

Who Says DMS & ICMS Technology is Obsolete?

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Xilinx Adapt: Automotive

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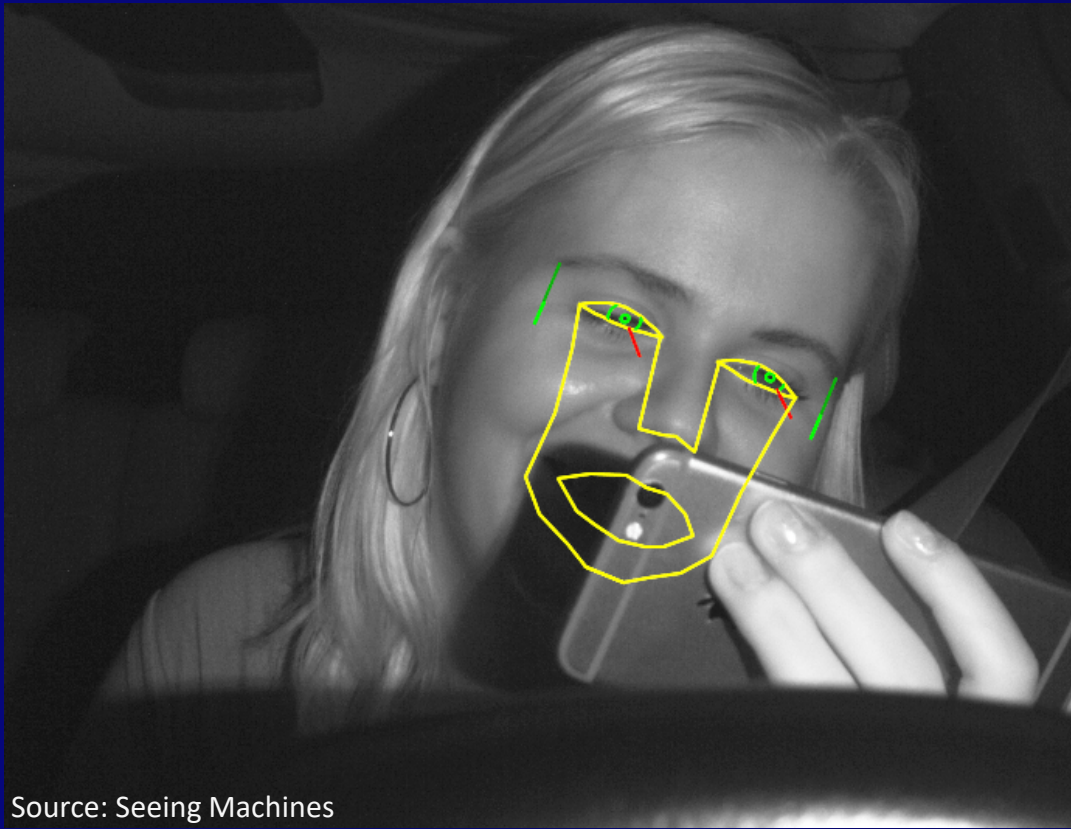
Biography

- “Seriously Skeptical” columnist in *EE Times*
- BEng (Hons) E/E Engineering from Aston University, England
- Market analyst for 25+ years
- Covered automotive electronics for 20+ years

Definitions – DMS & ICMS

- Driver monitoring (DMS) & In-cabin monitoring (ICMS) refers to vehicle interior vision systems
- IR vision-based systems (850nm/940nm)
- Time-of-flight (ToF) systems excluded
- Steering wheel torque sensor systems excluded
- Aftermarket and smartphone-based app systems excluded

Which Facial Parameters Are Measured?



Source: Seeing Machines

- Head pose
- Mouth opening
- Eyelid opening
- Eye-gaze vector
- Blinks
- Pupil dilation

Assisted vs. Autonomous Driving

L0

L1

L2

Assisted Driving



Human is liable: at all times

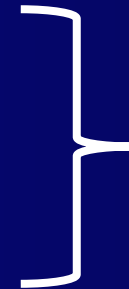
ADAS with DMS for distraction,
drowsiness and impairment monitoring

L3

L4

L5

Autonomous Driving

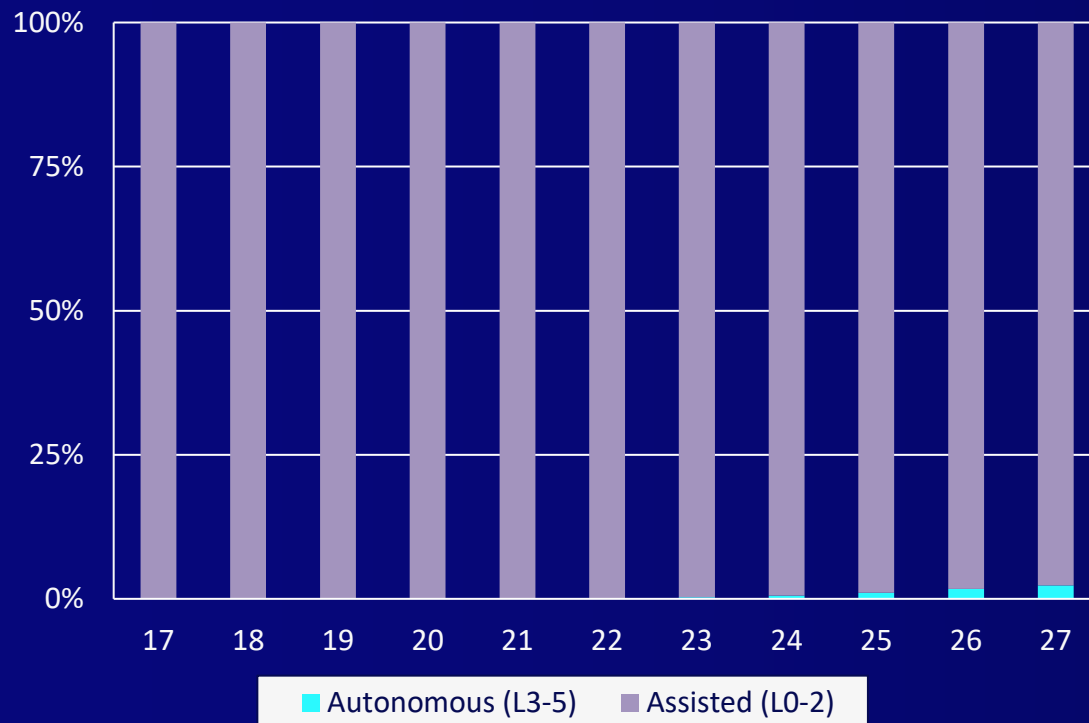


Automaker is liable:

L3: SOME of the time ;

L4: MOST of the time ; L5: ALL of the time

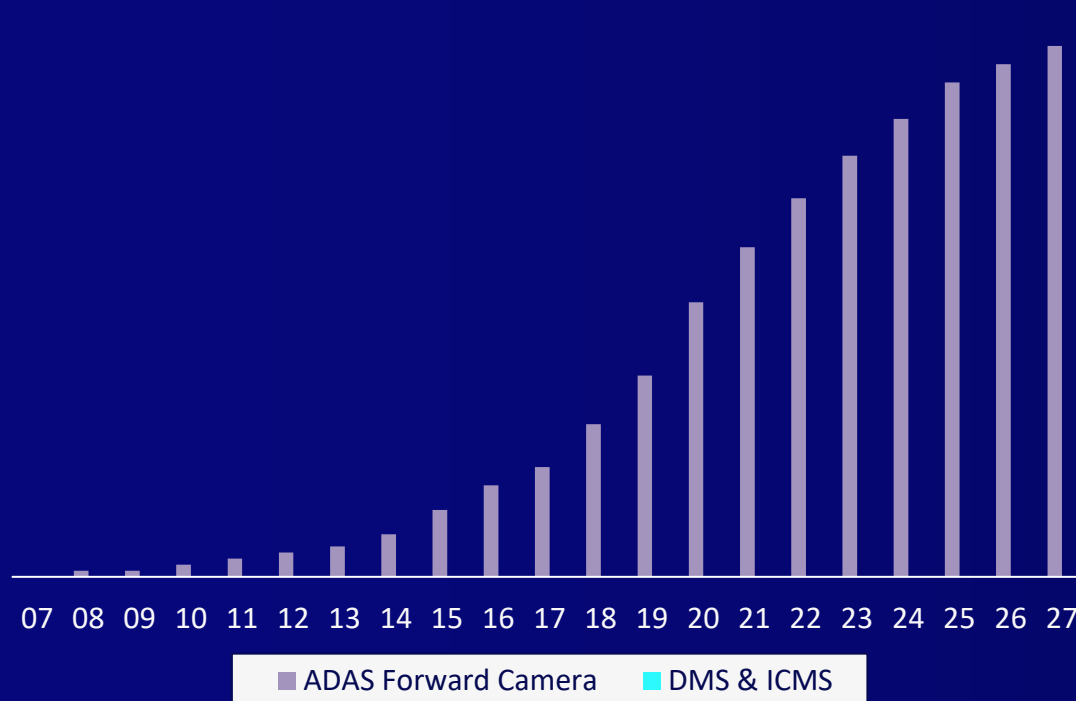
Assisted vs. Autonomous Driving



Source: Semicast Research Report "ADAS & Automotive Vision-based Driver Monitoring Systems - 2021 Edition"

- Liability risk at L3 leads to L2+, L3-, L2.9
- L4 somewhere after 2030, L5 ?
- Assisted driving includes AEB, LKAS, BSW etc.
- Goal to make human drivers into safer drivers

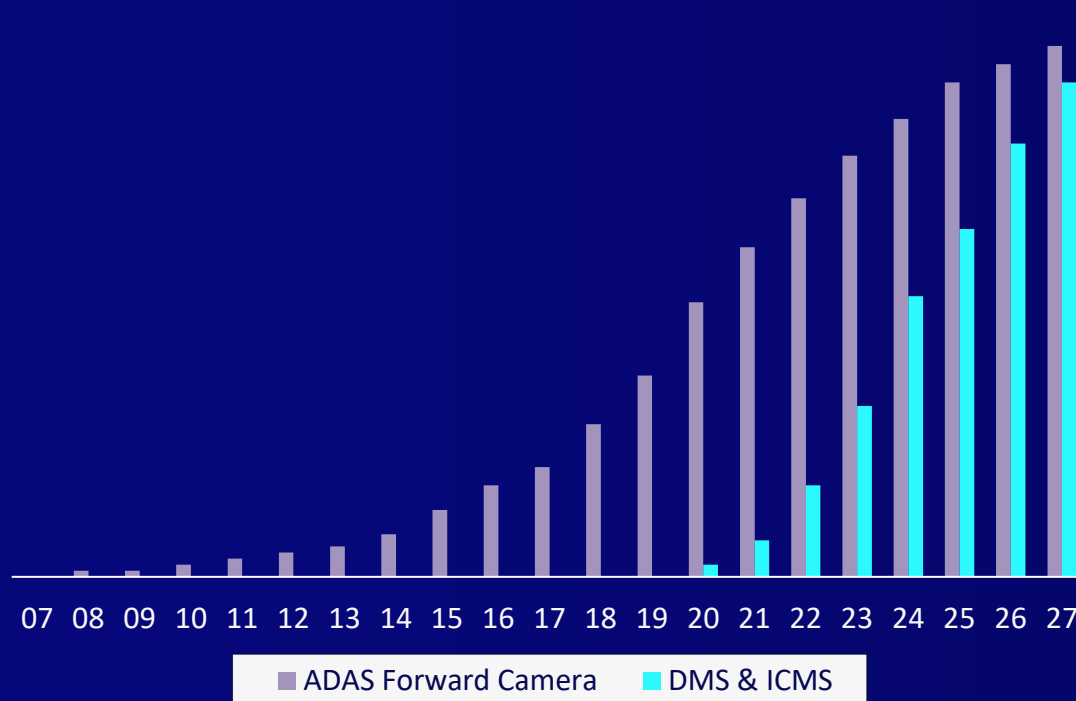
Evolution of ADAS Forward Camera Fitment Rate



Source: Semicast Research Report "ADAS & Automotive Vision-based Driver Monitoring Systems - 2021 Edition"

- Proven safety benefits
- Mandated in Europe from 2022
- Already included in Euro NCAP tests
- Fitment rate > 90% by end of the decade

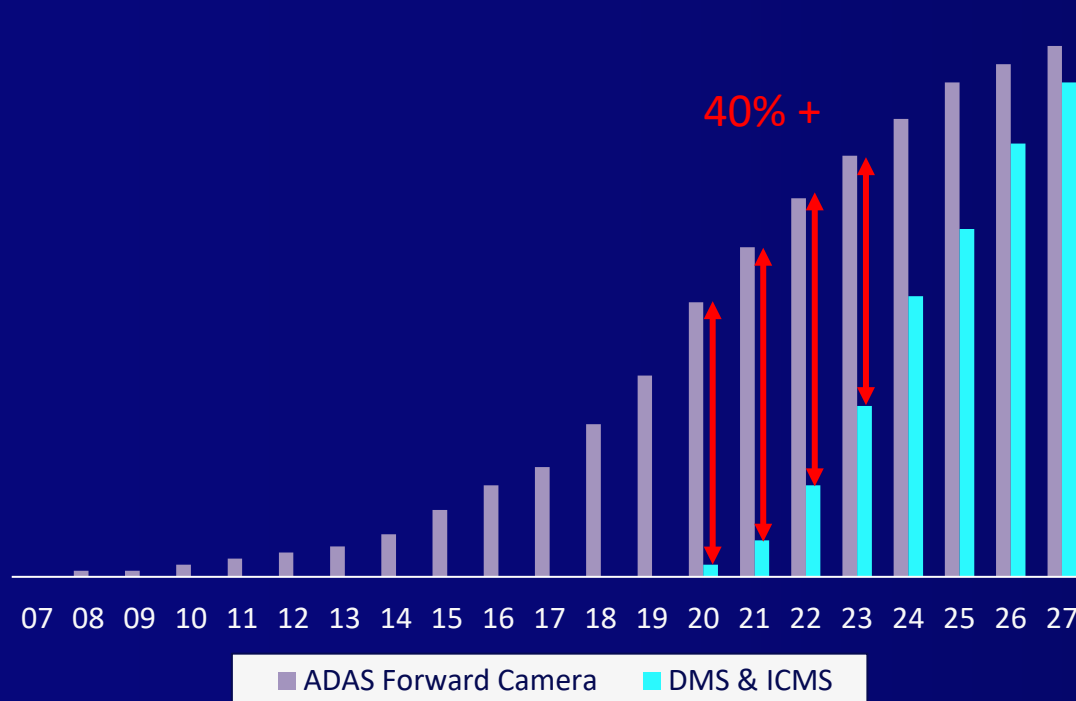
Evolution of ADAS Forward Camera vs. DMS & ICMS Fitment Rate



Source: Semicast Research Report "ADAS & Automotive Vision-based Driver Monitoring Systems - 2021 Edition"

- Who says DMS & ICMS is obsolete ?
- DMS & ICMS awareness much lower
- Highest growth starting 2022/23 timeframe
- Fitment rate > 90% by end of the decade

Evolution of ADAS Forward Camera vs. DMS & ICMS Fitment Rate



Source: Semicast Research Report "ADAS & Automotive Vision-based Driver Monitoring Systems - 2021 Edition"

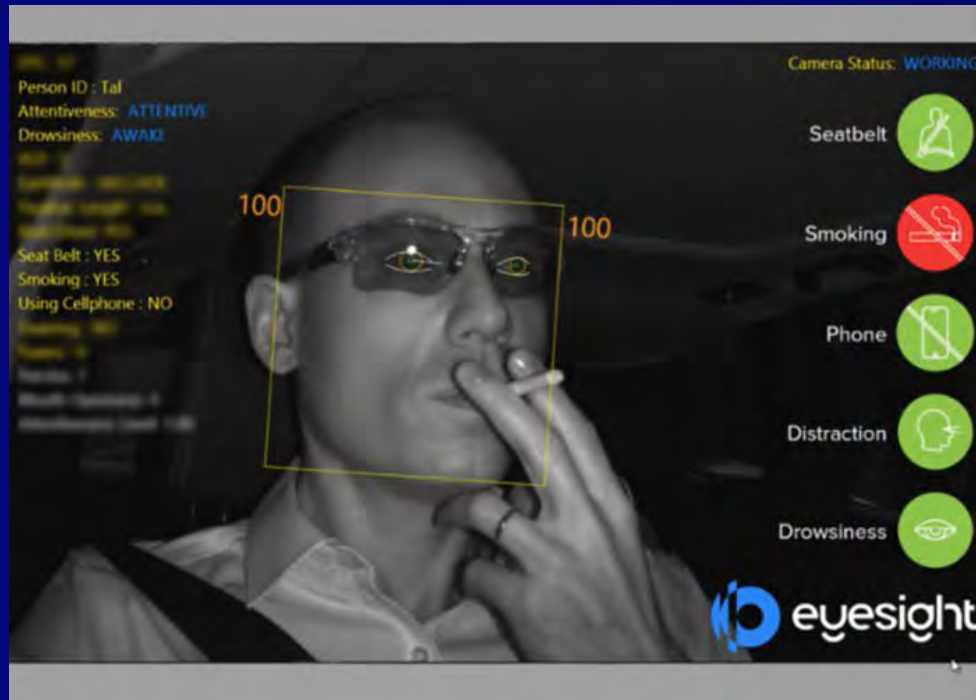
- 40%+ difference in fitment rates 2020-2023
- DMS & ICMS starts to catch up from 2024
- Intel bought Mobileye in 2017
- NCAP and safety legislation

World Health Organization Traffic-related Deaths



Source: Wikipedia and WHO

China DMS & ICMS Safety Legislation



- Driver cellphone use
- Eating
- Smoking
- Enforce seatbelt use for all occupants

Europe DMS & ICMS Safety Legislation



- Euro NCAP testing DMS & ICMS from 2024
- Delayed from 2022 owing to Covid-19



- “Driver readiness monitoring” from 2022
- “Advanced distraction recognition” from 2024

3.1 | Chassis & Safety → Autonomous Mobility and Safety

Further Active Safety Content Driven by Legislation (e.g. EU)

"General Safety Regulation" of the EU (simplified view)		Implementation (New Vehicles 2 years after New Types)												Division			Product (component only one time)
Cluster	Name	2022				2024				2026				C&S	Interior	Tires	Components
		M1	M2&M3	N1	N2&N3	M1	M2&M3	N1	N2&N3	M1	M2&M3	N1	N2&N3				
Emergency Braking	Advanced emergency braking for vehicles	■		■										■			ARS and/or MFC
Emergency Braking	Advanced emergency braking for VRU					■		■						■			ARS and MFC
Lane Keeping	Emergency lane keeping	■		■										■			MFC
Reverse Maneuvering	Reversing safety - with intervention	■	■	■	■									■			2*SRR
Traffic Sign Recognition	Intelligent speed assistance	■	■	■	■									■			MFC
Right Turn Assist	Blind spot information system (Turning Assist CV)			■	■									■			SRR or SVC
Event Data Recording	Event (accident) data recorder	■		■										■	■		ADCU or Infotainment HPC
Event Data Recording	Event (accident) data recorder									■		■		■	■		ADCU or Infotainment HPC
Driver Monitoring	Alcohol interlock installation facilitation	■	■	■	■										□		t.b.d.
Driver Monitoring	Drowsiness and attention detection	■	■	■	■									■			in-cabin cam
Driver Monitoring	Driver readiness monitoring	■	■	■	■									■			in-cabin cam
Driver Monitoring	Advanced distraction recognition					■	■	■	■					■			in-cabin cam
Tire Monitoring	Tyre pressure monitoring for heavy duty		■		■											■	TPMS

Source: Continental Investor Presentation April 2020 (Fact Book 2019)

As confirmed by EU on March 25th 2019: - On the Parliament's side, the IMCO committee should vote on April 2, 2020. The final, formal vote is expected to take place under the new Parliament in the autumn, after the EU elections.
- All timing proposals based on the assumption that GSR enters into force in November 2019. (Application date = +30 months | A = on application date | B = +24 months | C = +48 months).

Euro NCAP & Thatcham Research

Defining Safe Automated Driving
Insurer Requirements for Highway Automation

Thatcham Research | ABI

ASSISTED DRIVING GRADING* – OCTOBER 2020

POSITION	VEHICLE	VEHICLE ASSISTANCE	DRIVER ENGAGEMENT	SAFETY BACKUP	GRADING
1	Mercedes-Benz GLE	86	85	89	VERY GOOD
2	BMW 3-Series	82	83	90	VERY GOOD
3	Audi Q8	83	78	84	VERY GOOD
4	Ford Kuga	66	73	86	GOOD
5	VW Passat	76	79	61	MODERATE
6	Tesla Model 3	87	36	95	MODERATE
7	Nissan Juke	52	70	72	MODERATE
8	Volvo V60	71	78	49	MODERATE
9	Renault Clio	62	69	43	ENTRY
10	Peugeot 2008	61	74	40	ENTRY

*Final grading derived from lowest Vehicle Assistance or Driver Engagement score, plus Safety Backup score

U.S. DMS & ICMS Safety Legislation

1431

1 “(1) Not later than 2 years after the date of
2 enactment of this section, the Secretary shall complete research into the following:

3

4 “(A) Driver monitoring systems that will
5 minimize driver disengagement, prevent automation complacency, and account for foreseeable misuse of the automation.

6

7

8 “(B) Lane keeping assistance that assists
9 with steering to keep a vehicle within its driving
10 lane.

11 “(C) Automatic crash data notification systems that—

12

13 “(i) notify emergency responders that
14 a crash has occurred and provide the geographical location of the vehicle and crash
15 data in a manner that allows for assessment of potential injuries and emergency
16 response; and
17
18

- Moving Forward Act (H.R. 2) passed House, moved on to Senate
- Includes legislation for DMS and other auto safety technology
- <https://www.congress.gov/bill/116th-congress/house-bill/2/text>
- SAFE Act to reduce accidents and improve automotive safety

2020 is an important Customer launch year

Top 15 in 2020 ~\$300M average annual sales, average CPV ~\$165

Q1'20 to Q3'20

Polestar 2

- AVV ~60K
- MV4, 77Ghz, ADAS ecu, ZIS



Ford F150(delay of 6 weeks)

- AVV ~690K
- RCS, DMS



Japan based OEM

- from Q1'21
- AVV ~260K
- 24Ghz

Mercedes Benz - GLA / GLB

- AVV ~180K
- MVS, SVS, 77Ghz, ADAS ecu



VCC XC40

- AVV ~150K
- MV4, 77Ghz, ADAS ecu, ZIS



US based OEM

- AVV ~140K
- RCS, BCS

Mercedes S class(delay to Q3'20)

- AVV ~90K
- SV4, 77Ghz, ADASSW



Honda Acura TLX & MDX(partial delay to Q1'21)

- AVV ~80K
- 24Ghz



US based OEM

- AVV ~180K
- NiVi4, RCS,

Mercedes E class

- AVV ~370K
- MVS/SVS, 77Ghz, ADAS ecu



Subaru Levorg(delay to Q4'20)

- AVV ~30K
- SVS, 77Ghz



Japan based OEM

- AVV ~50K
- 77Ghz, RCS

BYD HC

- AVV ~50K
- MVS, 77Ghz



GM Escalade

- AVV ~40K
- NiVi4, RCS, HDLM



Japan based OEM

- AVV ~200K
- RCS

AVV- Average Vehicle Volume are primarily based on the IHS vehicle volume planning assumptions over vehicle life-cycle, CPV- Contour (Gen4 Mono Vision), SV4(Gen4 Stereo Vision), 77Ghz & 24Ghz Radar, NiVi4(Gen4 Thermal Sensing Night Vision), ADAS ecu(Advanced Driver Assistance System), ZIS(Zenuity Software), HDLM(High Definition Mapping), RCS(Restraint Control System).



Source: Twitter (@mrlevine)

2020 is an important Customer launch year

Top 15 in 2020 - \$300M

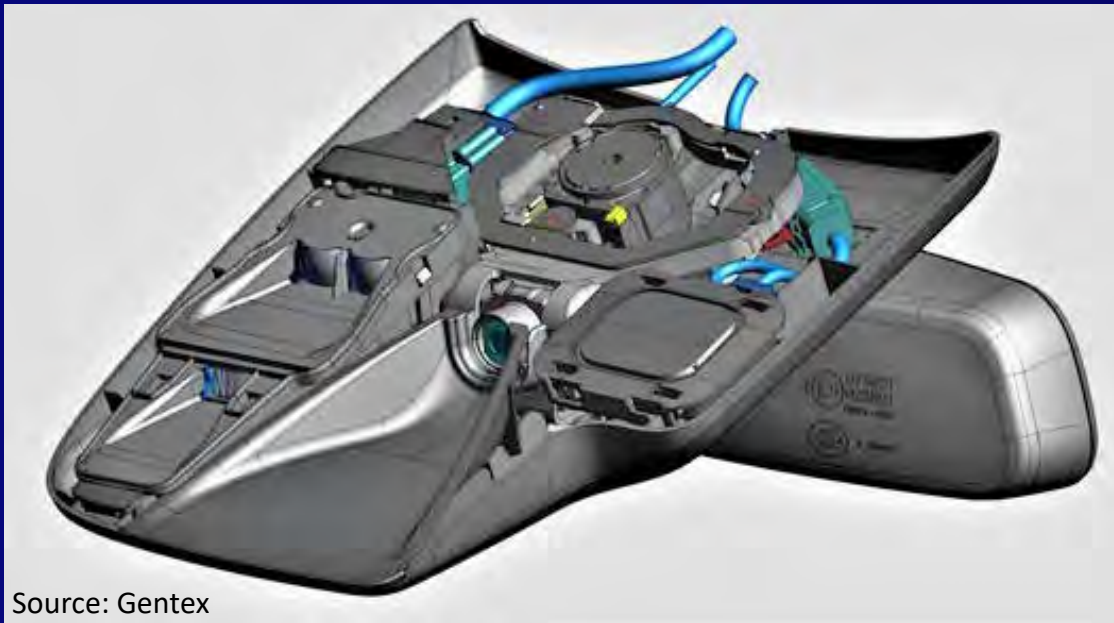
- Model 1**
\$100,000
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- Model 2**
\$100,000
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- Model 3**
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- Model 4**
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- Model 5**
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- Model 6**
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- Model 9**
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- Model 10**
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- Model 15**
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\$100,000, \$100,000, \$100,000



Source: Fox News

Source: Twitter (@mrlevine)

Leveraging ADAS Forward Camera for ICMS

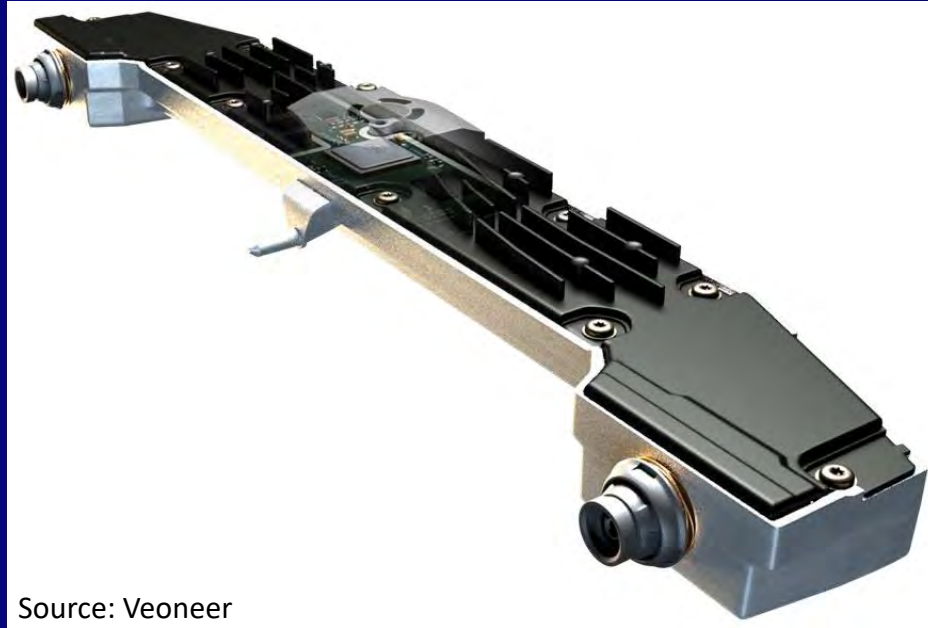


- Well-known and well-proven location
- Extremely space limited
- Integrate forward and interior cameras
- Maximum power consumption about 6W

Xilinx to Power New-Generation Subaru EyeSight

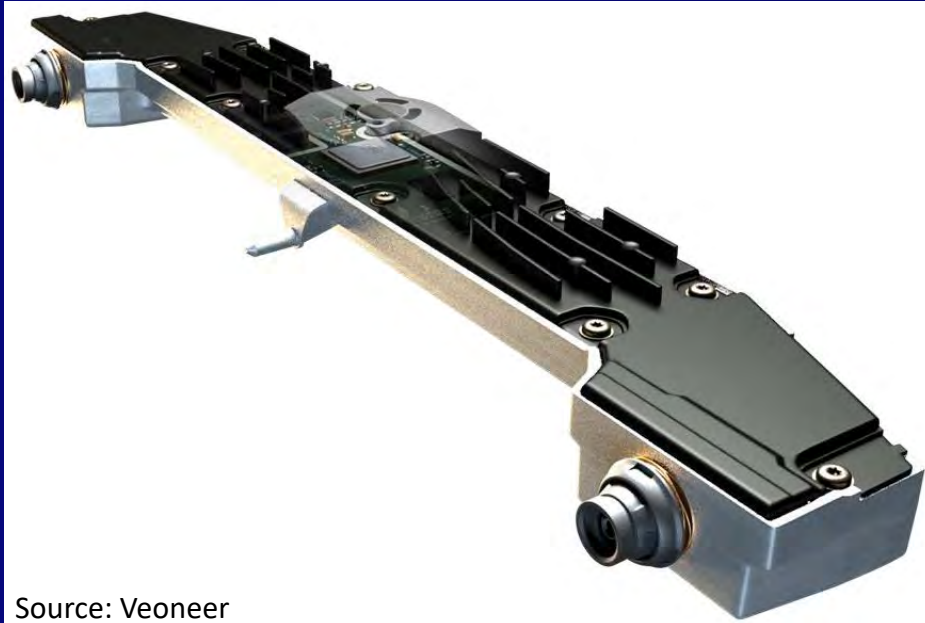


Leveraging ADAS Forward Camera for ICMS

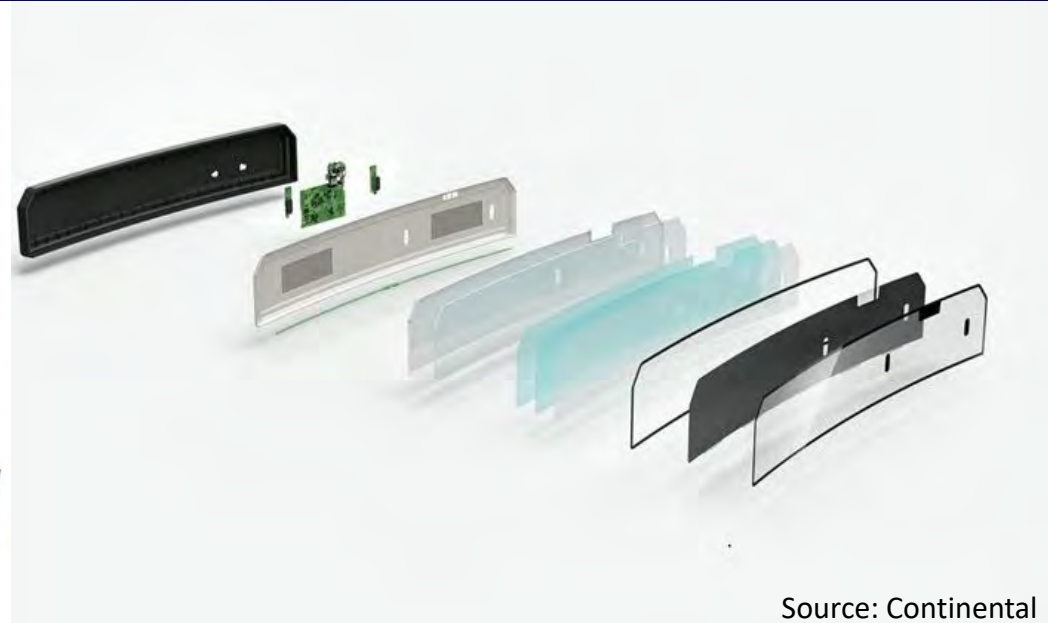


Source: Veoneer

Leveraging ADAS Forward Camera for ICMS

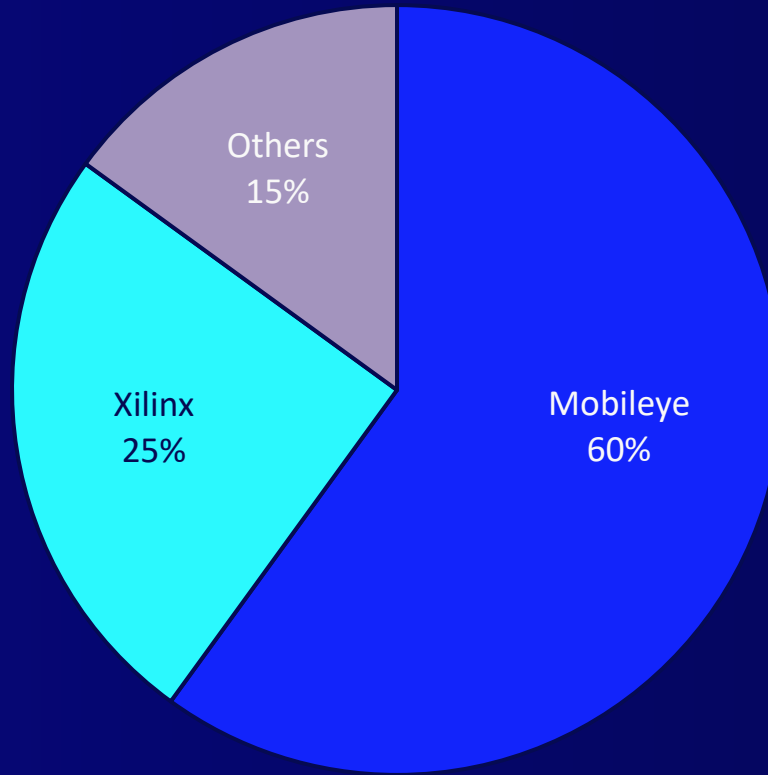


Source: Veoneer

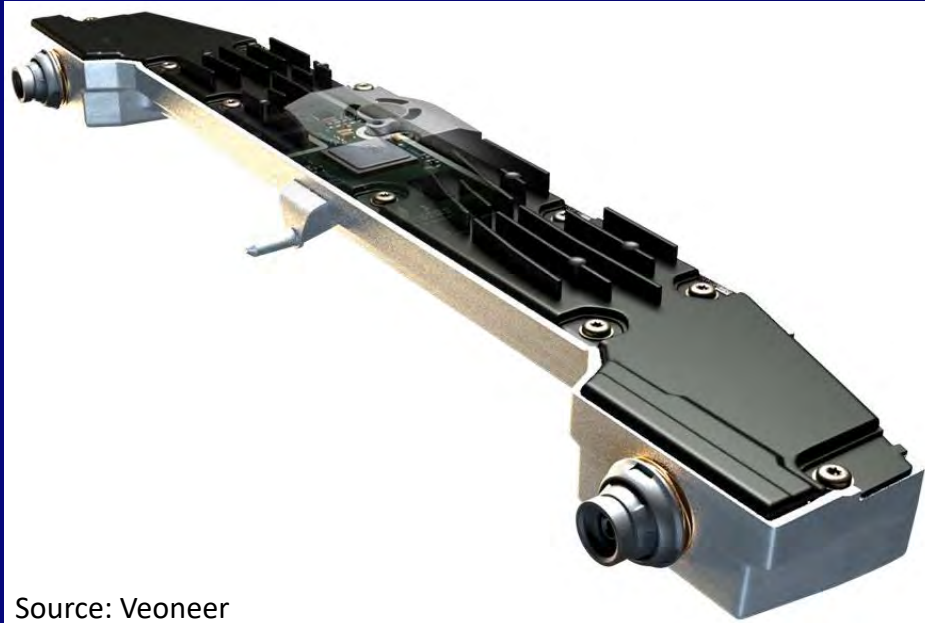


Source: Continental

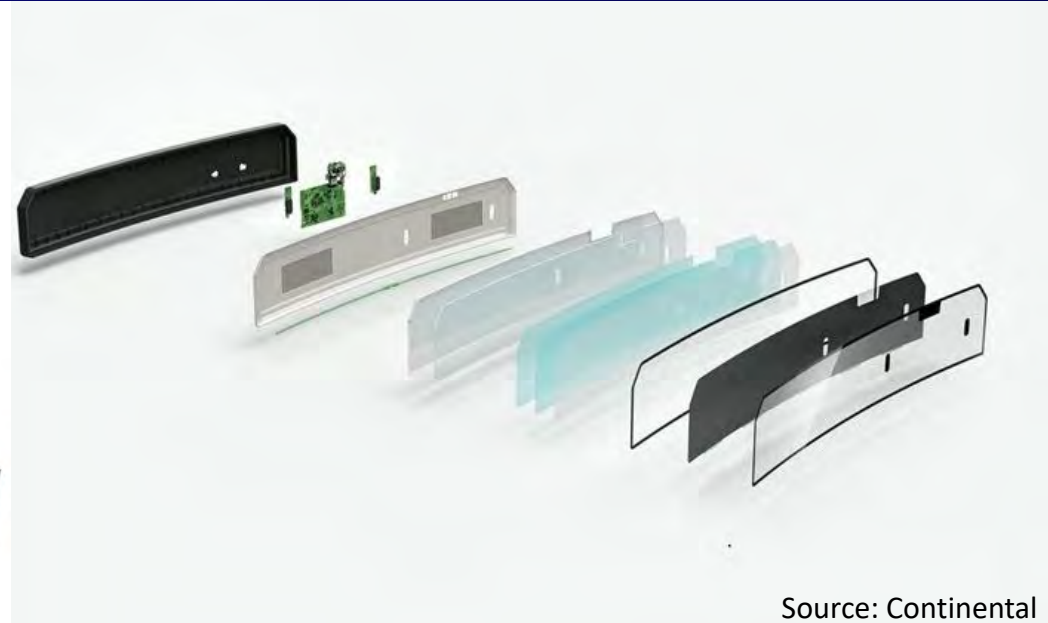
ADAS Forward Camera Market Share Estimates



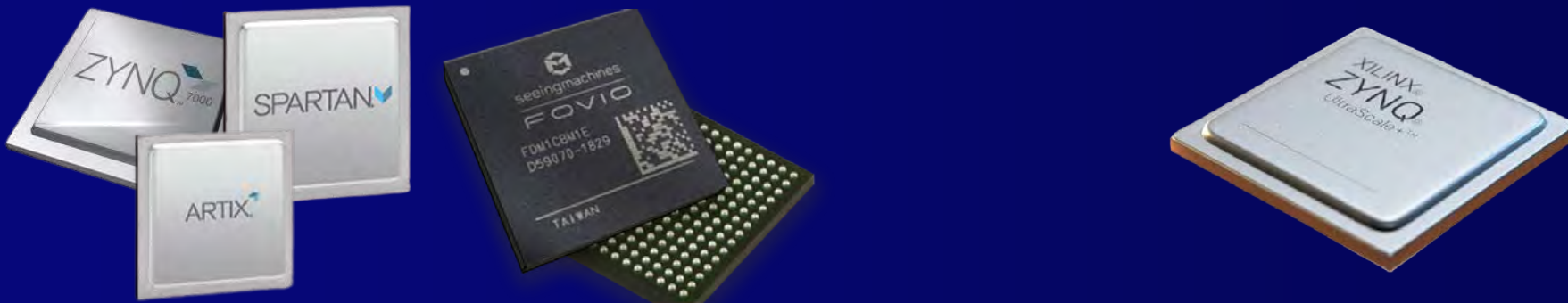
Leveraging ADAS Forward Camera for ICMS



Source: Veoneer



Source: Continental



DMS & ICMS Software Suppliers

- Seeing Machines Super Cruise; Fovio DMS processor; ~6 billion kms naturalistic data
- Smart Eye Head, face and eye tracking; series-production in various BMW models
- Eyesight Technologies Demonstrated algorithms running on Mobileye Open-EyeQ
- Jungo Connectivity DMS & ICMS called CoDriver
- Xperi Established automotive vendor (DTS)

- Others : ADAM, Affectiva, Minieye, Momenta, SenseTime, 30+ suppliers in China

A background pattern of white and light blue circuit traces and nodes on a dark blue background, resembling a printed circuit board (PCB) layout. The traces are of varying thickness and form, with some nodes represented by small circles. The pattern is dense and occupies the entire background.

Thank you

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EE Times