39	European Road Transport Telematics Implementation coordination Organization Scrl	ERTICO	BE
40	Center for Research And Telecommunication Experimentation for NETworked Communities	CREATE-NET	IT
41	Politechnika Warszawska	IRE PW	PL
42	Budapest University of Technology and Economics	BME	HU
43	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	CNRS	FR
44	Bundesanstalt fuer Strassenwesen	BASt	DE
45	THOMAS MILLER & CO. LTD	MILLER	UK
46	Provincie Noord-Brabant	PNB	NL
47	RENAULT SPAIN	RNS	ES
48	Universidad Politécnica de Madrid	UPM	ES
49	Telefónica Investigación y Desarrollo Sociedad Anónima Unipersonal	TEL	ES
50	CETECOM	CETECOM	ES
51	Magneti Marelli Electronic Systems	MMSE	IT

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 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.



from the Autonomous Intelligent Vehicle



to the Intelligent Cooperative System

COORDINATION LAYERS

HORIZONTAL ACTIVITIES

SAFESPOT CORE ARCHITECTURE (Link with CVIS)

BUSINESS MODELS, LEGAL ASPECT & DEPLOYMENT

TECHNOLOGIES ORIENTED SUB-PROJECTS

Information Sources

- IN VEHICLE SENSING & PLATFORM
- INFRASTRUCTURE SENSING & PLATFORM

Innovative Technologies

- ACCURATE COOPERATIVE LOCALISATION
- DYNAMIC LOCAL MAPS
- AD HOC COMMUNICATION NETWORKING

Test beds

- Vehicle Platform
- Infrastructure Platform

APPLICATIONS ORIENTED SUB-PROJECTS

Applications/ Scenarios

- COOPERATIVE SYSTEMS APPL. VEHICLE BASED
- Freeflow
- Tunnels, bridges
- Black Spot
- COOPERATIVE SAFETY SYSTEMS INFRASTRUCTURE BASED

Test sites

- ITALY
- GERMANY
- FRANCE
- SWEDEN
- NETHERLANDS

Validation/ Evaluation

- COOPERATIVE SYSTEMS APPL. VEHICLE BASED
- COOPERATIVE SAFETY SYSTEMS INFRASTRUCTURE BASED

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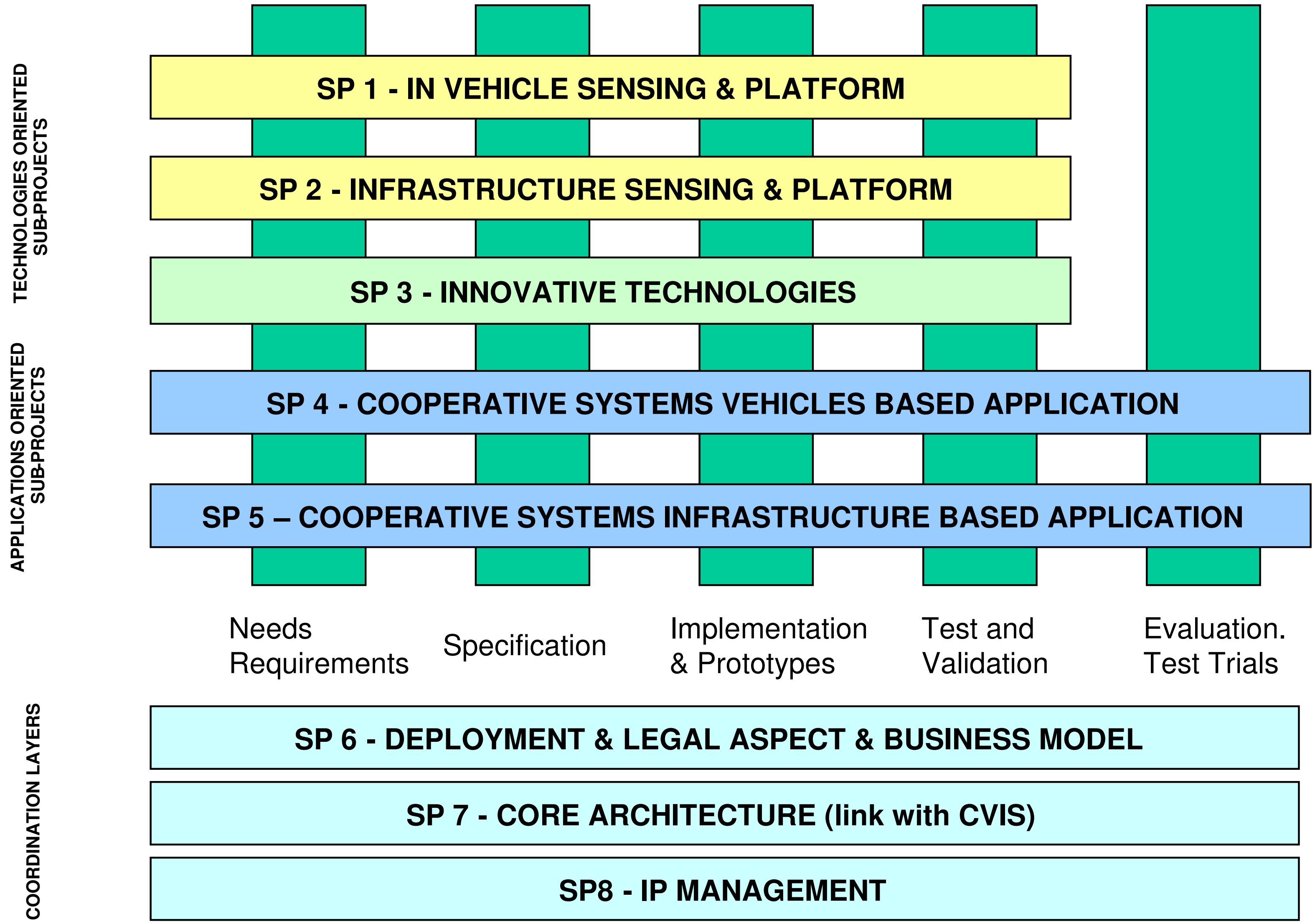

Main technological challenges (1)

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

- Candidate technology: IEEE 802.11p
- Need for dedicated frequency band in the 5.9 GHz. range for secure V2V and V2I, avoiding interference with existing consumer links
- Aligned to C2C-C and CALM standardisation groups

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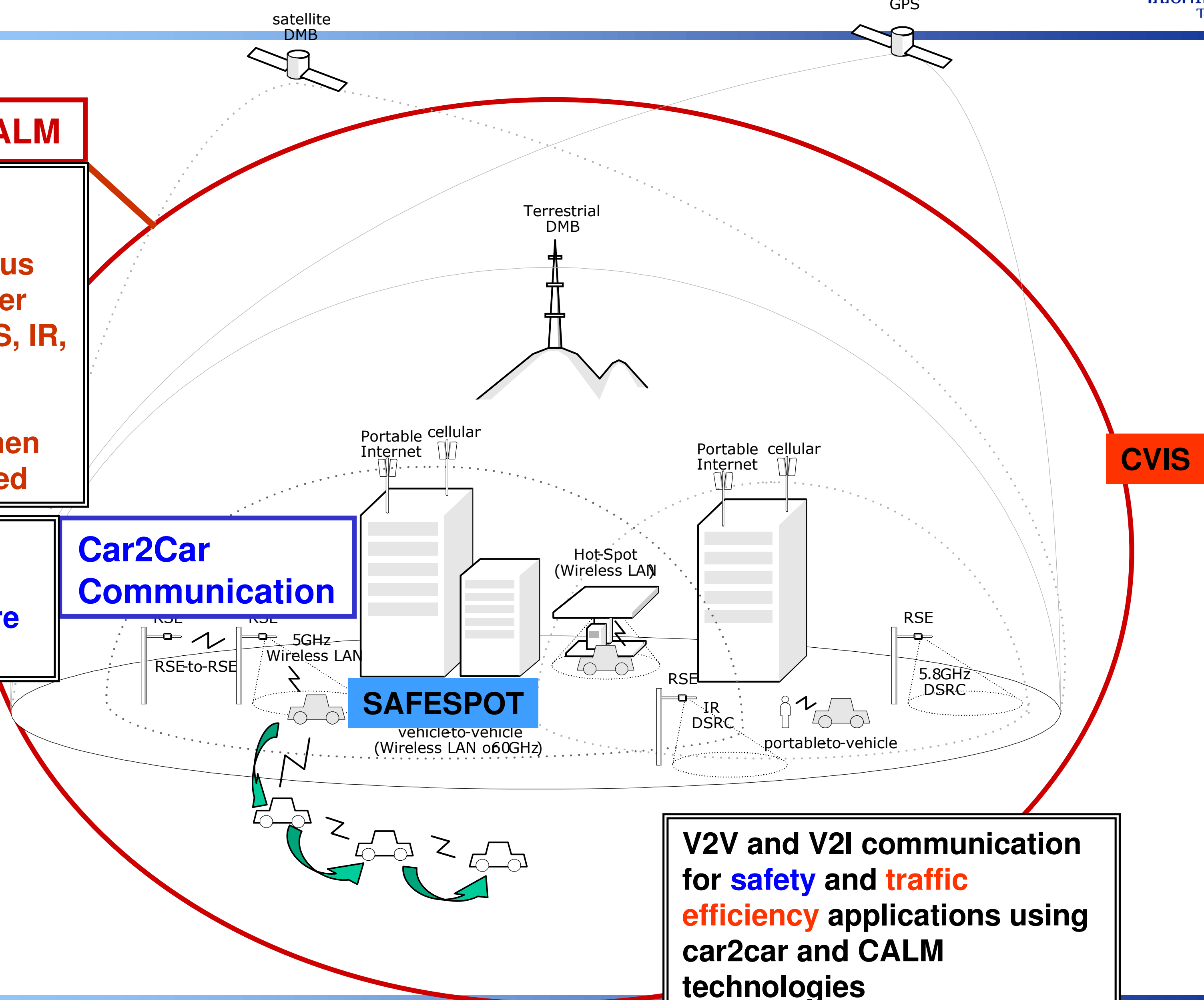
CALM

Support of ITS and Internet Services based on continuous communication over 802.11, GSM, UMTS, IR, IPv6, etc.
V2V and V2I communication when no routing is needed

V2V and V2I communication, based on geo-aware multi-hop routing

Car2Car Communication



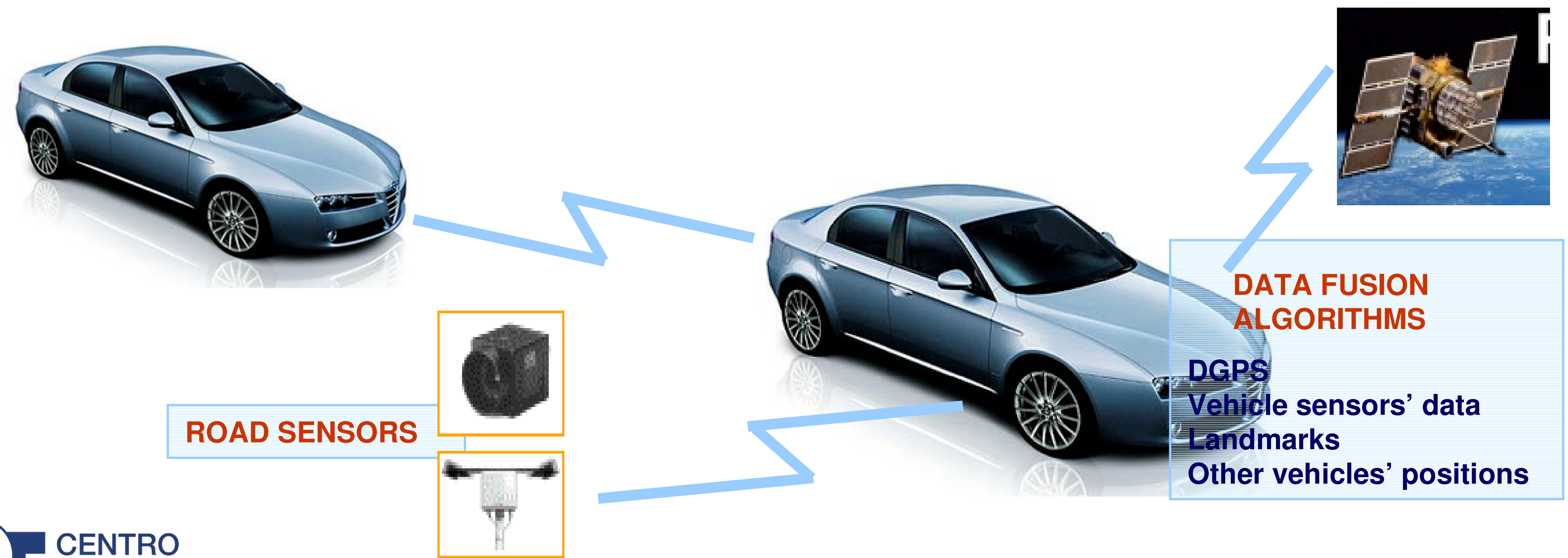
CVIS

V2V and V2I communication for safety and traffic efficiency applications using car2car and CALM technologies

Main technological challenges (2)

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

- Use of satellite raw data (**pseudo-ranges**) onboard of different vehicles resulting in an enhancement of proven **differential** procedures (DGPS) **without** the need of **stationary reference** stations broadcasting correction data.
- Combination with other complementary sensor data (**sensor fusion**), including landmarks registered on digital maps, to bridge the gaps and errors of the satellite based system



Main technological challenges (3)

A real time updateable **Local Dynamic Map**

- Integration of standard digital maps with dynamic (**short time)** and local (**short range)** layers of information collected by the infrastructure or by the vehicles (road status, obstacle presence, etc.).

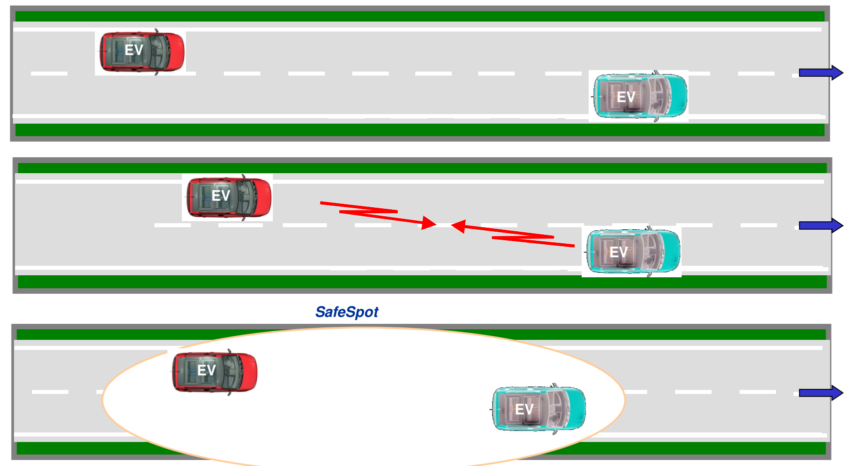
- Focus on new contents and information that is provided in real-time
  - need of high efficiency algorithms
  - definition of an adaptive optimal coverage range
  - compatibility with standard digital maps

- Target → representation of vehicle's surroundings with all static and dynamic safety relevant elements

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)

Some typical use cases:

- Safe lane change maneuvers
- Road departure
- Cooperative situation awareness and extended collision warning
- Cooperative tunnel safety
- Road condition Information
- Cooperative maneuvering
- Predictive speed reduction



COOPERATIVE SYSTEMS FOR ROAD SAFETY: "SMART VEHICLES" ON "SMART ROADS"

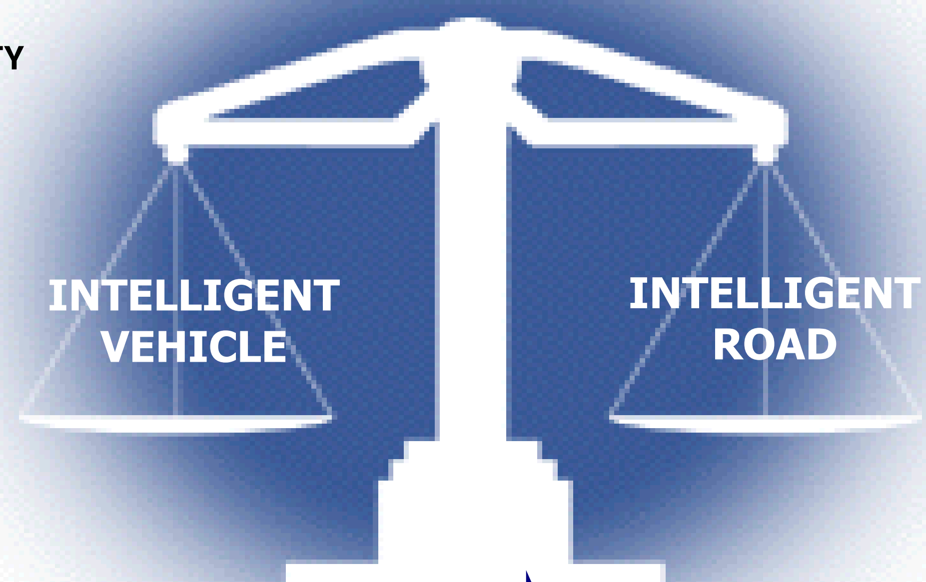
INTELLIGENT VEHICLE ADVANTAGES

REDUCTION OF VEHICLE SYSTEM COST AND COMPLEXITY

INTEGRATED WITH

INTELLIGENT ROAD ADVANTAGES

REDUCTION OF INFRASTRUCTURE COST AND COMPLEXITY



Sustainable deployment → **INCREASED SAFETY**

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