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智慧座艙進化論 Evolving Cockpit

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Make difference

People spend a lot of time in cars



In the US, people drive
8 Hrs 22 Mins per week, or
18 days per year, equal to
11 40-hr **work weeks**

> **130M** Americans (85% workforce) drive to work
~ **28 Mins** avg. one way commute
~ **75%** drive alone



People love their cars

A study sponsored by Cooper Tire in 2019 found:

64% of owners consider their car a friend

52% regret letting go of a particular car

45% cried parting ways with a particular car

70% said they have at least one fond memory of time spent in the car

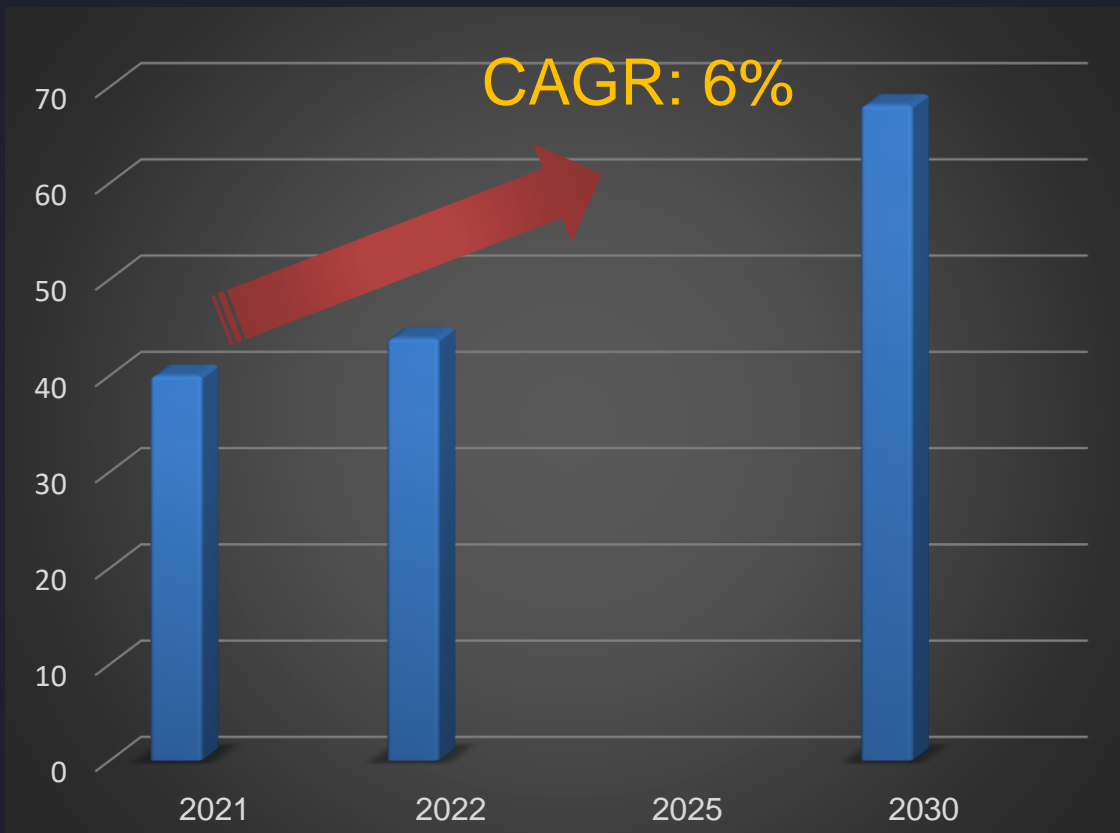


Cockpit, the 3rd living space



photo by Jimmy Conover on Unsplash

Market Value of Smart Cockpit



Global market value:

\$40B in 2021 and will grow to **\$43.88B** in 2022 and **\$68.1B** by 2030.

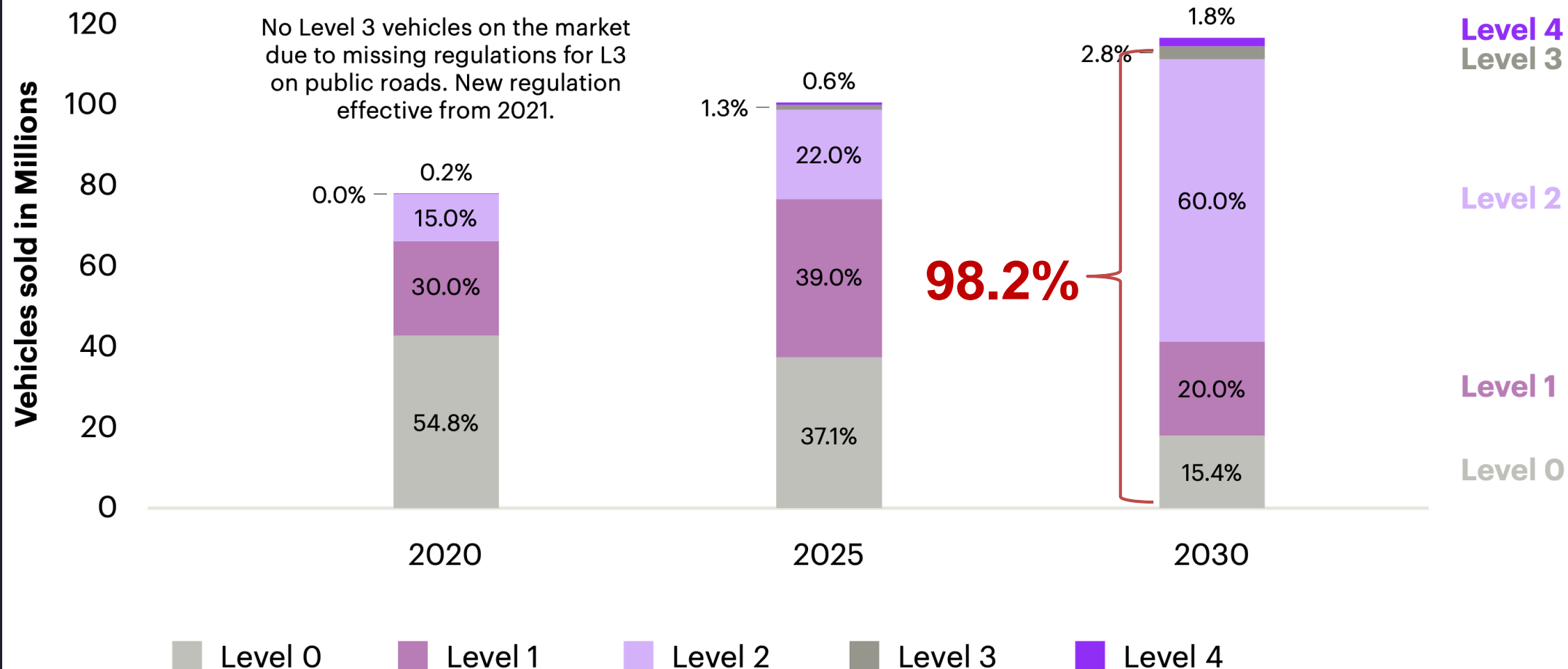
China will take up 35% of the market share by 2030, or \$23.9B, increasing from 20% market share in 2021, CAGR: 13%. (source: IHS Markit)

Scenario: Smart Cockpit on L0-L3 Cars

L3 (& L4) acquire small share in 2030, although the 1st L3 car launched last year

Market share Autonomous Vehicles | Yearly new vehicle sales

(Passenger cars + light commercial vehicles (under 6 tons))



Drivers has to drive on L0-L3 cars

SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
You <u>are</u> driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You <u>are not</u> driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”		
You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
Copyright © 2021 SAE International.					
These are driver support features			These are automated driving features		
These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met you are able to drive	This feature can drive the vehicle under all conditions	
<ul style="list-style-type: none">• automatic emergency braking• blind spot warning• lane departure warning	<ul style="list-style-type: none">• lane centering OR• adaptive cruise control	<ul style="list-style-type: none">• lane centering AND• adaptive cruise control at the same time	<ul style="list-style-type: none">• traffic jam chauffeur	<ul style="list-style-type: none">• local driverless taxi• pedals/steering wheel may or may not be installed	<ul style="list-style-type: none">• same as level 4, but feature can drive everywhere in all conditions

source: SAE, 2021

Needs: travelling from A to B



safely



efficiently



joyfully

(actually you need a good companion)

The Origin of Cockpits



First Modern Car – 1885, Carl Benz

The Origin of Cockpits

- from AM to Apple



AM Radio

1930s



FM Radio

1950s



8-track cassette

1970s

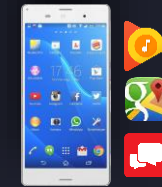


CD

1990s



BT for
hands-free



phone-link

2010s



compact cassette



GPS Navi



internet radio

Safety is the most important!



Distracted Driving



Taking your
eyes off
the road



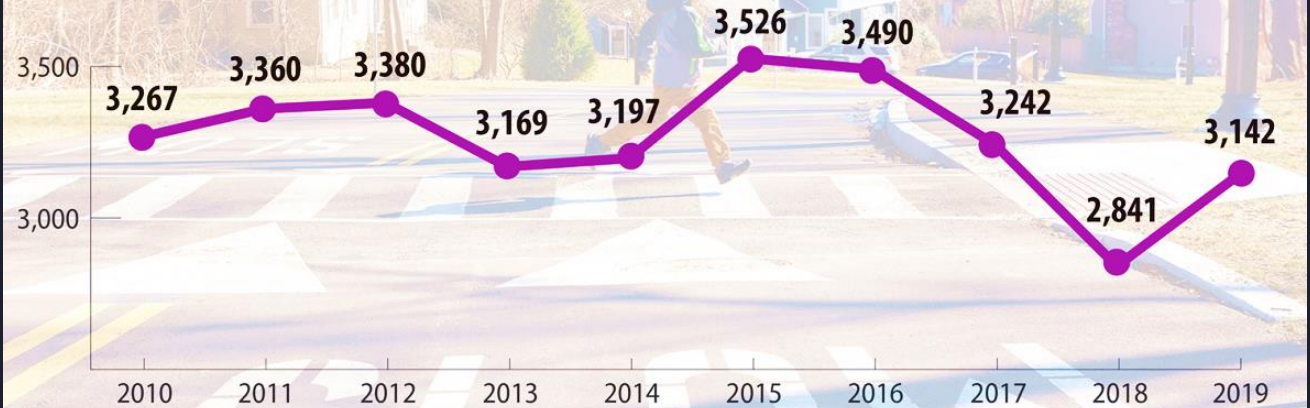
Taking your
hands off
the wheel



Taking your
mind off
driving

About **3,000 people die** in crashes involving a distracted driver every year.

U.S. motor vehicle crash deaths—National Highway Traffic Safety Administration, 2010-2019



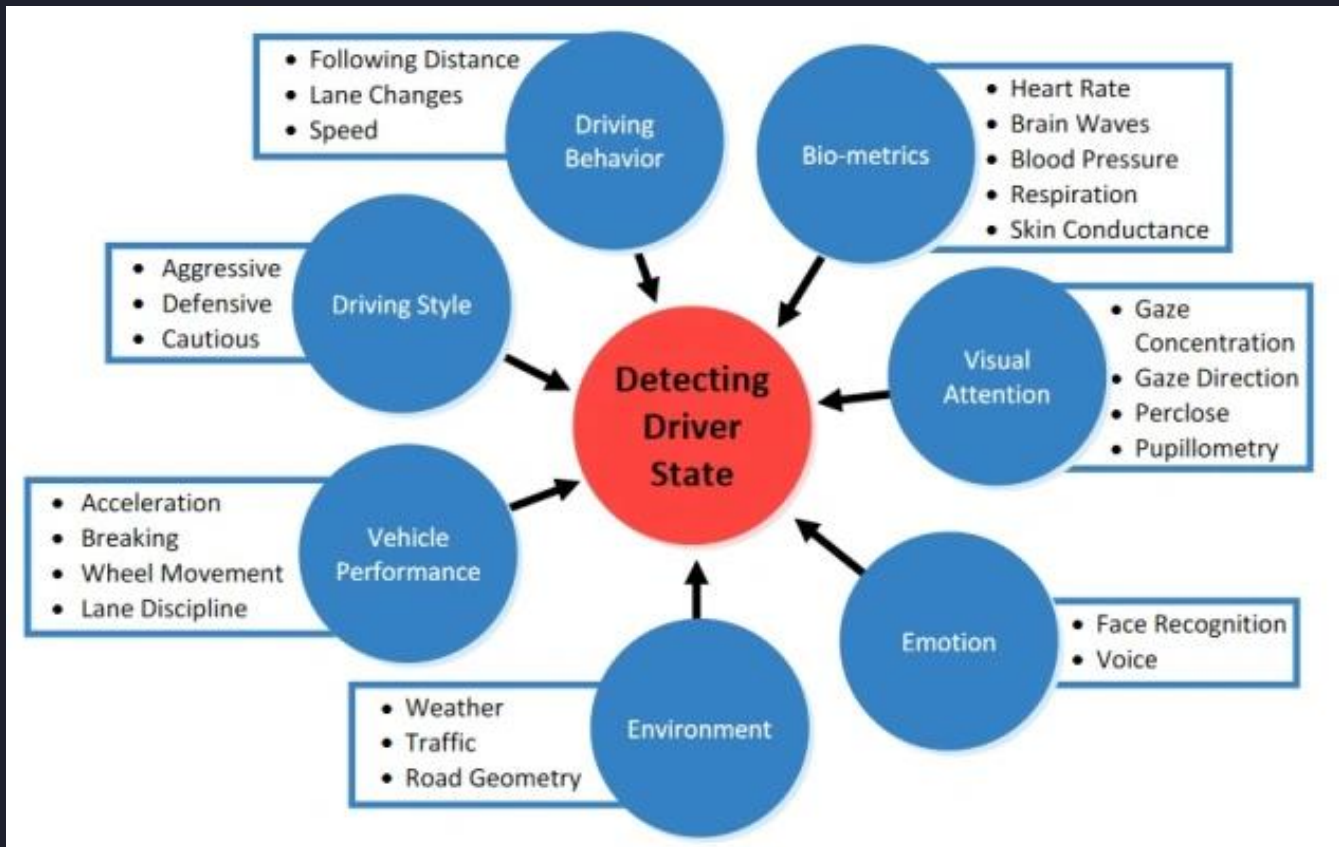
www.cdc.gov

A NHTSA study states that **80%** of **accidents** and **16%** of **highway deaths** are the results of distracted drivers.



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Driver Monitoring System



source: EETimes; IEEE Pervasive Computing

Requirements:

■ Distraction

- Long, Short, Phone Use

■ Fatigue

- Drowsy, Microsleep, Sleep

■ Unresponsive Driver

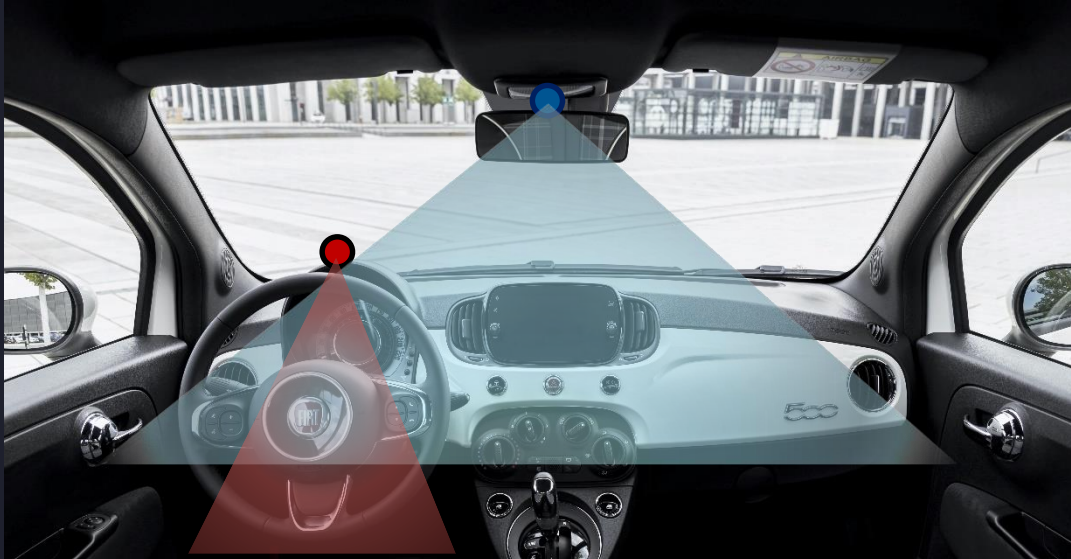
(Euro NCAP ASSESSMENT PROTOCOL – SAFETY ASSIST V10.1)

Challenges:

- Various light conditions (day, night, direct sun)
- Various accessories (glasses, sunglasses, hat, mask)
- A drowsy dummy?



Driver Monitoring System – Vision-based



source: AutoSys



More Safety Assistance

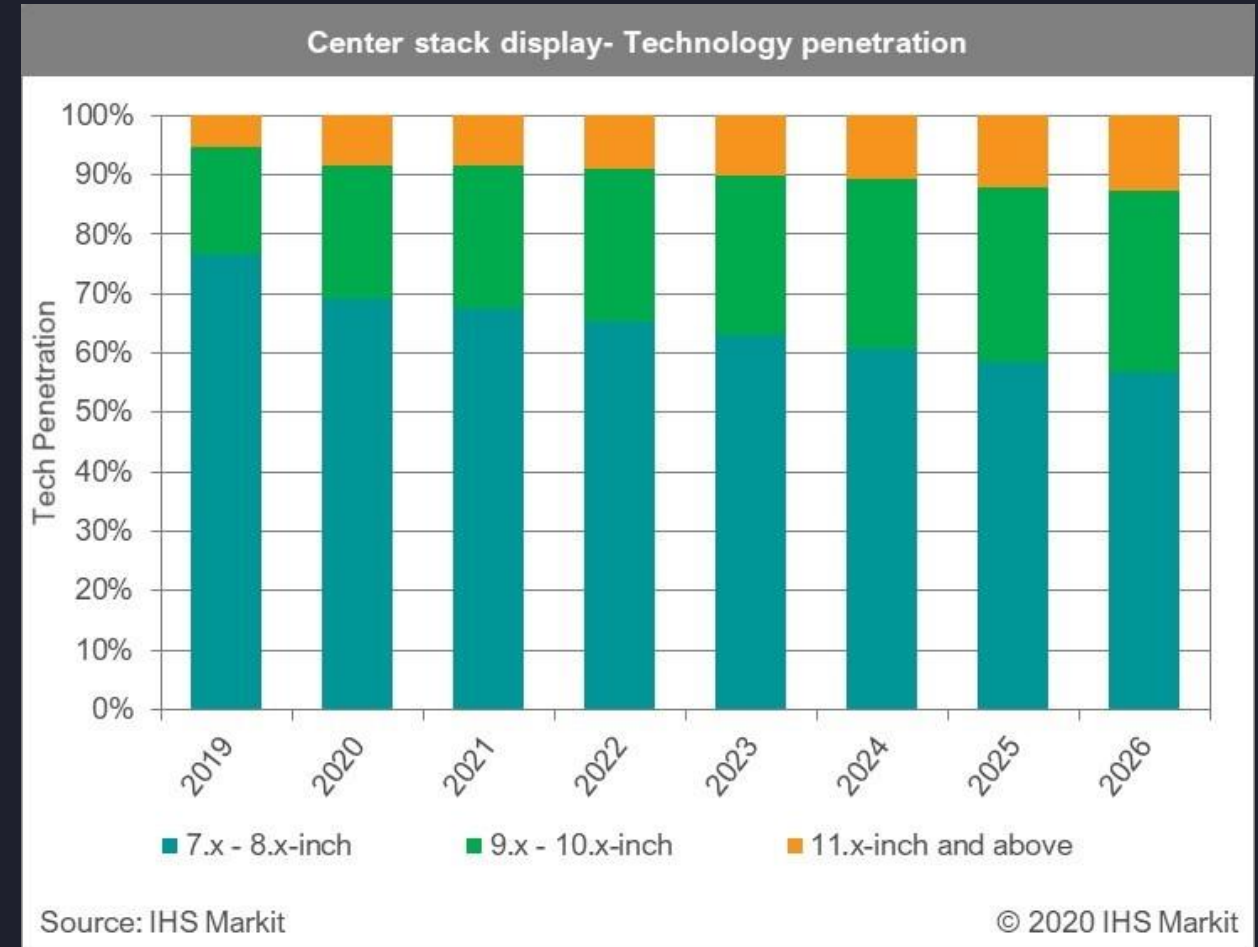
■ Displays delivering critical information to the driver

■ HUD

■ E-mirrors with object detection

■ Larger CID (majority: 10"-12")
with safer HMI design (tasks
< 2s)

■ Voice Assistant



Smartphone Connectivity – Voice Control

Eye tracking analysis: mean time (sec) spent looking at the IVI system (Android Auto)

Task		Voice	Touch
	Spotify	4	20
	Radio	6	16
	Navi to railway station	4	16
	Navi to restaurant/gas station	4	21
	Reading 1st text	5	5
	Reading 2nd text & making a call	9	29

Red text: failed to meet NHTSA guidelines

Apple CarPlay and Android Auto were 5 sec, or **24% faster**, than a vehicle's native system when making a call and 15 sec, or **31% faster**, when navigating.

(source: AAA Foundation for Traffic Safety, 2018)



source: TRL Limited, 2020

Efficiency

- 停車暫借問?
- Co-pilot (with a map)
- Smart Navigation
 - smartphone link with most updated road info, voice control, and LBS

At WWDC 2022, Apple showed the penetration rate and demand for CarPlay

98%

Availability in the US



79%

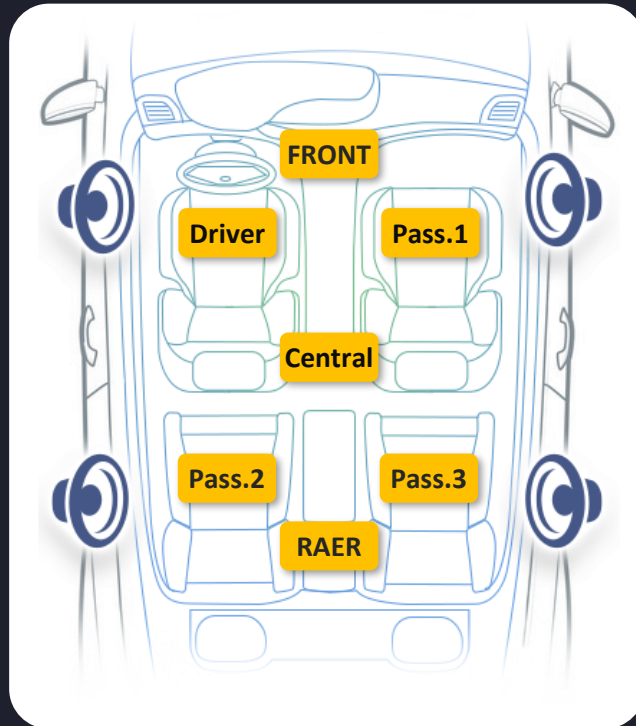
US buyers only consider CarPlay-capable vehicles



Threatened, but finally most of the carmakers adopted CarPlay and/or Android Auto features.

Joy – In-cabin Acoustics

Sound Field with IMS



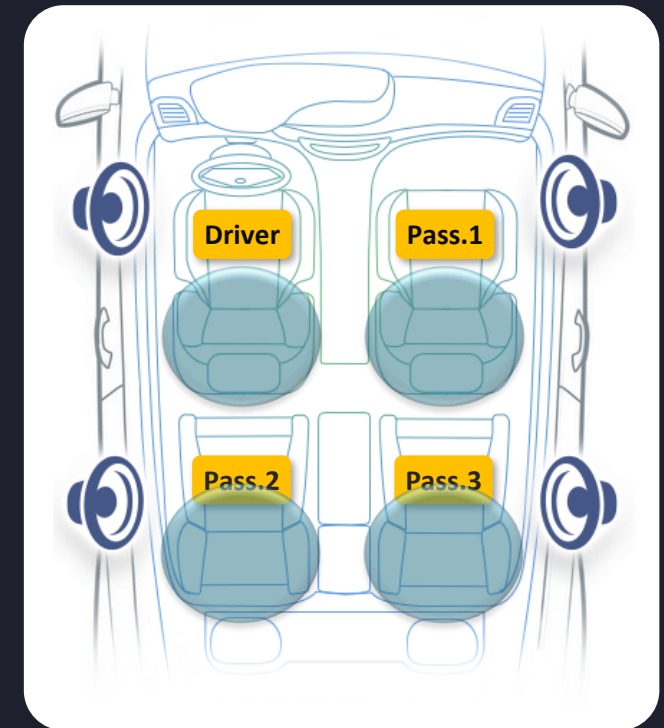
The IMS sees the occupants and feeds the info to IVI for optimal sound field settings.

Immersive Sound



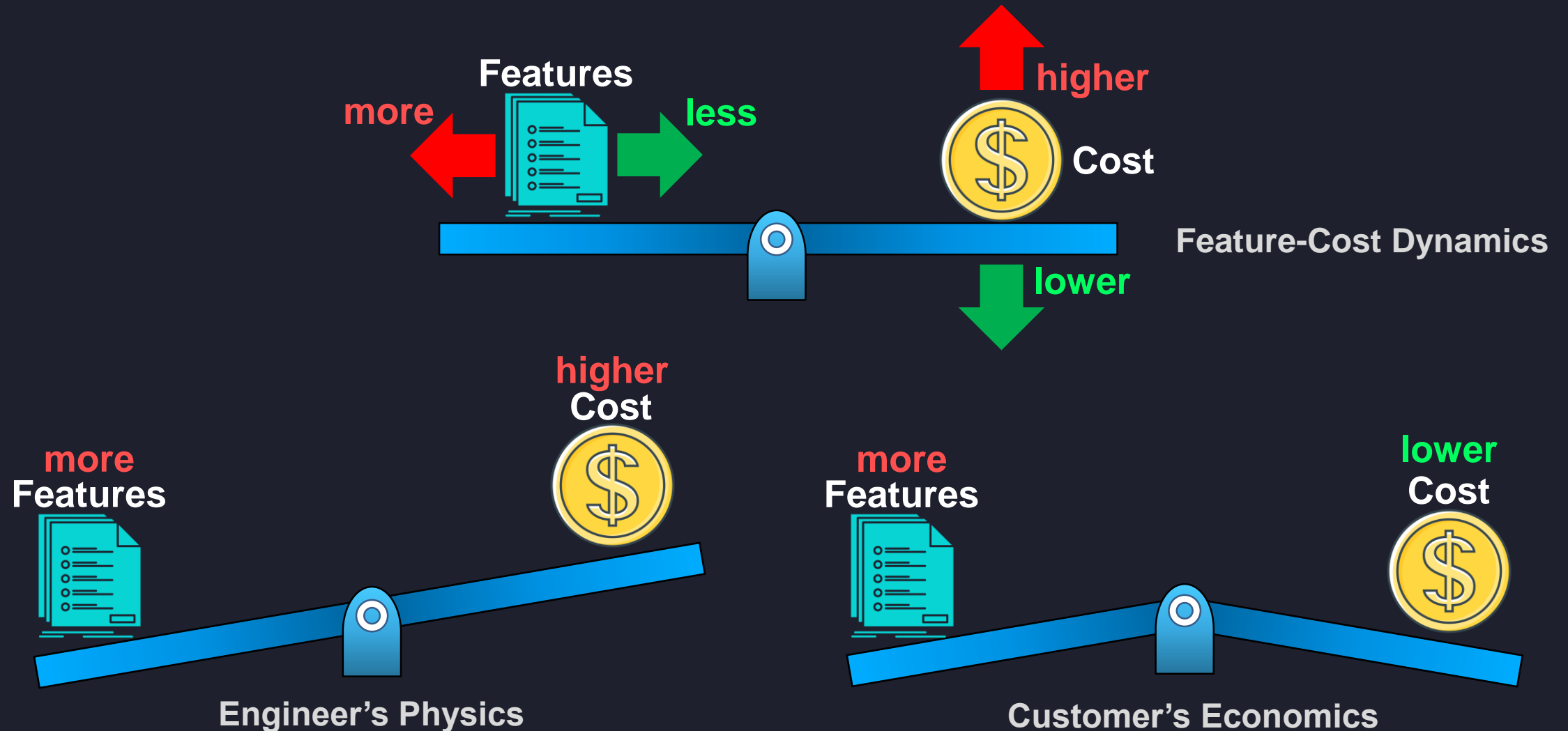
Bringing the 3D surround technology, such as Dolby Atmos™, or Sunplus Spatial Sound to the cabin.

Sound Bubble (w/ ANC)

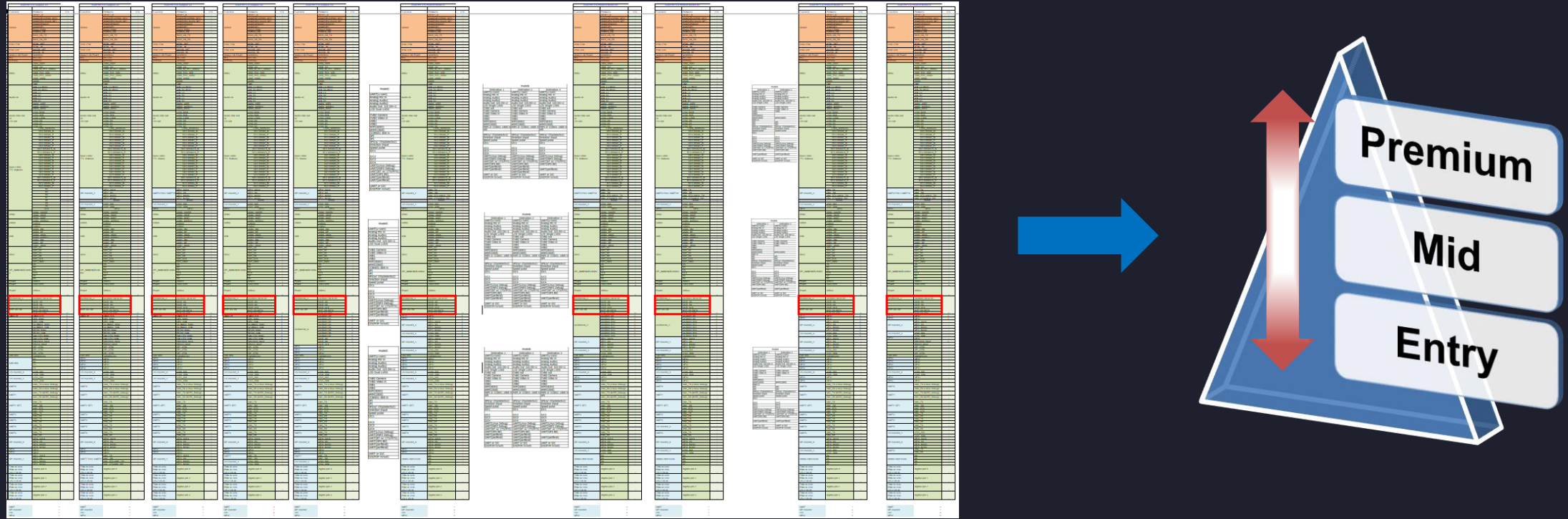


Giving every occupants a quiet zone, or independent listening zone.

Challenges of Cockpit SoC – Features vs Cost



Challenges of Cockpit SoC – One Platform for All Segments

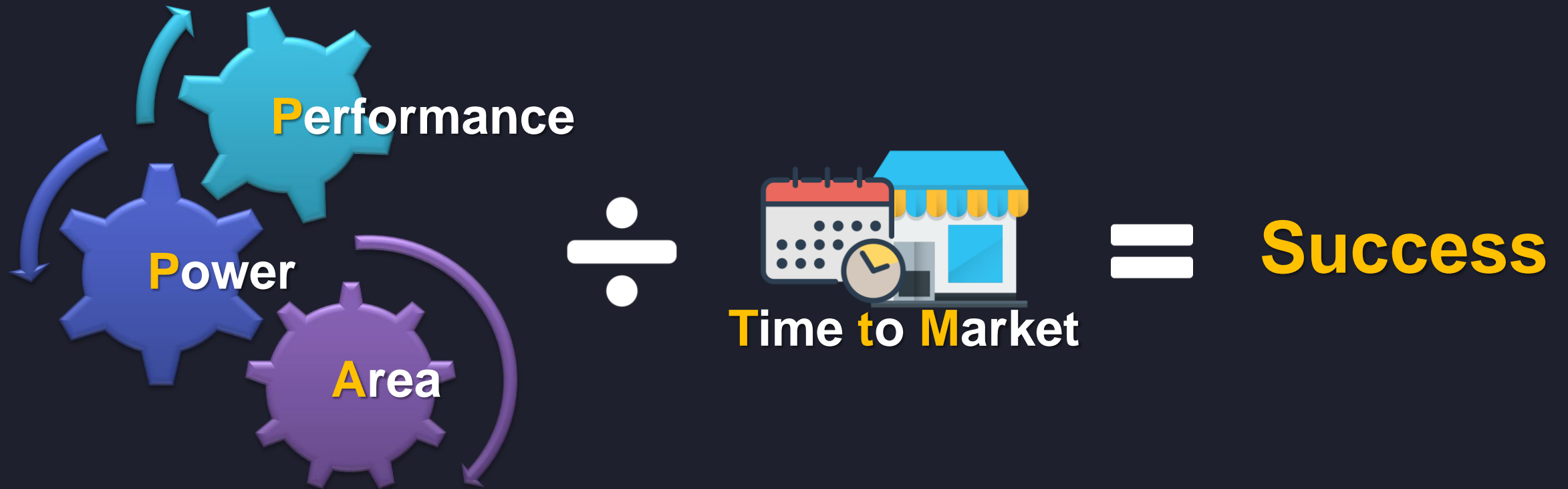


Needs: numerous and various video inputs and outputs, external devices, sufficient computing capacity for all segments

Requirement: one platform for aftermarket and OE

Reason: the development and verification cost of a platform is huge

Challenges of Cockpit SoC – PPA / TTM



Start from needs.



safety



efficiency



joy



Make difference

Thank You

