RDW

What if technology takes over all driving tasks?

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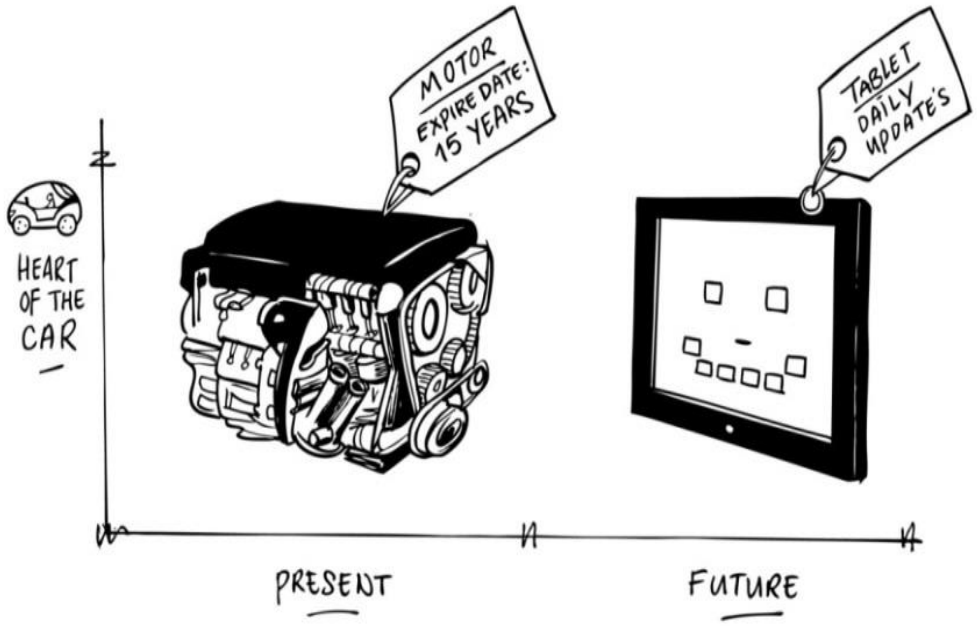
Agenda

1. Human driver in control
2. (Human driver as backup)
3. Human driver not needed



Levels:

1 hands on

2 assisted

3 hands off

4 eyes off

5 mind off

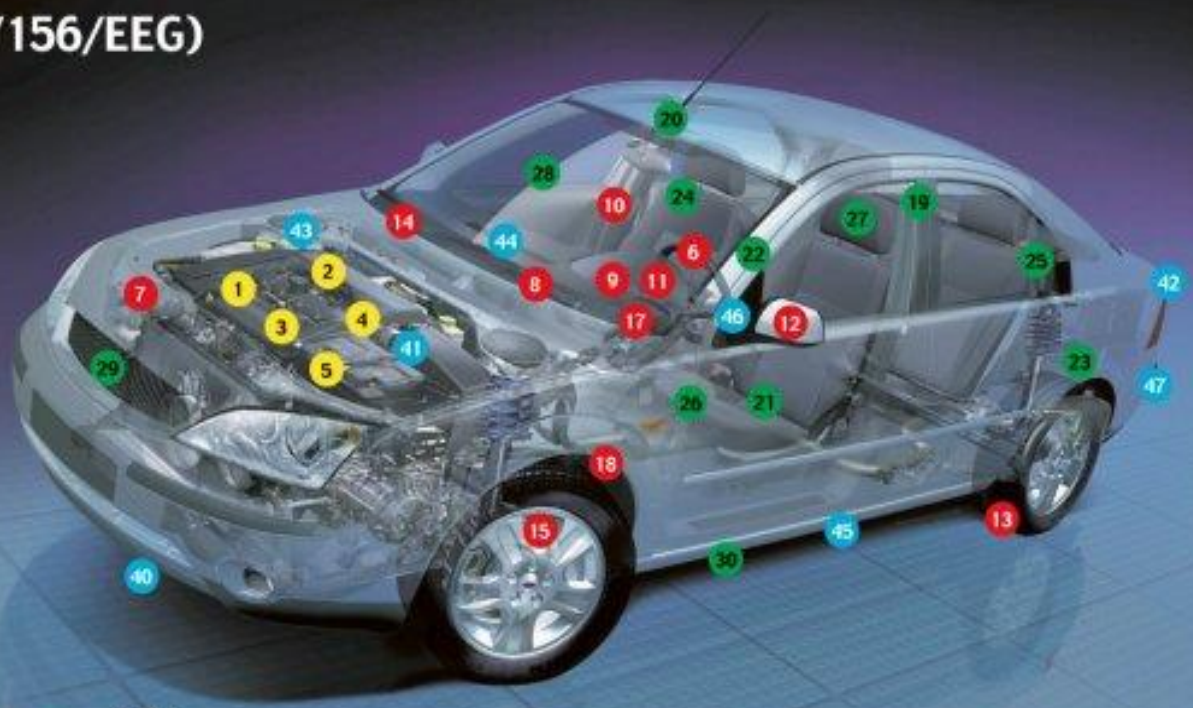
SAE J2016 Levels of Automation

SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring of* Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

1. Human driver in control

Europese typegoedkeuring voor personenauto's

(70/156/EEG)



Milieubescherming

1. Geluidsniveau 70/157/EEG (R51)
2. Emissies 70/220/EEG (R83)
3. Dieselrook 72/306/EEG (R24)
4. Brandstofverbruik 80/1268/EEG (R84)
5. Motorvermogen 80/1269/EEG (R85)

Actieve veiligheid

6. Stuurinrichting 70/311/EEG (R79)
7. Geluidssignaalinrichting 70/388/EEG
8. Ruitenwissers en -sproeiers 78/318/EEG
9. Anti-diefstal/startonderbreker 74/61/EEG (R18+97)
10. Zichtveld 77/649/EEG
11. Snelheidsmeter 75/443/EEG (R39)
12. Achteruitkijkspiegels 71/127/EEG (R46)
13. Banden 92/23 EEG (R30)
14. Ontdooiings- en ontwasemings-inrichtingen 78/317/EEG
15. Remsystemen 71/320/EEG (R13-H)
16. Installatie van verlichting 76/756/EEG (R48)
17. Identificatie van bedieningsorganen 78/316/EEG
18. Wielafschermingen 78/549/EEG

Passieve veiligheid

19. Bevestigingspunten van veiligheidsgordels 76/115/EEG (R14)
20. Scherpe uitwendige delen 74/483/EEG (R26)
21. Sterkte van de zitplaatsen 74/408/EEG (R17)
22. Gedrag stuurinrichting bij botsingen 74/297/EEG (R12)
23. Brandstoftanks 74/221/EEG (R34)
24. Scherpe inwendige delen 74/60/EEG (R21)
25. Veiligheidsgordels 77/541/EEG (R16)
26. Deursloten en scharnieren 70/387/EEG (R11)
27. Hoofdsteunen 78/932/EEG (R25)
28. Veiligheidsruiten 92/22/EEG (R43)
29. Frontale botsing 96/79/EEG (R94)
30. Zijdelingse botsing 96/27/EEG (R95)

Verlichtingscomponenten

31. Retroreflectoren 76/757/EEG (R3)
32. Markerings-, breedte-, achter-, stop- en dagrijlichten 76/758/EEG (R7)
33. Richtingaanwijzers 76/759/EEG (R6)
34. Kentekenplaatverlichting 76/760/EEG (R4)
35. Koplichten 76/761/EEG (R1/5/8/20/31/37/98/99)
36. Mistlichten (voor) 76/762/EEG (R19)
37. Mistlichten (achter) 77/538/EEG (R38)
38. Achteruitrijlichten 77/539/EEG (R23)
39. Parkeerlichten 77/540/EEG (R77)

Overige voorschriften

40. Sleepinrichtingen 77/389/EEG
41. Onderdrukking radiostoring 77/245/EEG (R10)
42. Plaats voor achterkentekenplaat 70/222/EEG
43. Platen en gegevens 76/114/EEG
44. Verwarmingssystemen 78/548/EEG
45. Massa's en afmetingen 92/21/EEG
46. Achteruitrijinrichtingen 75/443/EEG
47. Koppelingen 94/20/EEG (R55)

Rear view mirror (71/127/EEG)

DESIGN SPECIFICATIONS AND TESTS REQUIRED FOR EC COMPONENT TYPE-APPROVAL OF A DEVICE FOR INDIRECT VISION

A. MIRRORS

1. **General specifications**

1.1. All mirrors must be adjustable.

1.2. The edge of the reflecting surface must be enclosed in a protective housing (holder, etc.) which, on its perimeter, must have a value 'c' greater than or equal to 2,5 mm at all points and in all directions. If the reflecting surface projects beyond the protective housing, the radius of curvature 'c' on the edge of the projecting part must be not less than 2,5 mm and the reflecting surface must return into the protective housing under a force of 50 N applied to the point of greatest projection, relative to the protective housing, in a horizontal direction, approximately parallel to the longitudinal median plane of the vehicle.

2. **Dimensions**

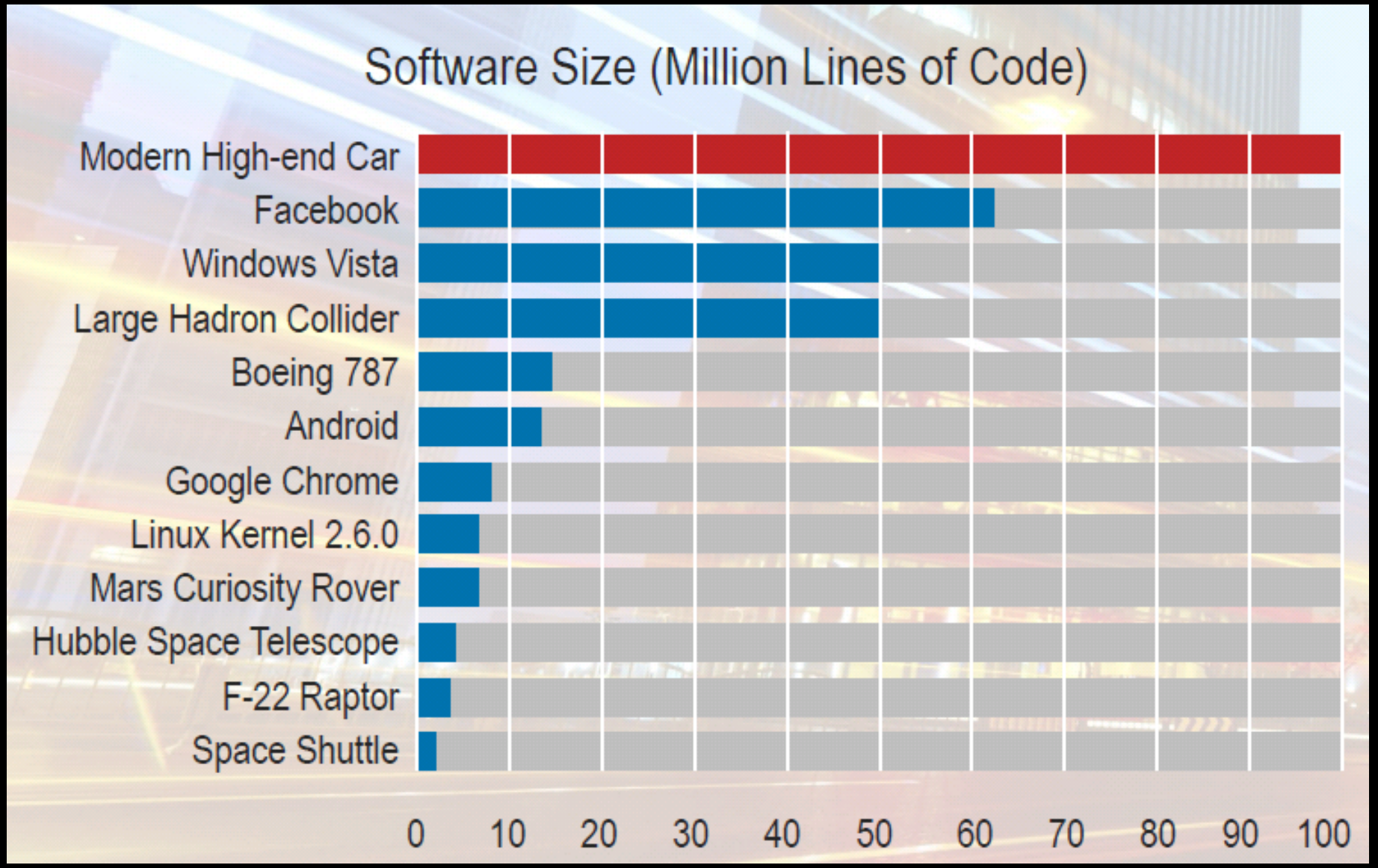
2.1. Interior rear-view mirrors (Class I)

The dimensions of the reflecting surface must be such that it is possible to inscribe thereon a rectangle one side of which is 40 mm and the other 'a' mm in length, where

$$a = 150 \text{ mm} \times \frac{1}{1 + \frac{1\,000}{r}}$$

and r is the radius of curvature.

No room for innovation…


Software Size (Million Lines of Code)
Modern High-end Car
Facebook
Windows Vista
Large Hadron Collider
Boeing 787
Android
Google Chrome
Linux Kernel 2.6.0
Mars Curiosity Rover
Hubble Space Telescope
F-22 Raptor
Space Shuttle
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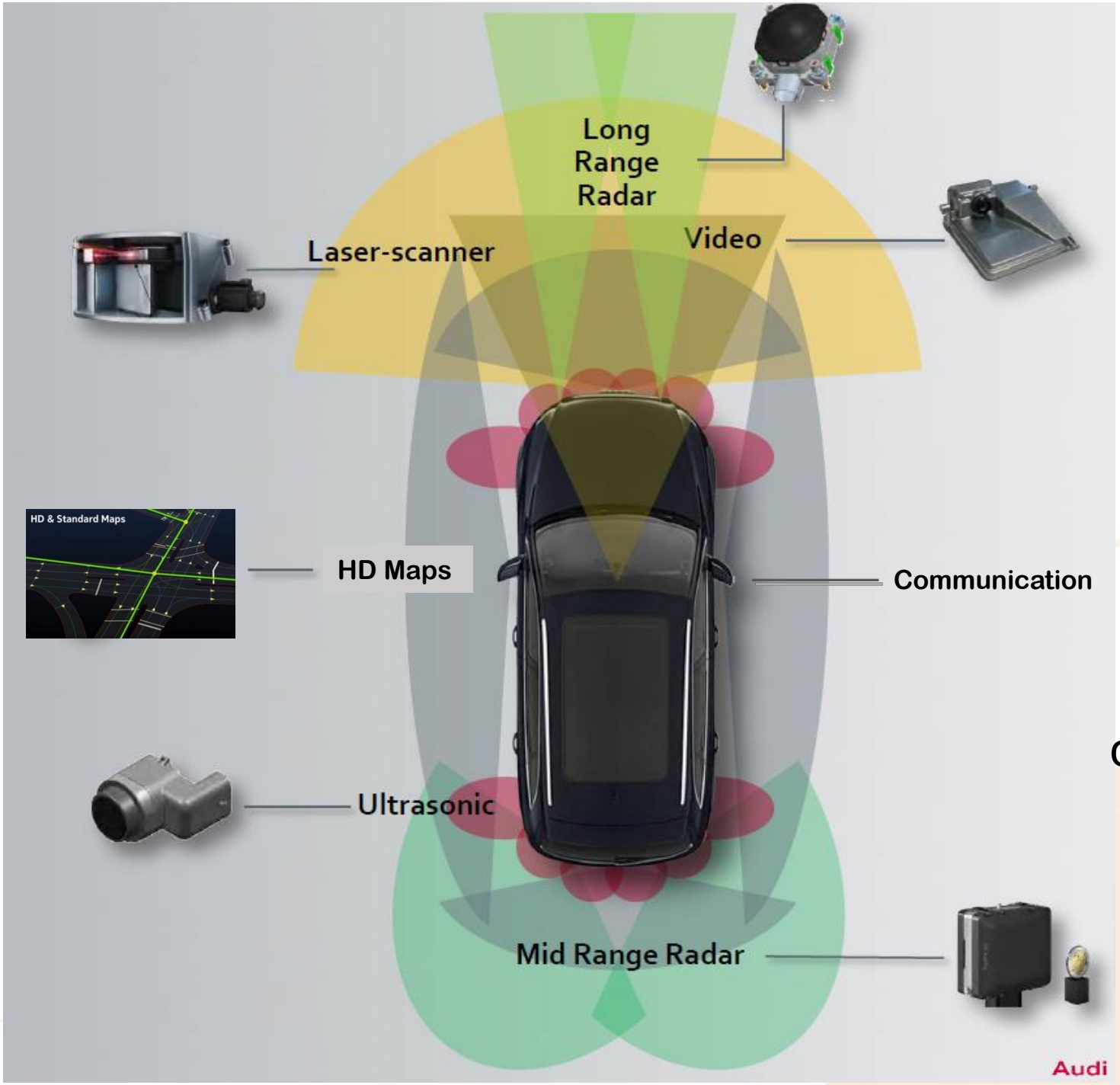


Ever changing

Ever learning

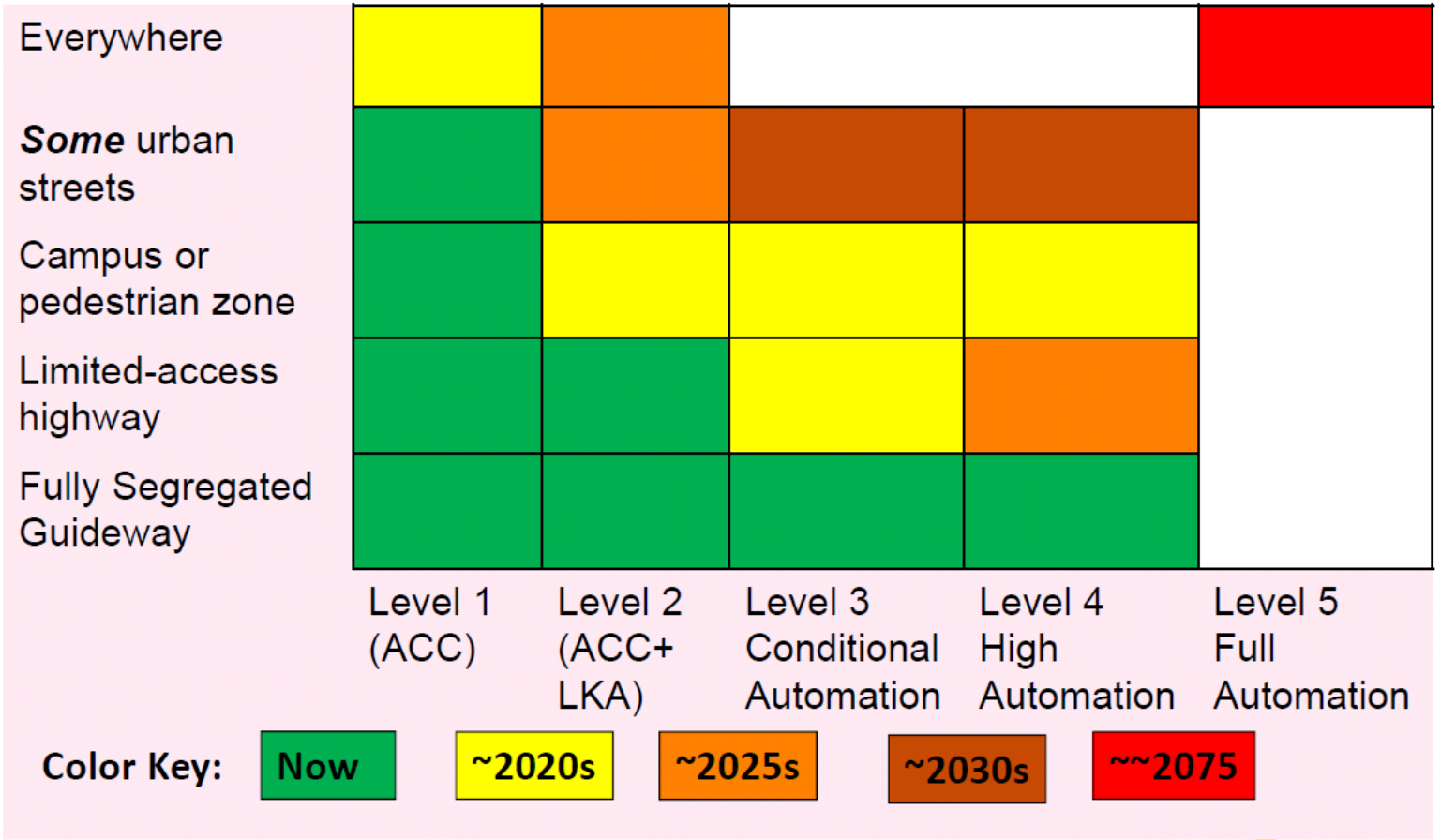
Ever communicating


WINNER SPEDITION
F-3
TRANSPORT
MIĘDZYNARODOWY
SPEDYCJA
TRANS-OIL
STOP
STOP
60
Ego

Can we bridge these gaps?

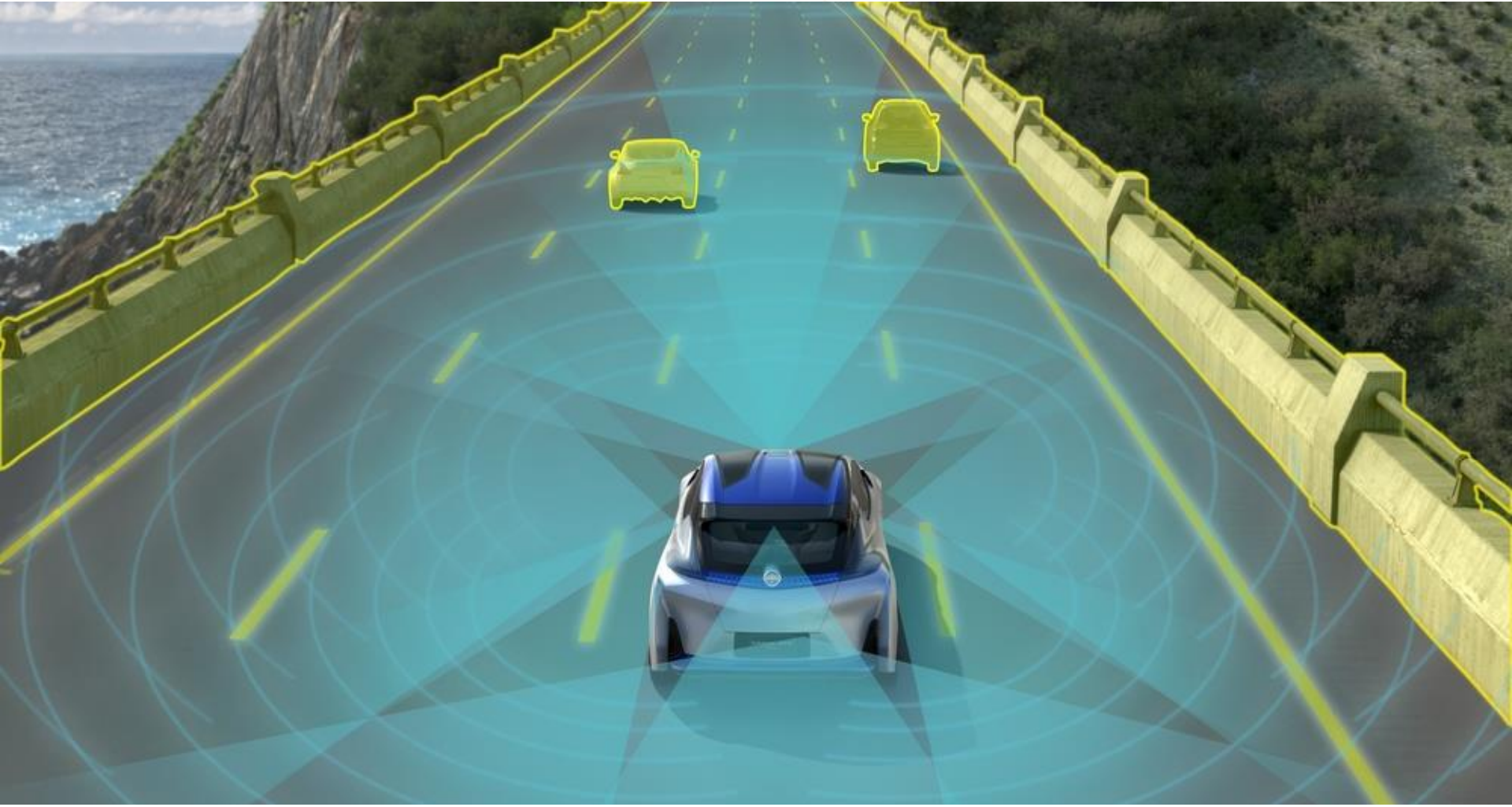
	Human:	Software:
Dealing with unexpected situations:	Very good	Bad
Able to monitor continuously	Bad, easily distracted	Very good
Dealing with all types of infrastructure	Very good	Bad, different risks
Being and staying alert	sometimes good, sometimes bad	Very good
To form a good environmental image	Only around the vehicle	Very good, with communication also for 5 km up the road
trafficmanagement	Moderate, tendency towards egocentric behavior	Very good, programmable

Personal Estimates of Market Introductions *(based on technological feasibility)*



Source: Steven E. Shladover, Sc.D. University of California, Berkeley

PATH



3. Human driver not needed

A driving license for an automated vehicle

Assumptions:

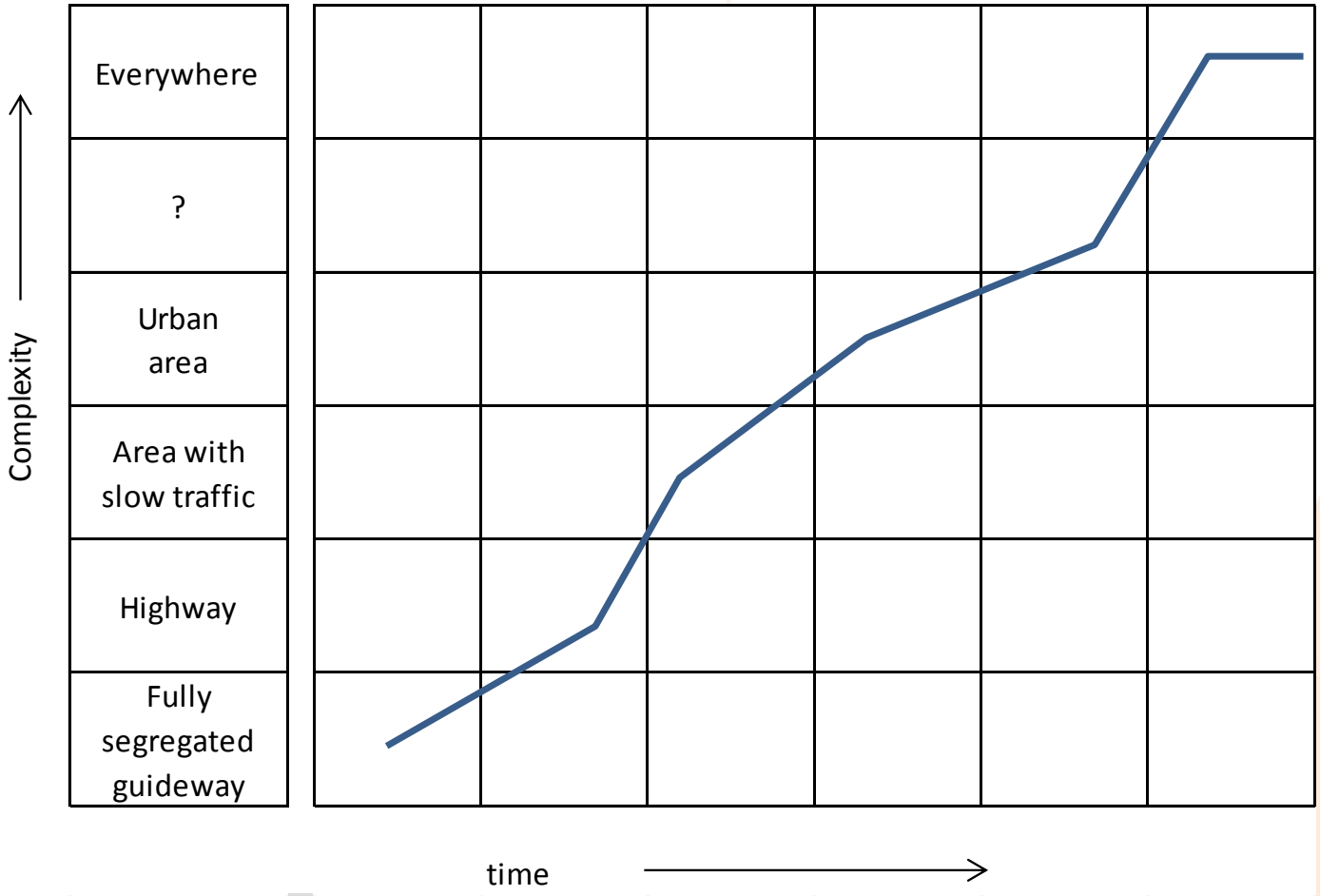
- Level 4 and 5 systems
- Human drivers will be on the road for the coming years, so the automated vehicle has to act like a human
- It's about showing safe and predictable driving behaviour
- Virtual testing and simulations on a closed proving ground will play an important role
- It's a system approach (vehicle-infrastructure-behaviour)

A driving license for an automated vehicle

Intended method:

1. From simulators used for training humans, we know how a good human driver performs in a broad set of traffic situations (use cases)
2. The automated vehicle ‘competes’ in a virtual environment against this human driver
3. To make sure the software is not written especially for the virtual traffic situations, a real life test on a closed proving ground is performed for validation
4. For the specific use cases, the software obtains the driving license
5. This methodology is described in an ISO standard

Driving license?



RDW

Vehicle

Software

Software

Hardware

NEW ADDITION IN THE TYPE APPROVAL PROCESS

SOFTWARE AUTOMATED VEHICLES

Admittance

Virtual testing

Testtrack exam

Surveillance

Safe and predictable traffic behavior of automated systems

PROCESSES ARE SIDE BY SIDE

CURRENT SITUATION

Admittance

European Type Approval

Surveillance

- Manufacturer
- Vehicle
- Driver

Reflections…

- When is the automation robust enough?
- Risk mitigation: mapping all possible traffic situations or mapping possible reaction patterns (steer, brake, accelerate)?
- Is there a QUERTY effect?
  (Infra for human will end up being the infra for CAV)
- Is Artificial Intelligence the way to go?
  (like the unconsciousness human brain: to understand choices, not to make them)

- Do we need to worry?

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