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智慧座艙進化論
Evolving Cockpit

凌陽科技 車用產品中心 林至信

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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

(*source: the US Census Bureau; OnePoll*)

photo by Alora Griffiths on Unsplash

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

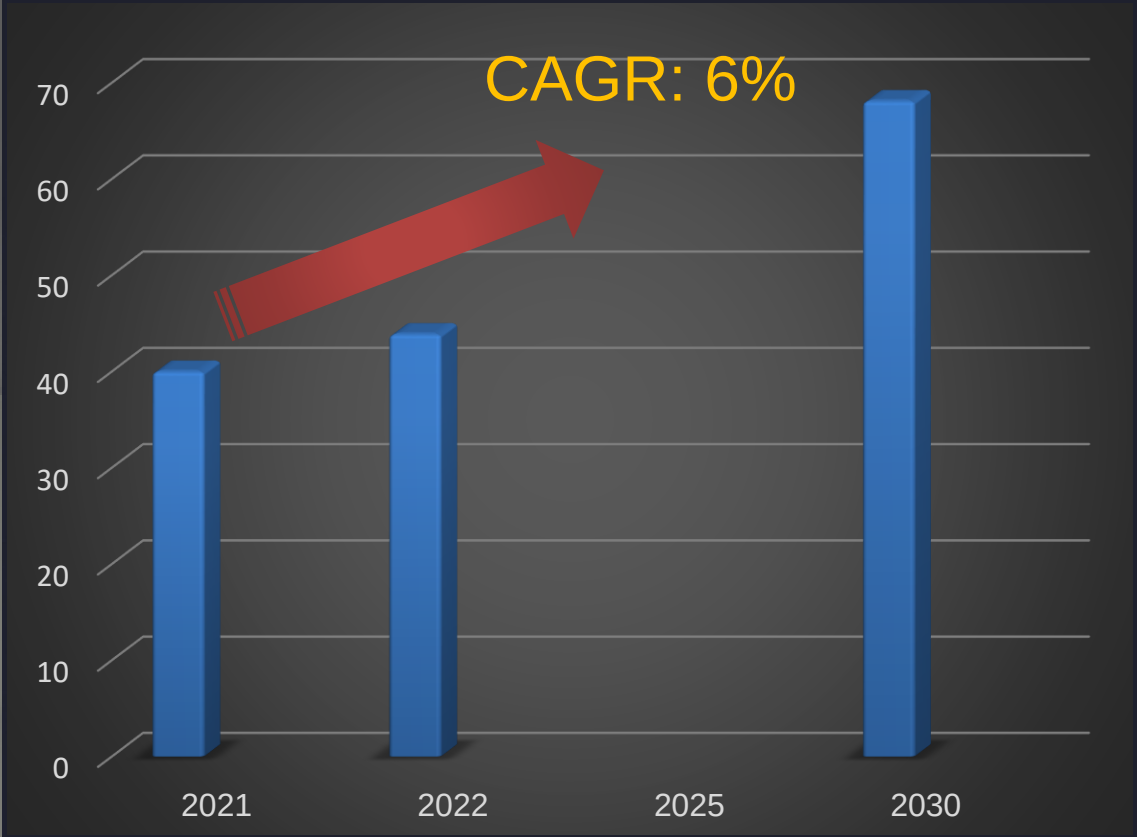
45% cried parting ways with a particular car

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

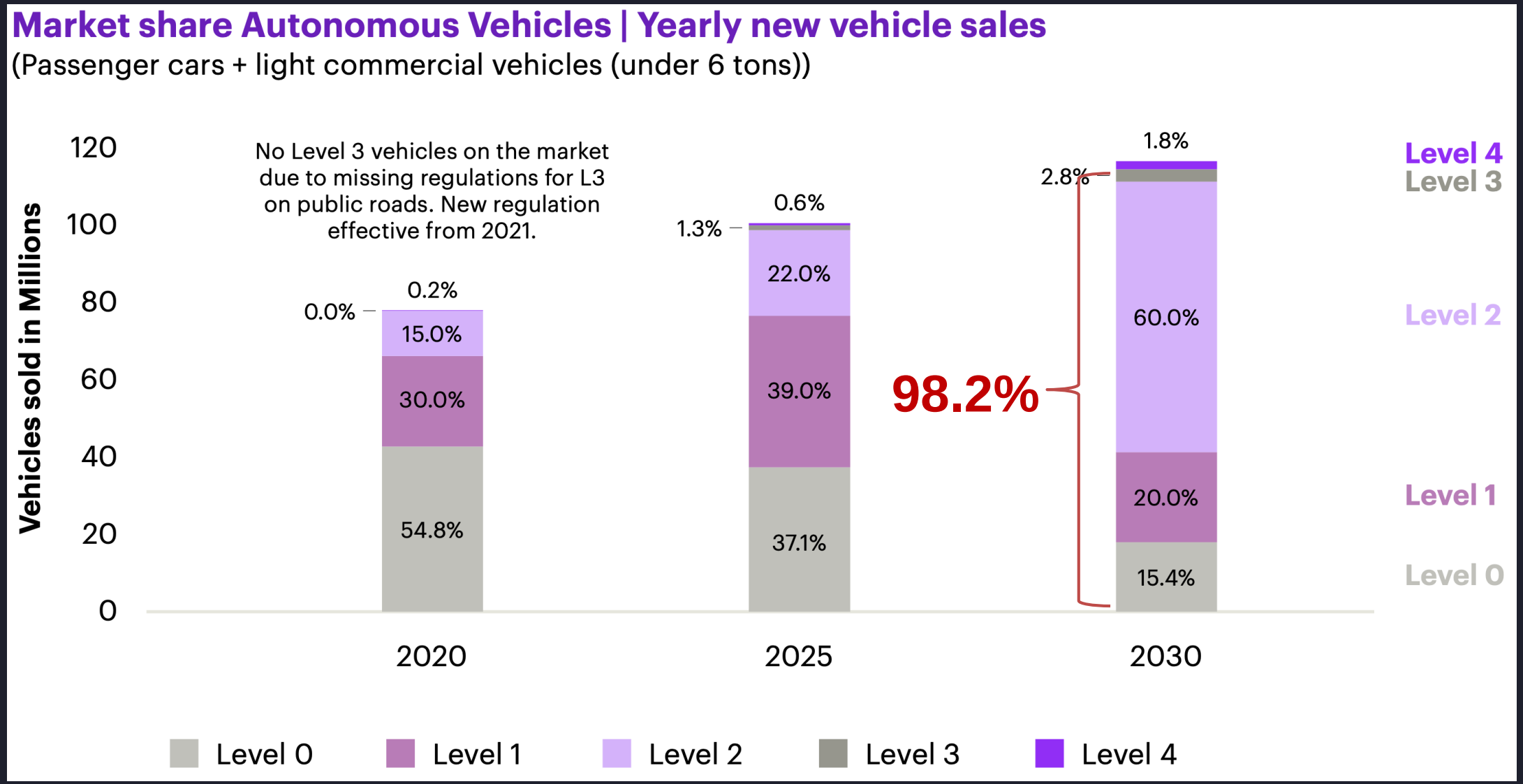
$43.88B in 2022 and

$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*)

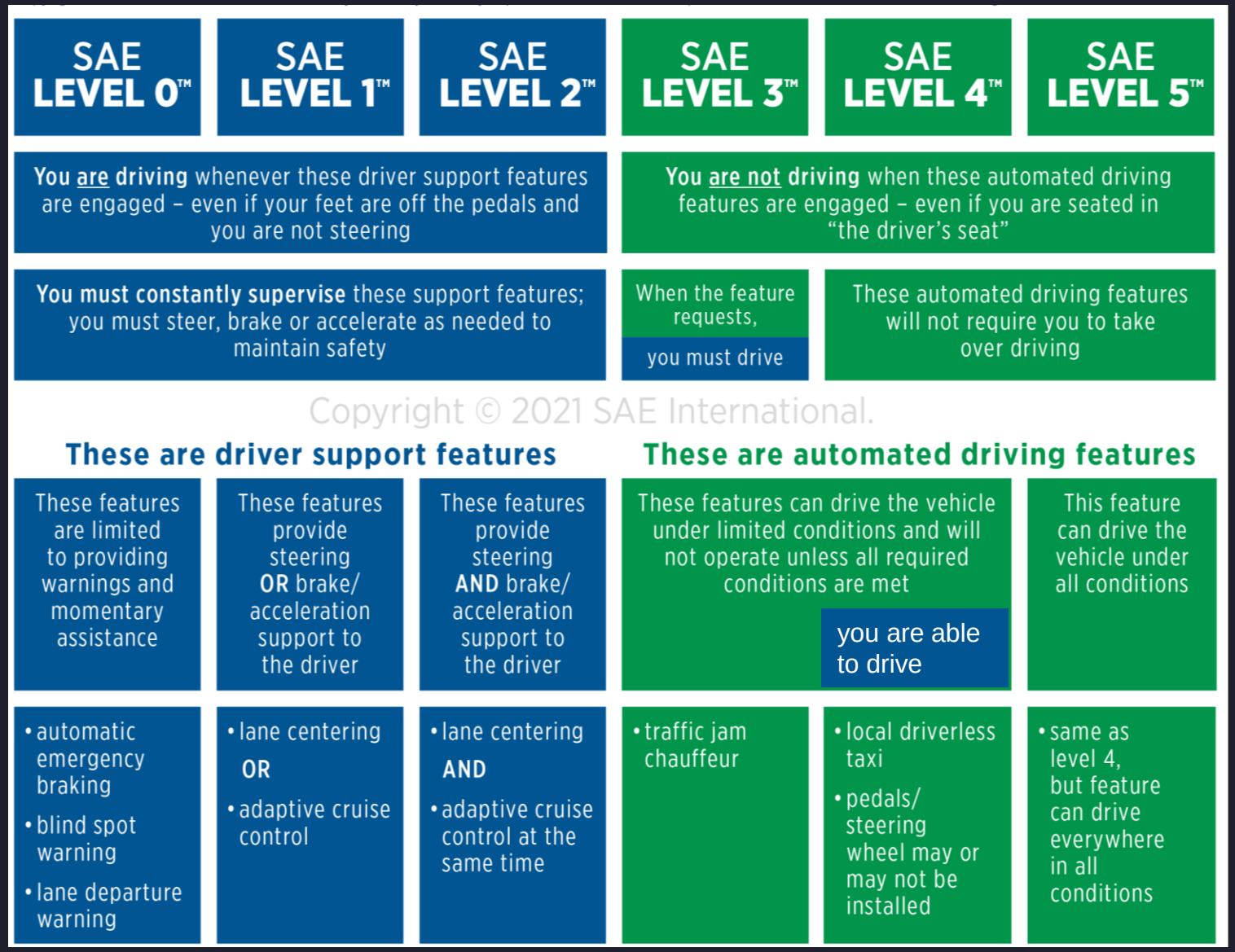
Scenario:
Smart Cockpit on L0-L3 Cars

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



source: Accenture, 2021

Drivers has to drive on L0-L3 cars



source: SAE, 2021

Needs: travelling from A to B

safely **efficiently** **joyfully**

(actually you need a good companion)

photos: Unsplash

The Origin of Cockpits

First Modern Car – 1885, Carl Benz

The Origin of Cockpits - from AM to Apple

8-track cassette

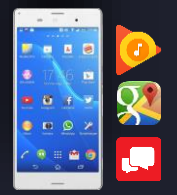
SiriusXM SATELLITE RADIO

AM Radio

FM Radio

CD

BT for hands-free



phone-link

1930s — 1950s — 1970s — 1990s — 2010s

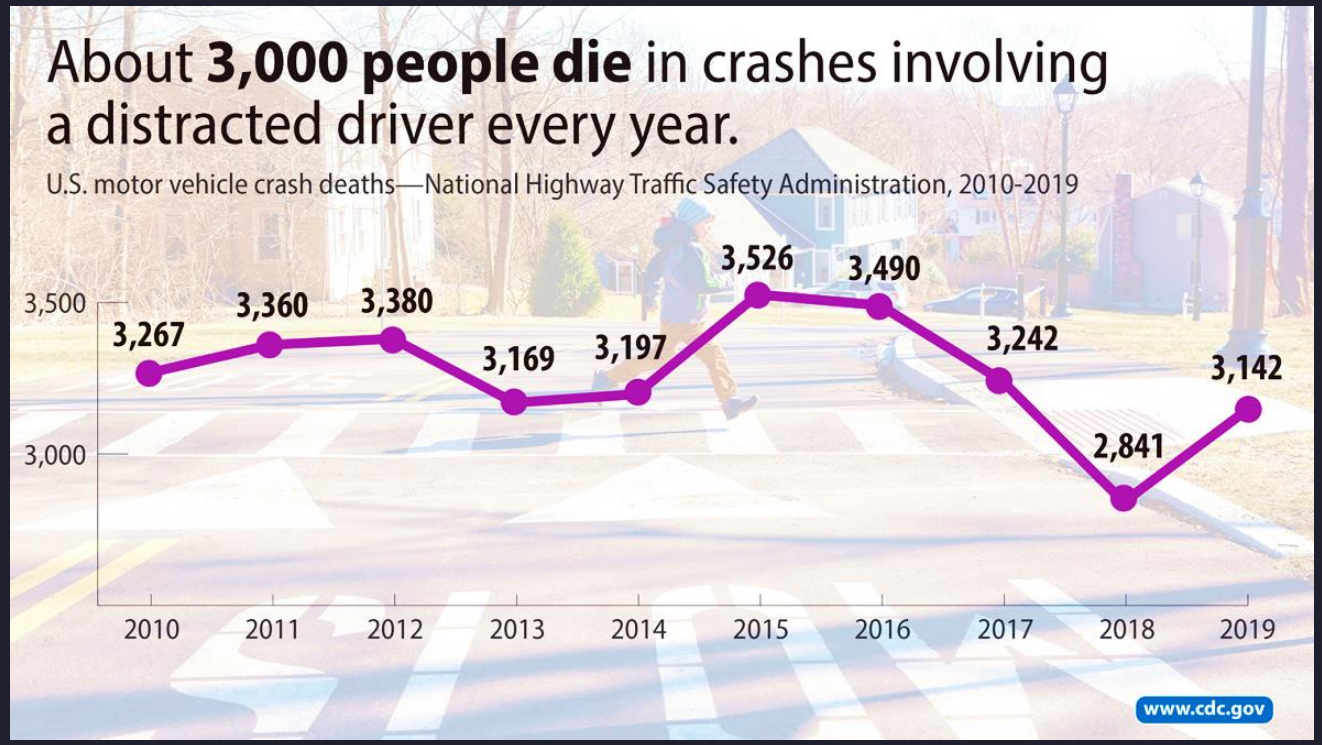
compact cassette

GPS Navi

internet radio

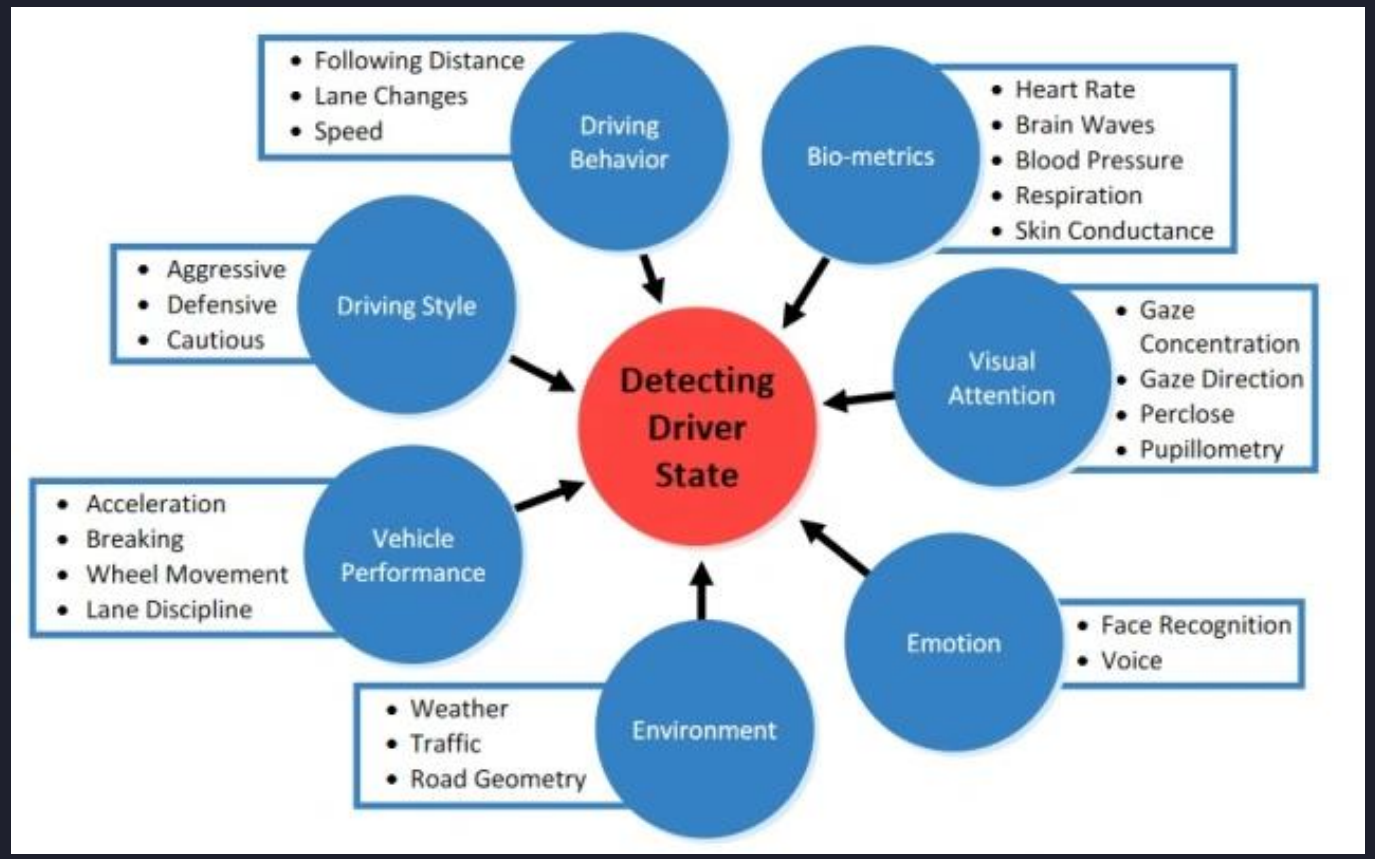
Safety is the most important!

Distracted Driving



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

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:

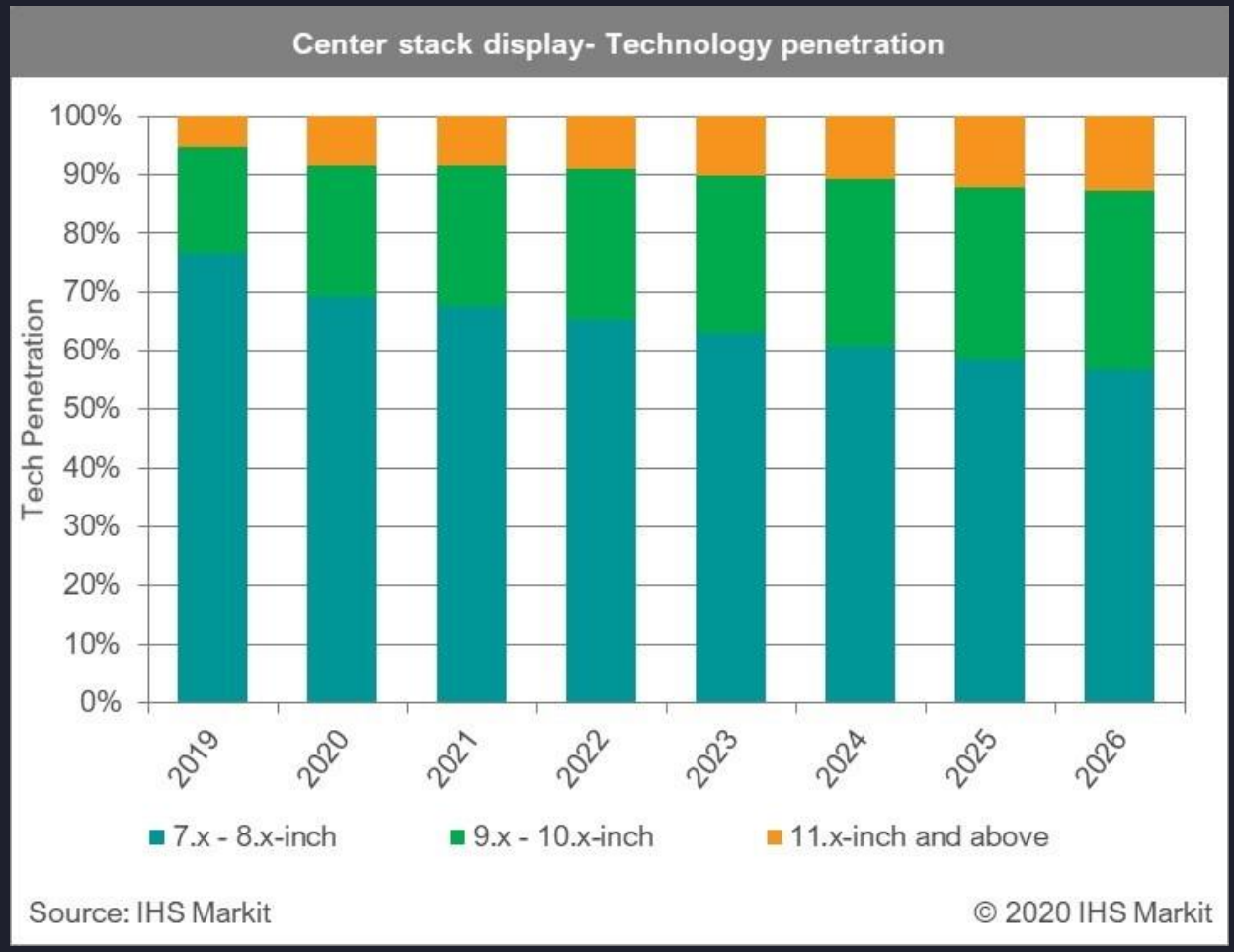
- Various light conditions (day, night, direct sun)
- Various accessories (glasses, sunglasses, hat, mask)
- A drowsy dummy?

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

source: TRL Limited, 2020

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.

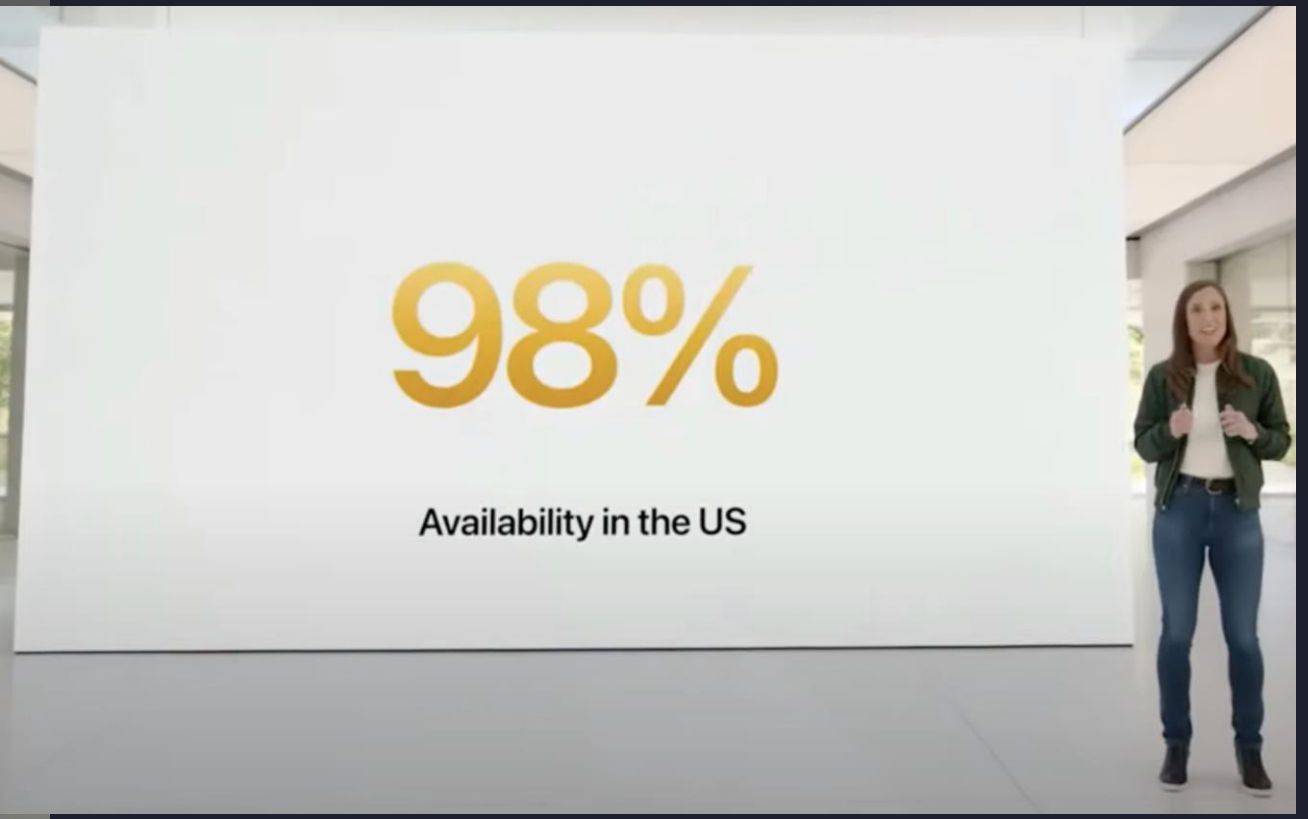
(*source: AAA Foundation for Traffic Safety, 2018*)

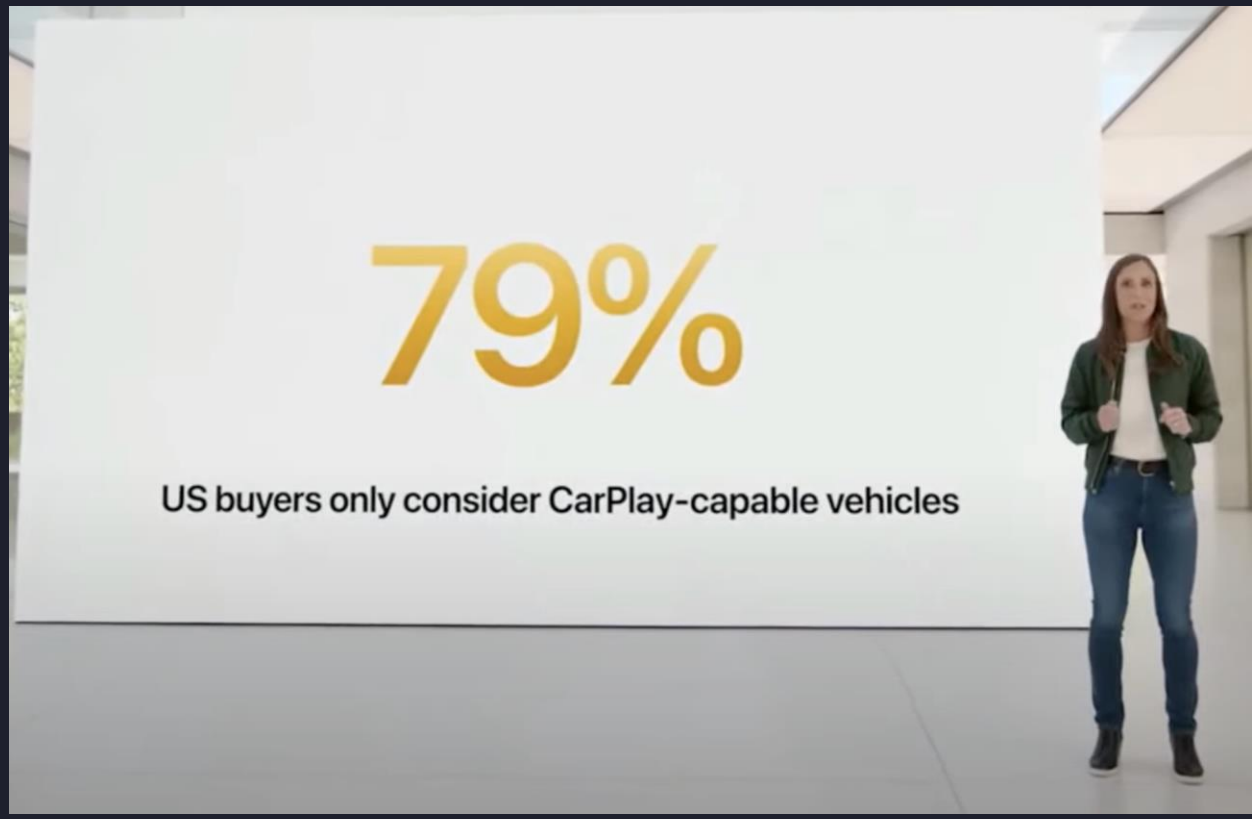
Efficiency

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

photo by Tabea Schimpf on Unsplash

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

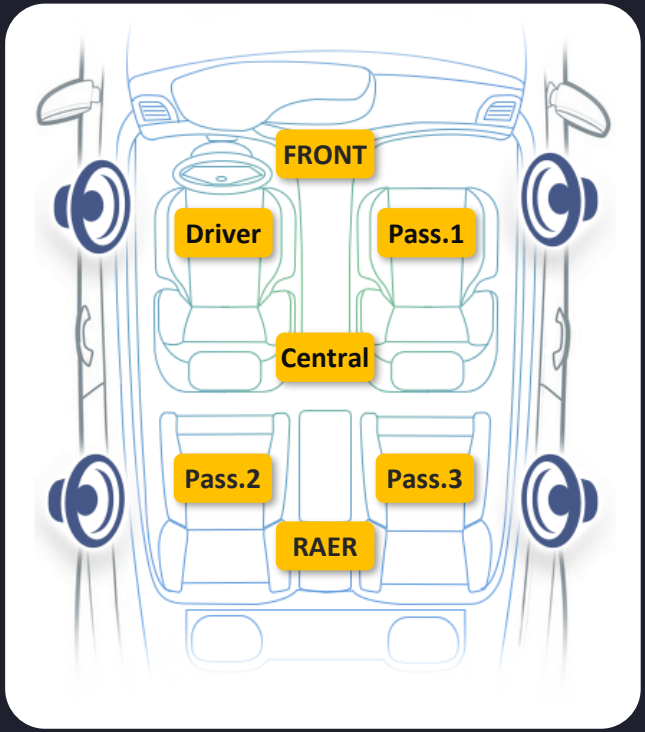




Threatened, but finally most of the carmakers adopted CarPlay and/or Android Auto features.

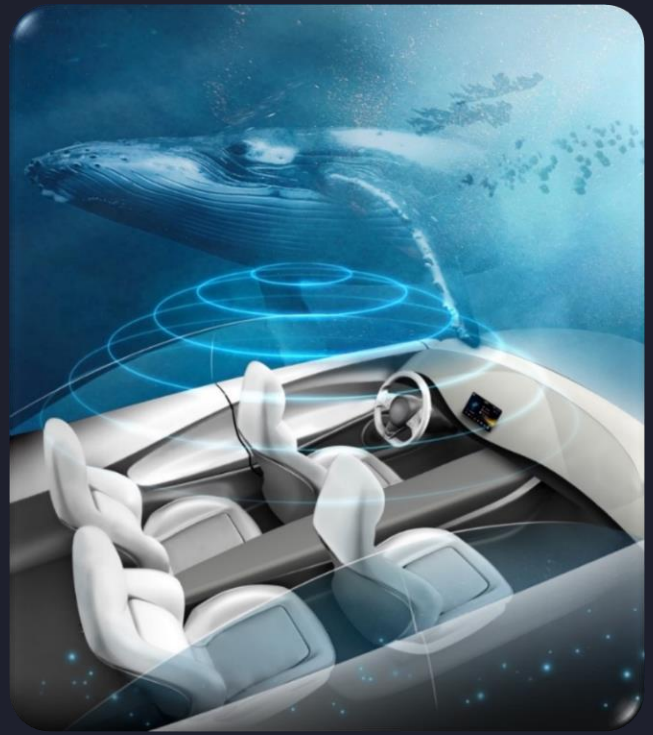
Joy – In-cabin Acoustics

Sound Field with IMS



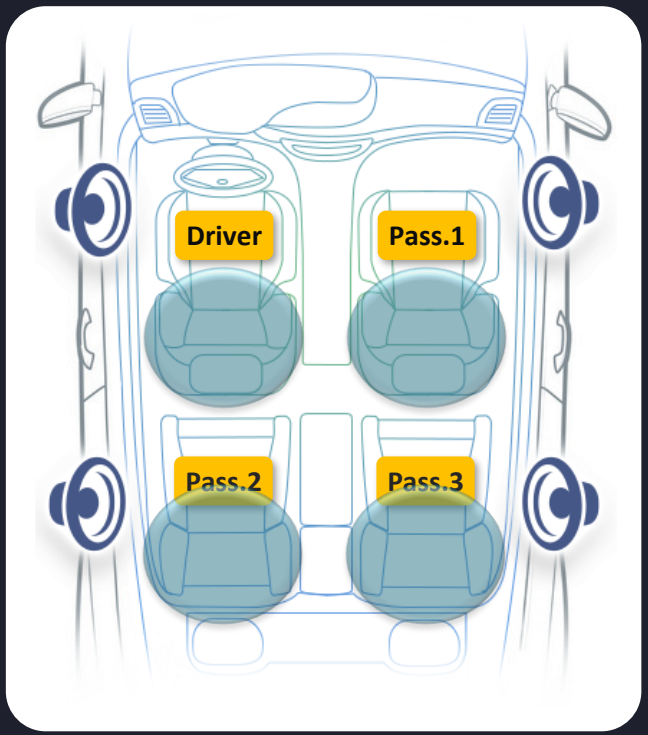
The IMS sees the occupants and feeds the info to IVI for optimal sound field settings.

Immersive Sound



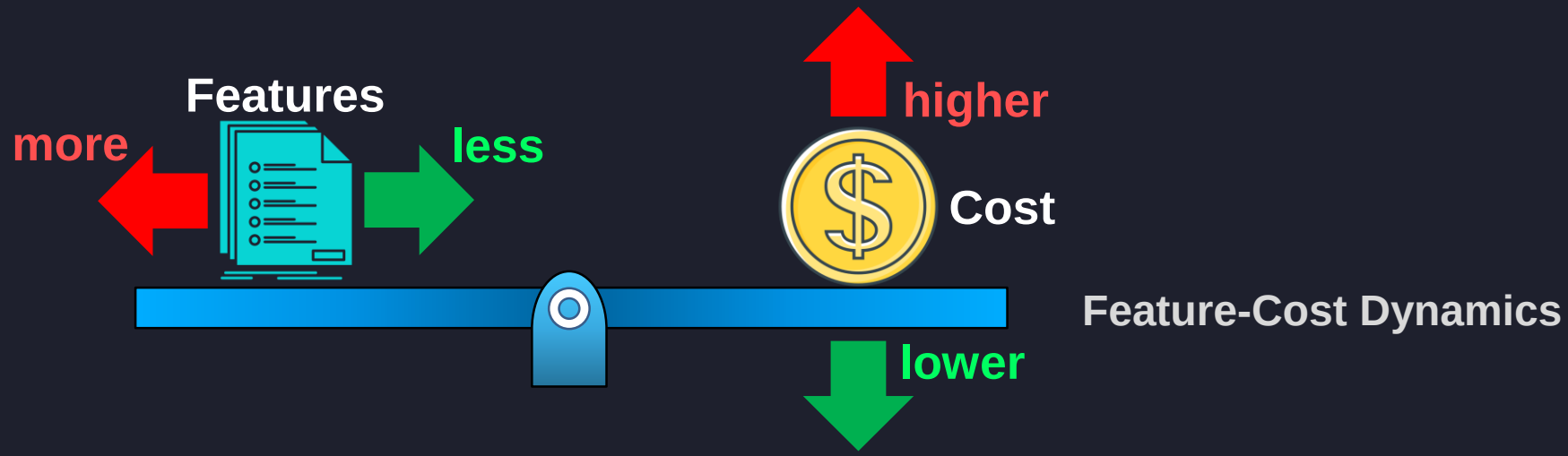
Bringing the 3D surround technology, such as Dolby Atmos™ , or Sunplus Spatial Sound to the cabin.

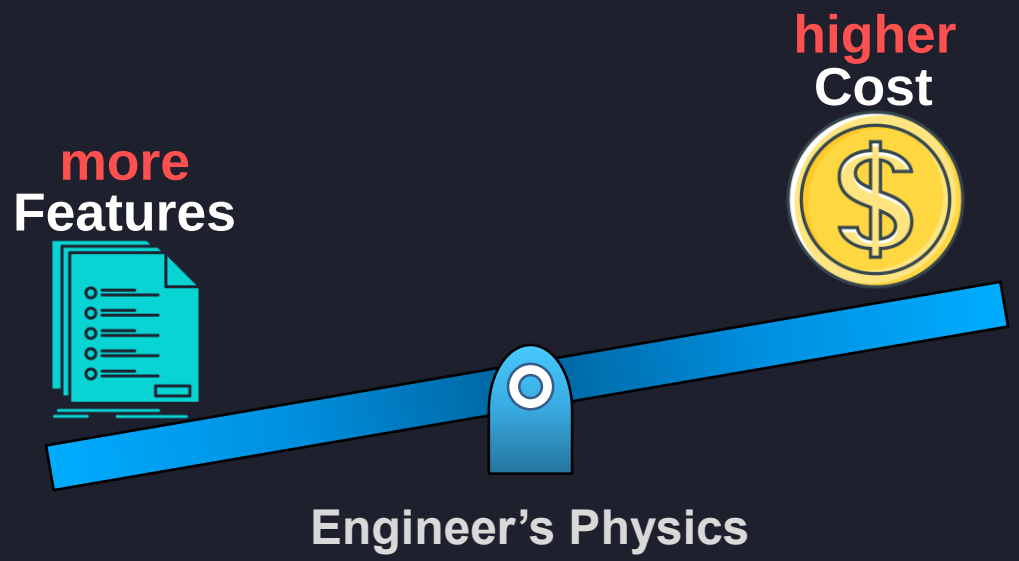
Sound Bubble (w/ ANC)

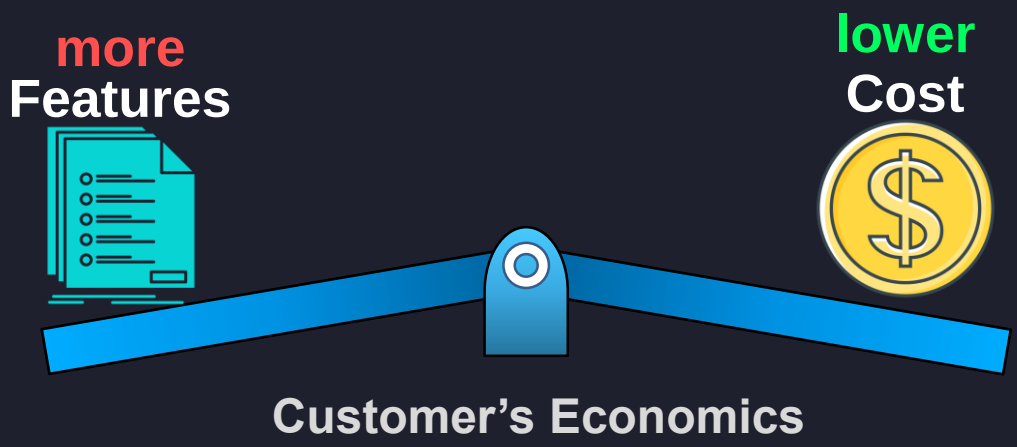


Giving every occupants a quiet zone, or independent listening zone.

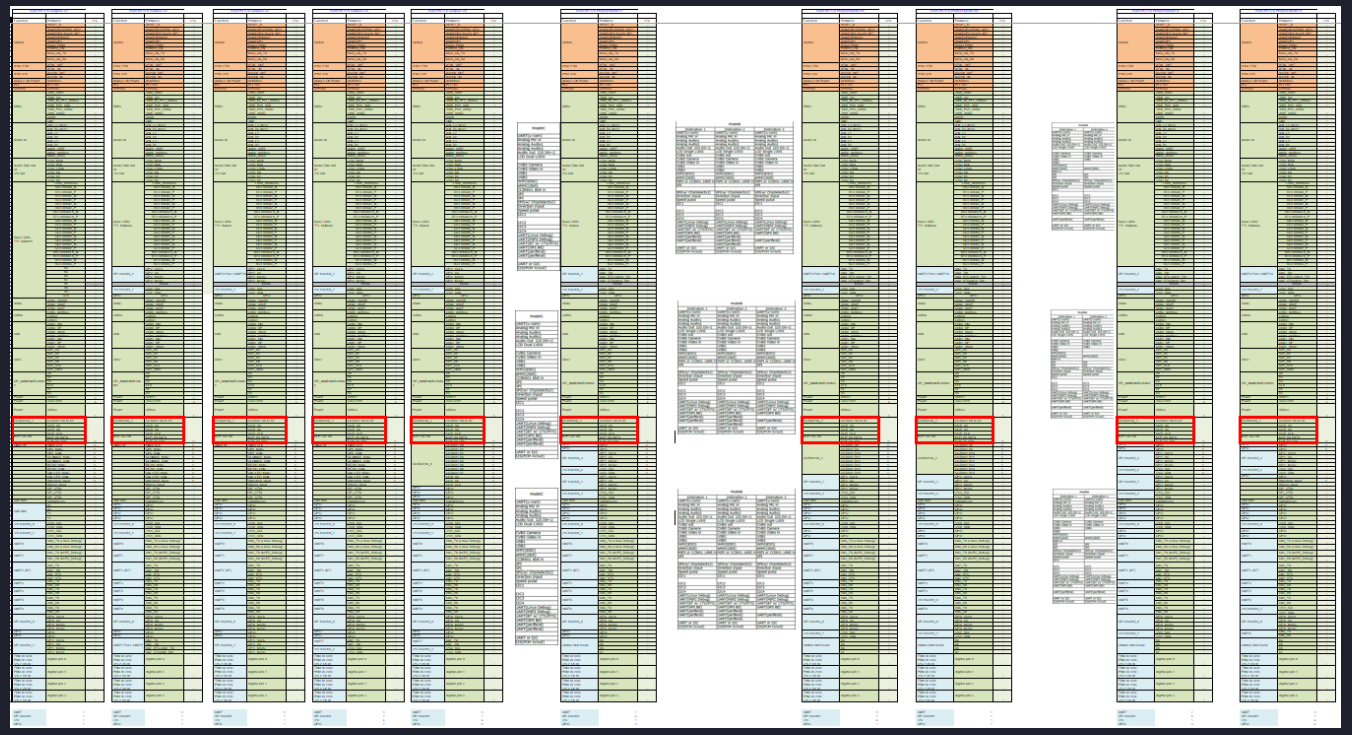
Challenges of Cockpit SoC – Features vs Cost

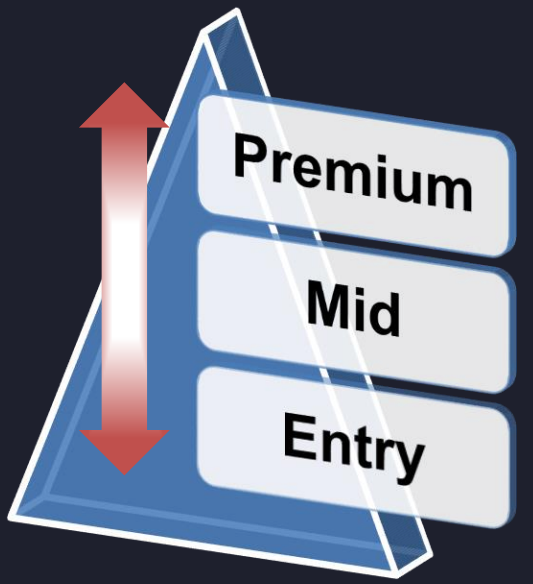






Challenges of Cockpit SoC – One Platform for All Segments





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

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Time to Market

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Success

Start from needs.

safety **efficiency** **joy**

photos: Unsplash

Thank You