EuMC07 Special Session

20th Anniversary of the European Microwave Week

"The Future becomes the Present"

(a Look at Developments in Enabling Technologies and Systems over the Last 20 Years)

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48TH EUROPEAN MICROWAVE CONFERENCE 2018

The 48th European Microwave Conference

EuMIC 2018

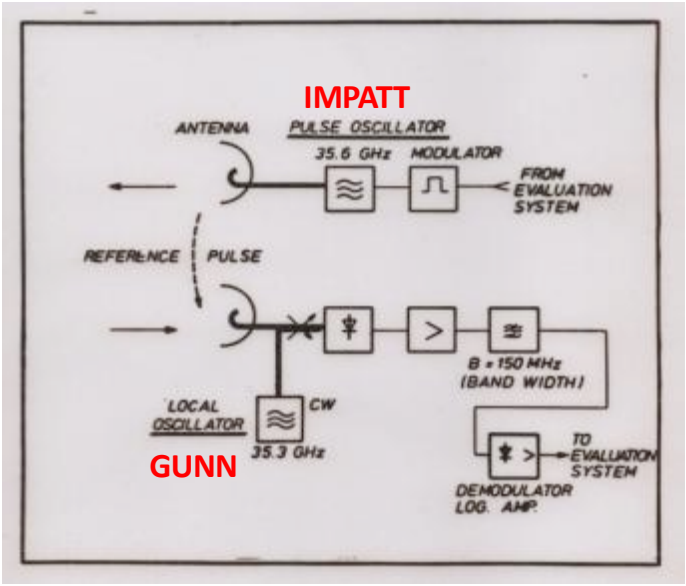
The 13th European Microwave Integrated Circuits Conference

EuRAD 2018

The 15th European Radar Conference

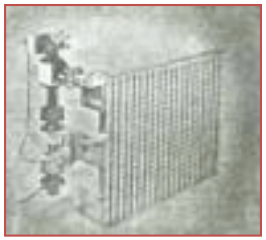
1974

Where do we (I) come from ...



35 GHz

Physically separated TX and RX modules
IMPATT- and GUNN-diodes



1971
First blind-spot detection (BSD) radar at 16 GHz presented at Bendix Labs in Southfield, Mich.

1975
First road testing vehicles using 35 GHz radar for automatic cruise control and anti-collision

1993
Radar-based 24 GHz collision warning system reduces accidents by 21% for Greyhound buses

1998
Mecedes-Benz DISTRONIC System uses 77 GHz band

2004
European Commission harmonized use of 79 GHz band for short-range radar

2006
Field trials of 60 GHz automotive radar systems on Jo-Shin-Etsu Highway in Japan

2006
Mecedes-Benz DISTRONIC PLUS uses 24 GHz radar for short range, 77 GHz band for long range

2014
Delphi ships 1 millionth 77 GHz electronically scanning radar

2016
National Highway Traffic Safety Administration announces that all automakers will supply collision avoidance by 2022

Source:
Paul Khanna, NI

Milestones

installed in the MB E-class

1998

The first series 77 GHz ACC system

Source: DAIMLER AG

77 GHz MMICs are available and it starts ...

10 years ago

- Comfort
  - fall-safe application
- Single sensors
  - LRR, BSD, LCA, ...
- Standard radar
- SiGe, BiCMOS

Today

- Safety
  - ASIL, SOTIF, etc.

SOTIF
ISO 26262 –ASIL B

- Multiple function sensors
  - SRR, MRR, LRR in one unit
  - SoC in RF-CMOS
- Sensor fusion
  - radar, LiDAR, cameras
  - with low power consuption
- High resolution radar
  - DBF, micro Doppler detection, etc.
- High performance Radar
  L2+3 vs. L4+5

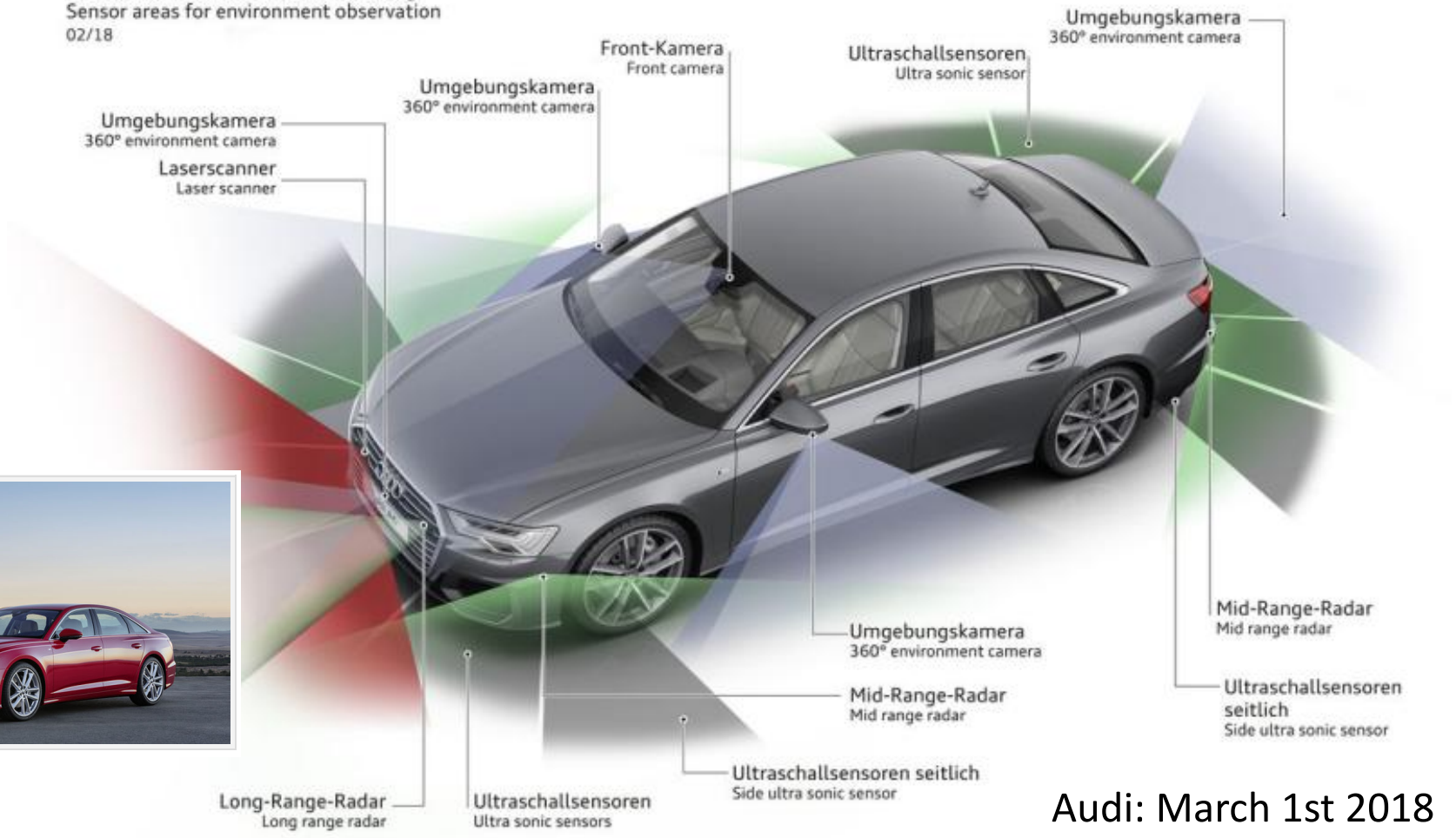
"from *comfort* to *safety*"
under enhanced safety requirements

Paradigm change

Safety of the intented functionality

Audi A6 Limousine

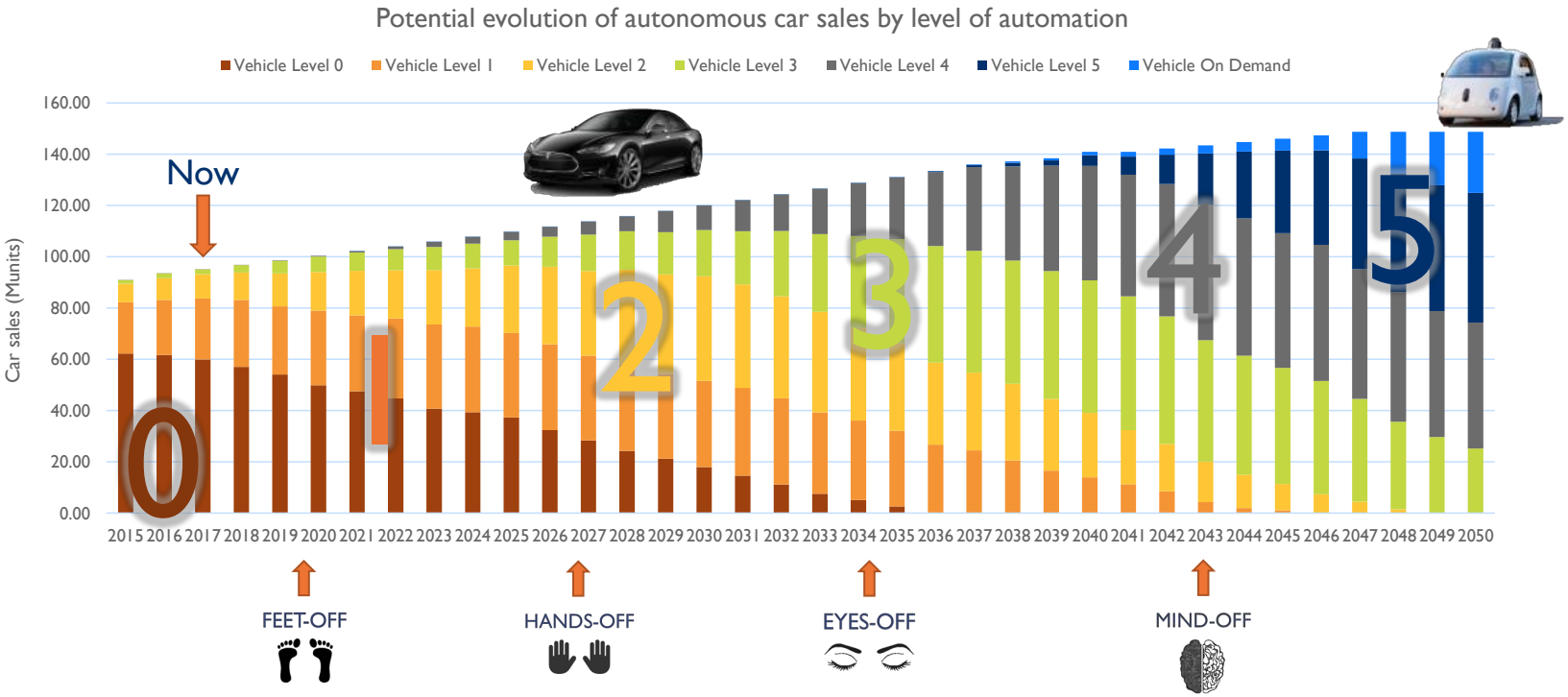
Sensorfelder der Umfeldüberwachung
Sensor areas for environment observation
02/18



Audi: March 1st 2018
Geneva

THE END OF DRIVING

By 2050, 5% of all vehicles sold should be Level 5-ready!

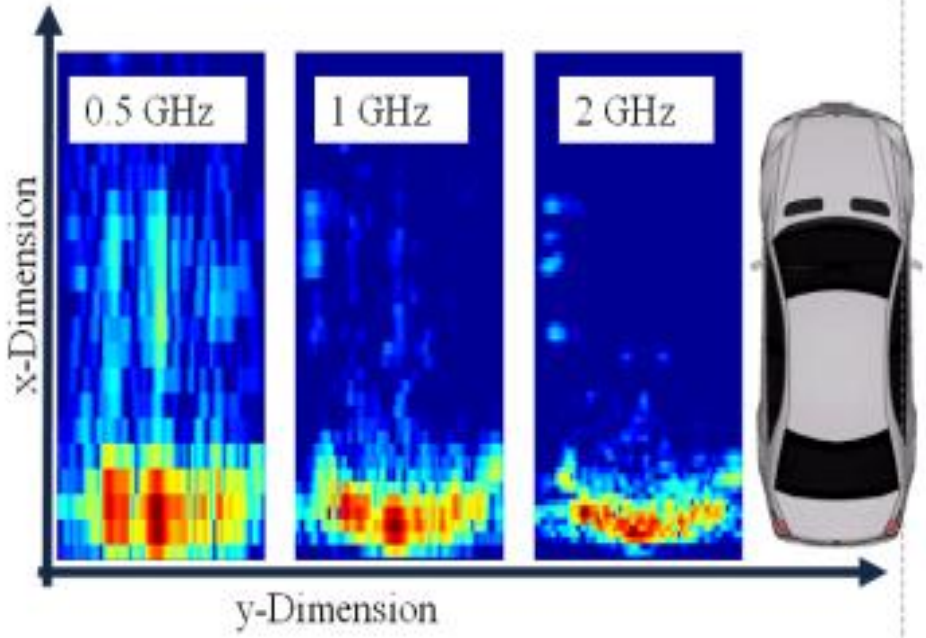


By 2045, more than 70% of all vehicles sold will integrate autonomous capabilities

YOLE Développement

Source: Yole Développement - France – 2018

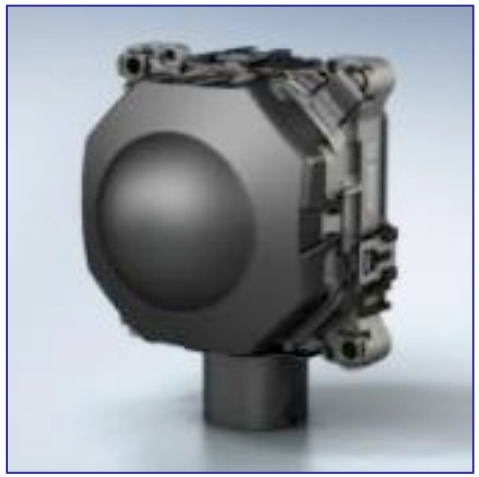
More than 120 Mio. radars are on our streets today



Quelle: Daimler Research Ulm

Object resolution

as a function of bandwidth
- at 500, 1.000 and 2.000 MHz



BOSCH – LRR4

WARC 2015 – since November 17th 2015:

WARC - World Administrative Radio Conference

Automotive radar at 76 to 81 GHz is a **„primary service“** now
- other possible users have to make sure, that they do not interfere with this primary service
- *They have to protect the functioning as a safety feature for automotive use*

Innovative Sicherheitslösungen durch Einsatz neuer Technologien

Mercedes-Benz Safety

- Die PRE-SAFE® Phase ist wichtigstes Handlungsfeld unserer Integralen Sicherheitsstrategie

Social/ Societal Impact

Series in MB E/S-class

Innovative Sicherheitslösungen durch Einsatz neuer Technologien

Mercedes-Benz Safety

- PRE-SAFE® Impuls Seite – Erweiterung des Schutzraumes zur Seite

Automated Driving and Insurances

Thatcham Research
Safer cars, fewer crashes

Incorporating an **AEB**-System within a vehicle

– i.e. **Automated Emergency Braking**

in the UK the insurance fee is reduced by 10%

- being the standard today already

The next step: incorporating an **AES**-System within a vehicle

– i.e. **Automated Emergency Steering** (rolling ball followed by a child)

an ongoing fee reduction is to be expected in the UK

Source: Matthew Avery, Thatcham Research, Automotive Sensor Systems Conference Munich, February 6-7, 2018.

Financial Impact

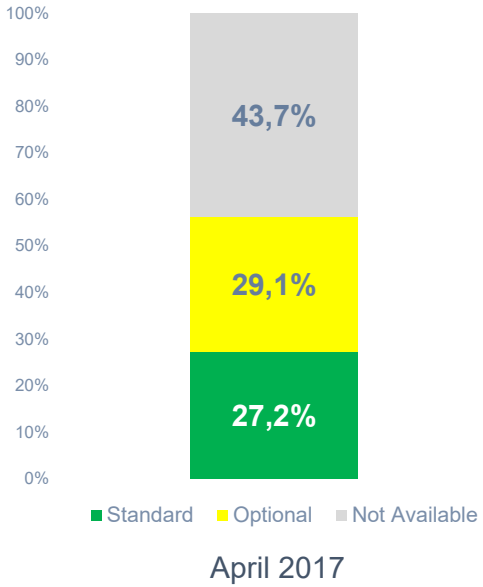
Thatcham Research
Safer cars, fewer crashes

ADAS Effect

Thatcham and AEB

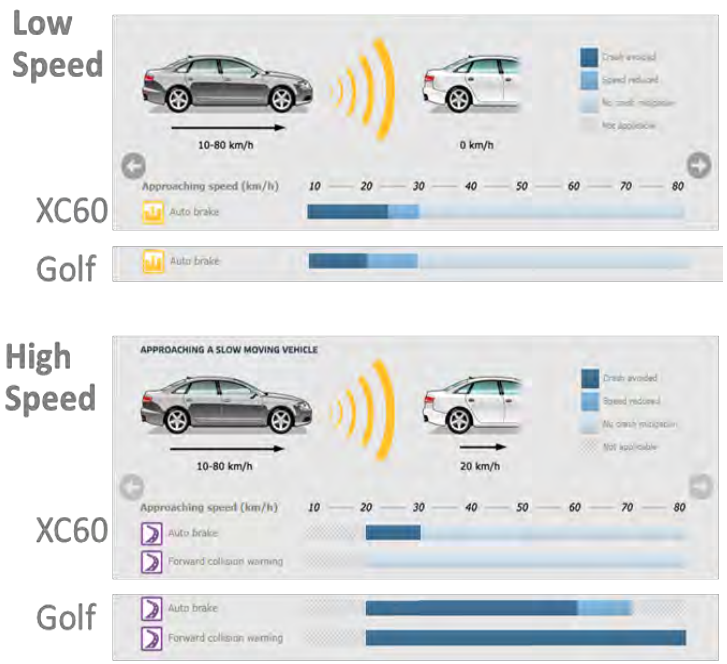
Thatcham has been instrumental in developing AEB test procedures in Euro NCAP and RCAR and analysing the real-world effect of these systems

New car AEB fitment

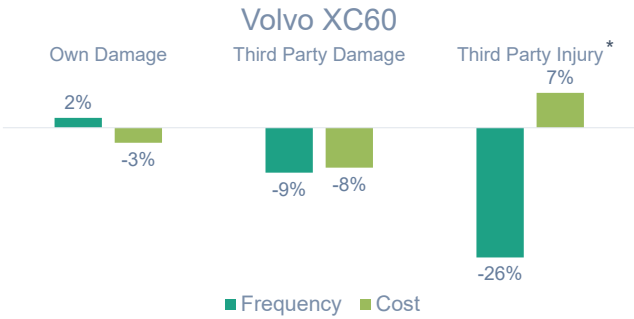


April 2017

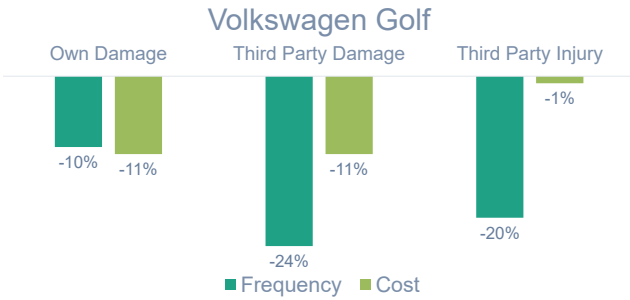
AEB testing



Real-world analysis



* Increasing costs due to raising of average cost through elimination of lower value whiplash cases



Financial Impact

Source: Matthew Avery, Thatcham Research, February 6-7, 2018.

Wednesday - Time: 08:30 – 17:50 Room: N118

WW-02 (EuRAD)

Automotive Radar and HAD

Organiser: Holger H. **Meinel**1, Marlene **Harter**2
1Independent Consultant, 2Bosch GmbH, Stuttgart

Automotive radar at 77 GHz is in production and on our roads since 1998; only recently the production numbers have exploded. Currently, we have around 120 million radar systems on our streets worldwide. VALEO presented a 77 GHz radar sensor based on LTCC for mass production at the recent EuMWeek 2017 in Nuremberg.

Quo Vadis - ADAS and HAD ? – Market, measurement and society-wise. These future directions will be reviewed and discussed in this workshop being described here.

Thursday

EuRAD03 – Automotive Radar 1

EuRAD05 – Automotive Radar 2

Friday

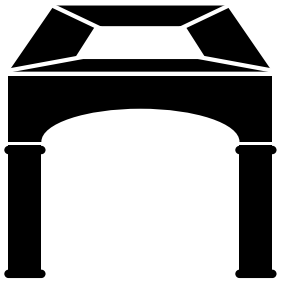
EuRAD12 – Micro Doppler Analysis

Further more ....

ATRIUM - Bridging the Gap between Simulation and Measurement Techniques for Automotive Radar

Thomas Dallmann, et al.
Fhg-FHR, Wachtberg, Germany

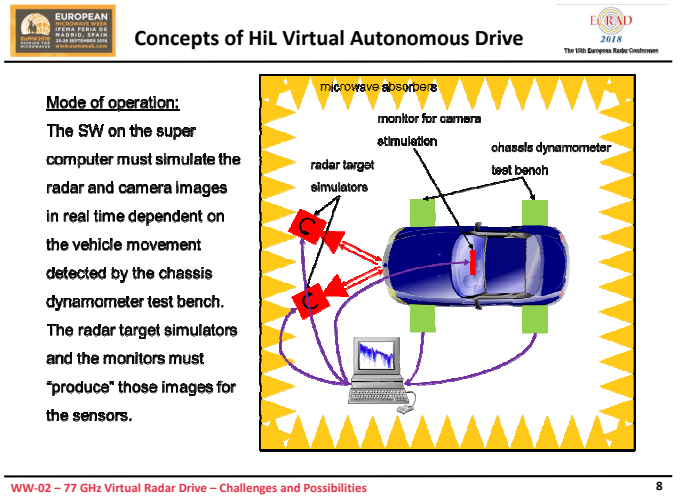
ATRIUM



Booth # **H004**

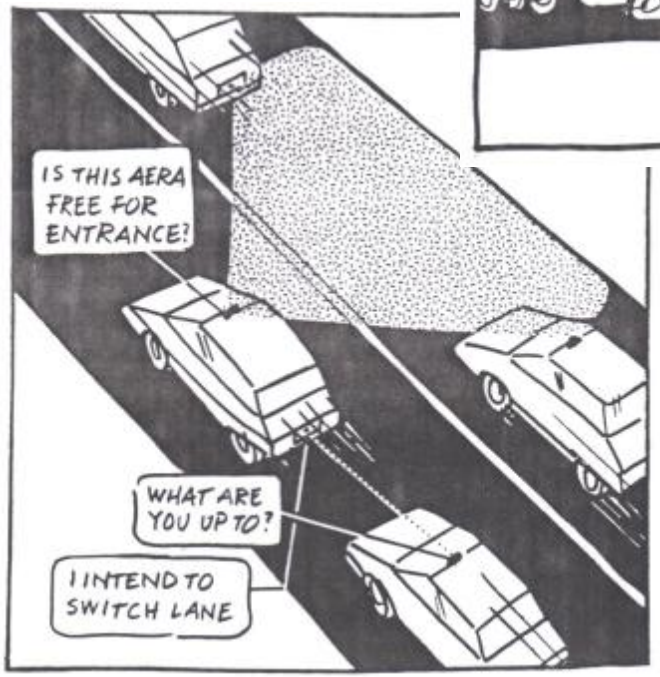
WS **WW02-10**

Automobile **T**estumgebung rur
Radar **I**n-the-loop **U**ntersuchungen und **M**essungen



WS **WW02-11**

We all knew it,
since a long,
long time . . .



Source: Peter Weissglass
Swedish Institute of Microeöectronics
at **EuMC 1990**

ADAS is it !

Thank you for your attention !