

CHAUFFEUR 2 Final Presentation, Balocco, 07.05.2003

The CHAUFFEUR 2 project
Christophe Bonnet, DaimlerChrysler AG



Once upon a time ...

PROMOTE-CHAUFFEUR



The Electronic Towbar

- leading vehicle is driven conventionally
- following vehicle automatically follows like a “trailer”
- very close following distance (6-12m) due to dedicated image processing, vehicle-vehicle communication, vehicle control



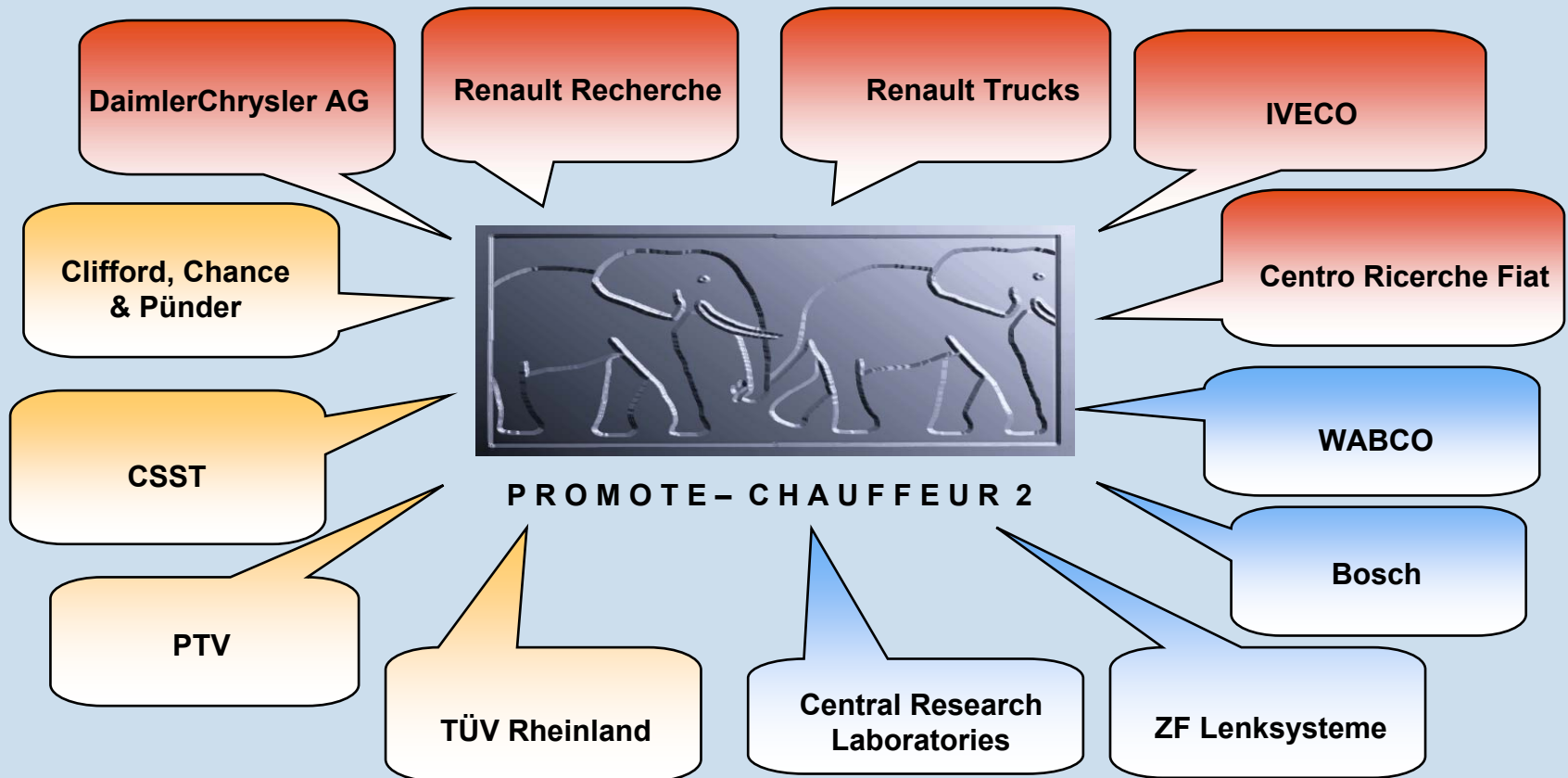
Once upon a time ...

PROMOTE-CHAUFFEUR

The Electronic Towbar with the DaimlerChrysler and IVECO trucks



The CHAUFFEUR 2 consortium



The CHAUFFEUR 2 applications



CHAUFFEUR Assistant:

- Extension to a “**flexible**” Electronic Towbar
- Truck is able to follow any other vehicle on a motorway in a **safe following distance** and **laterally guided**
- While driving alone, driver benefits from **lane keeping system** and **cruise control**



The CHAUFFEUR 2 applications



Platooning

- direct extension of the Electronic Towbar
- leading vehicle is driven conventionally
- both following vehicles automatically follows like “*trailers*”
- very close following distance (6-12m) due to dedicated image processing, vehicle-vehicle communication, platooning vehicle control



Non-technical project issues

But CHAUFFEUR 2 does not only realise technical systems. To develop truly operable and useful systems the project has also conducted system evaluation on theoretical and operational level.

Evaluation activities

- User acceptance tests, user workshops
- HMI studies
- Cost/benefit evaluation
- Traffic simulations
- Investigation of legal and liability issues



Expected benefits

- In general, the benefits identified for CHAUFFEUR 1 systems:
 - up to 20% reduction in fuel consumption,
 - improvement of traffic flow, reduction of transportation times,
 - reduction in operating cost
 - increased safetycan be expected for CHAUFFEUR 2 as well

- Moreover, CHAUFFEUR 2 offers:
 - More flexibility in use,
 - CHAUFFEUR 2 systems useful for small vehicle fleets,
 - Reduction of driver's workload even when driving alone



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The Platooning application
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Functions

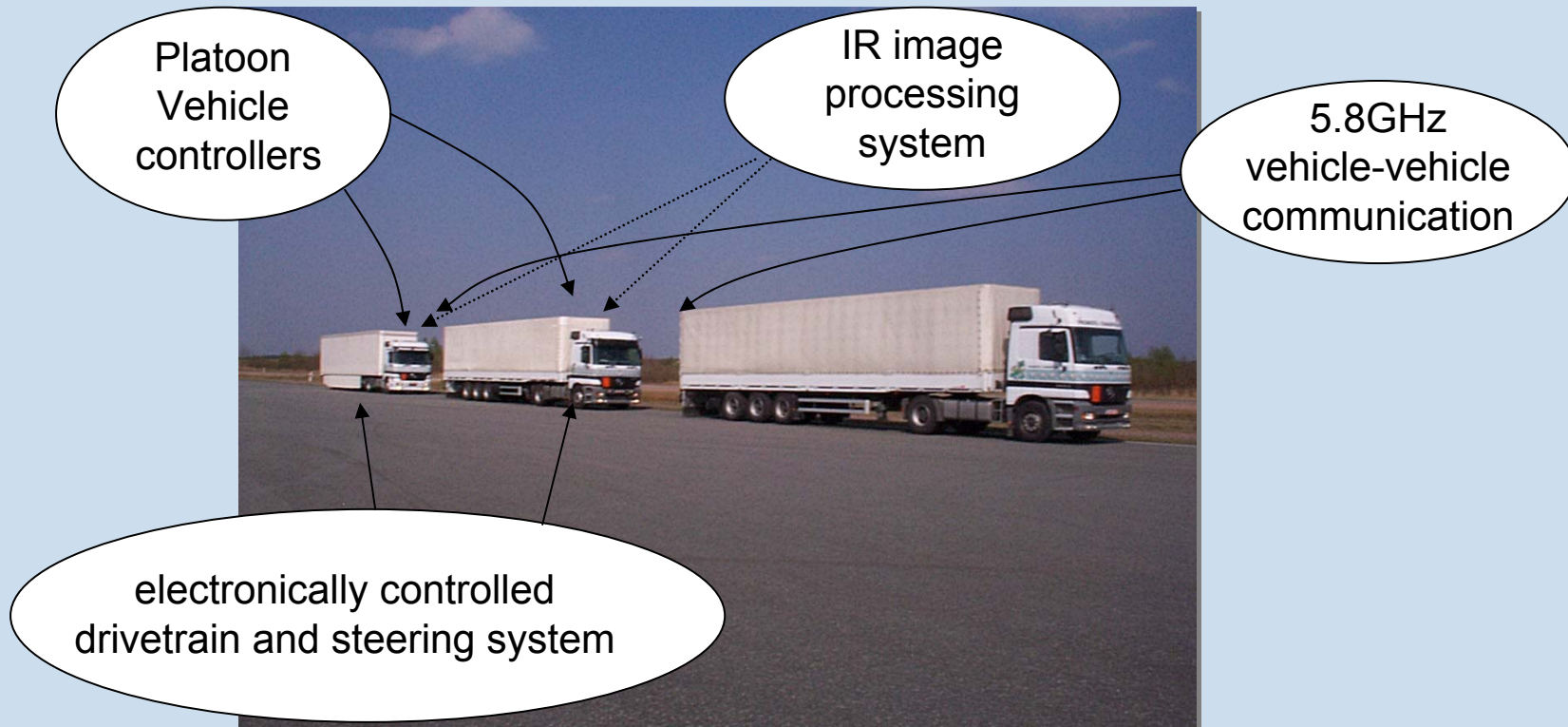
- extension of the Electronic Towbar from 2 to 3 trucks
- automatic following at very short distance
- following vehicles like “trailers”
- coupling and de-coupling maneuvers

Requirements

- ▶ no additional infrastructure
- ▶ very short distance (6 to 13 m)



System overview



The Platooning trucks

The two CHAUFFEUR1 trucks

- with integration of platooning components

“Drive-by-wire” truck with integrated powertrain (with DC power systems)

- steer-by-wire
- brake-by-wire
- powertrain interface for driving applications
- platooning components



Image processing

Infrared pattern

- active pattern for robust and accurate detection



Image processing

The interface displays two sets of camera views labeled 'FAR' and 'NEAR'. Each set shows a dark field with several bright white points representing detected infrared markers. A central control panel includes a small image of a truck labeled 'PROMOTE CHAUFFEUR DaimlerChrysler'. Below this are status indicators for 'SF', 'FF', and 'OF', each with a green light. An 'ERROR' indicator shows a red light and the word 'None'. At the bottom, there are three readouts: 'Angle between LV <-> PV' with a value of 8.95 Grad, and 'Cycle Time' with a value of 80 ms.

Pattern recognition

- detection and tracking of infrared pattern
- robust and accurate measurement with 2 CCD cameras
- Measurement of towbar distance and towbar angle



Vehicle-vehicle communication

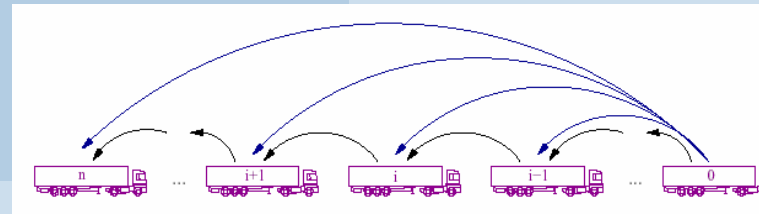
- 5.8 GHz **bi-directional** vehicle-vehicle communication
- integrated error management
- complex coupling / de-coupling platoon protocol
- VVC information
 - organisational information for coupling/de-coupling
 - status information for HMI
 - sensor and system information for platoon control



Longitudinal platoon control

Platoon distance controller using inputs from:

- IR image processing (distance)
 - own sensors (vehicle speed and acceleration)
- and
- sensor data from leading and preceding vehicle (speed and acceleration)



- platoon distance controllers designed for more than 3 trucks
- investigated and tested in simulation with up to 10 trucks
- challenges: platoon safety and platoon stability



Lateral platoon control

“Towbar” controller

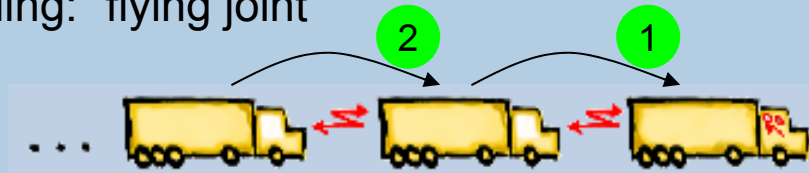
- uses only inputs of infrared image processing: towbar distance and towbar angle of preceding vehicle
- controls steering to follow the preceding vehicle (same trajectory)



Platooning manoeuvres

Platooning manoeuvres with 3 trucks

- coupling: “flying joint”



- platooning driving (lane changing, accelerating, braking)
- de-coupling: inverted flying-joint



Benefits

- improvement of traffic flow
- increased safety
- lower fuel consumption
- reduced environment impact
- no infrastructure needed



Enjoy your drive !





01.09.2003

PROMOTE-CHAUFFEUR 2



Platooning video

DAIMLERCHRYSLER

