Electric Vehicles – Part 2

Center for Learning in Retirement – Spring II 2024

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drivethefuture.tech

TOCPA.club

(director – Bucks County chapter)

Who Am I

- Penn State grad 1977
- Information Technology (1978-2011)
- Retired from Intel in 2011
- Teach Tech to seniors (http://seniortechadvisor.com/)
- Build electric bikes as a hobby (http://ratelectricbike.com/)
- Believe electric vehicles ARE the future (http://drivethefuture.tech/)

Let’s talk about

- Acronyms
- Choices
- Battery Tech
- Charging
- Road Tripping
- Cold Weather
- Other Options
- EV Mandate
- 4 Stages of EV Acceptance
- Buy vs. Lease
- Apps & Accessories
- Local (Tesla) clubs
- Extra Credit: FSD

Acronyms

- HEV - Hybrid electric vehicles (HEVs) are powered by an internal combustion engine (ICE) in combination with one or more electric motors that use energy stored in batteries.
- PHEV - Plug-in hybrid electric vehicles (PHEVs) use batteries to power an electric motor, as well as another fuel, such as gasoline, to power an internal combustion engine. PHEVs can charge their batteries through charging equipment and regenerative braking.
- BEV - Battery electric vehicles (BEVs) use a battery pack to store the electrical energy that powers the motor(s). The batteries are charged by plugging the vehicle in to an electric power source, as well as through regenerative braking.

Many choices!

BEV models for sale in the US:

- Rivian - R1T truck and R1S SUV
- Volkswagen - ID.4
- Kia - EV6 and Niro
- Hyundai - Kona and Ioniq 5 and 6
- Tesla - Models S, 3, X, Y, and Cybertruck
- Chevrolet - Bolt EV
- Ford - Mustang Mach-E and F-150 Lightning truck
- Volvo - EX90, EX30, XC40 Recharge, and C40 Recharge
- Porsche – Taycan

and many others: **Lucid** Air, **Fisker** Ocean, **Mecedes-Benz** EQS and EQB, **GMC Hummer** SUV & SUT, BMW iX, i4 and i7, **Cadillac** Lyriq, **Nissan** Ariya and Leaf, **Genesis** G80 and GV60, **Polestar** 2, **Audi** Q4 E-Tron, **Toyota** BZ4X, **Jaguar** iPace, **Subaru** Solterra, **Vinfast** VF 8, **Lordstown** Endurance, **Mini Cooper** SE, **Mazda** MX-30, etc.

Best sellers

Source

Top ten best-selling EVs in 2023

With over 394,000 units sold, Tesla's Model Y represented one in every three EVs sold last year. The Model 3 placed second with 220,910 units sold.

Rank	Top 10 best-selling EVs of 2023	2023 sales	2022 rank (+/-)
1	Tesla Model Y	394,497	1 (-)
2	Tesla Model 3	220,910	2 (-)
3	Chevy Bolt EV/EUV	62,045	5 (+2)
4	Ford Mustang Mach-E	40,771	3 (-1)
5	Volkswagen ID.4	37,789	9 (+4)
6	Hyundai IONIQ 5	33,918	7 (+1)
7	Rivian R1S	24,783	N/A
8	Ford F-150 Lightning	24,165	10 (+2)
9	Tesla Model X	23,015	6 (-3)
10	BMW i4	22,583	N/A

Top 10 best-selling EVs in 2023 (Source: Kelley Blue Book)

But be informed...

- Chevy Bolt – ‘Chevrolet Recalls Over 50,000 Vehicles Due to Fire Risk‘
- Ford Mach-E – ‘Some Ford Mustang Mach-Es Are Bricking Despite Full Charge‘
- Hyundai Ioniq 5 – ‘Yikes! The $60,000 Hyundai Ioniq 5 Battery Replacement Saga Continues‘
- Volkswagon ID.4 – ‘Volkswagen has given a name to its pain, and it is ‘software’
- Vinfast VF 8m – ‘Critics Agree: The VinFast VF8 Is Very, Very Bad‘
- Toyota BZ4X – ‘Toyota finally found a way to keep wheels from falling off its electric SUV‘
- GMC Hummer EV – GMC Hummer EV Battery Teardown Proves Our Fears
- Fisker Ocean – This is the Worst Car I’ve Ever Reviewed, by Auto Focus
- Tesla – ‘Tesla recalls nearly all vehicles sold in US to fix system that monitors drivers using Autopilot‘

Battery Tech (source)

- **Lithium-Ion Batteries**
- **Nickel-Metal Hydride Batteries**
- **Lead-Acid Batteries**
- **Ultracapacitors**
- **Meet the new batteries unlocking cheaper electric vehicles**
  - Lithium ferrous phosphate (LFP) batteries are a lower-cost alternative to the nickel- and cobalt-containing batteries used in most electric vehicles in the US and Europe today

Common battery chemistries

- The most common battery chemistry used in electric vehicles (EVs) today is **Lithium-ion (Li-ion)**, specifically with a cathode composition of **Nickel-manganese-cobalt (NMC)**. This chemistry offers a good balance between factors like:
  - **Range:** NMC batteries can store a significant amount of energy, allowing for longer driving distances on a single charge.
  - **Charging performance:** They can be charged relatively quickly compared to other Li-ion chemistries.
- However, there are other Li-ion options emerging, so the landscape is evolving. For instance, Lithium iron phosphate (LFP) batteries are gaining traction due to their stability and safety, though they may sacrifice some range.

Common battery cell formats in a Tesla

- Tesla uses **Nickel-Cobalt-Aluminum (NCA)**, **Nickel-Cobalt-Magnesium (NCM)**, and **Lithium-Iron-Phosphate (LFP)** chemistries.
- Tesla battery cell formats include **18650** cells, **2170** cells, **LFP prismatic** cells, and **4680** NMC* cells.

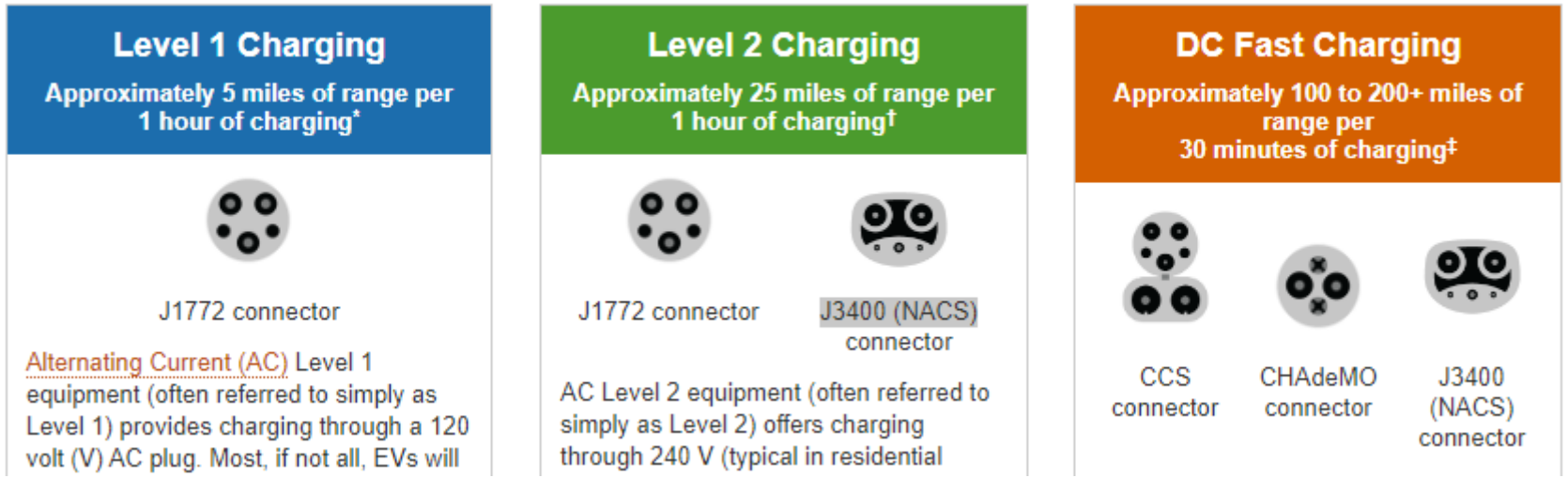
LFP Prismatic Cell

4680 Battery Cell

*Tesla's 4680 cells are based on the NCM 811 cathode chemistry.
Tesla is transitioning to NMC 955 in 2024.

Charging (source)

- SAE J1772
- Combined Charging System (CCS)
- CHAdeMO
- J3400 (NACS)*



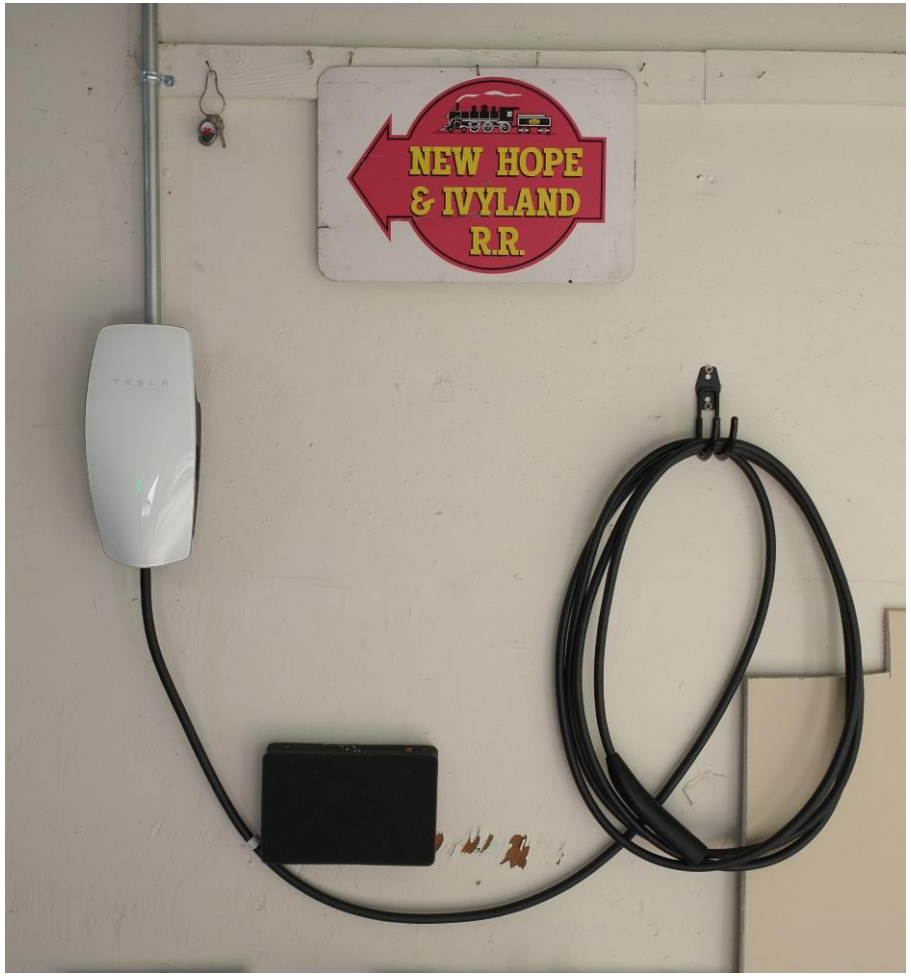
*NACS (aka J3400)

- The **North American Charging Standard** (**NACS**), also known as the **Tesla charging standard**, is an EV charging connector system developed by Tesla. It has been used on all North American market Tesla vehicles since 2021. Many other vehicle manufacturers have announced that starting in 2025, their electric vehicles in North America will be equipped with the NACS charge port. And several electric vehicle charging network operators and equipment manufacturers have also announced plans to add NACS connectors.
- "Magic Dock" allows for an EV to charge with either an NACS or Combined Charging Standard (CCS) version 1 connector, which would provide the technical capability for almost all battery electric vehicles the chance to charge. It is expected that Tesla will outfit many North American Supercharger stations with both connector standards after 2023, in part to gain access to several billion dollars of infrastructure build-out subsidies available from the US Federal government for charging stations that include the CCS1 connectors during the mid-2020s.

Home Charging

- This is where things get complicated (and interesting):
  - What type of charging connector do you need for your car?
  - Where will your car (and charger) be located?
  - Where is your power source?
  - How much charging power (amps) do you require for home charging?
  - Does your electrical panel have sufficient capacity to support your car's power requirements?
  - And although the home charger installation might not look complicated, you REALLY should hire a 'professional' to do the job!

Level 2 J3400 (NACS)
Tesla Wall Connector



Charging rates

LEVEL ONE	**4-5 miles** per hour (charge overnight)	Basic outlet anywhere	Standard wall plug
LEVEL TWO	**25 miles** per hour (charge overnight)	Installed public or private	Clothes dryer plug
FAST CHARGE	**60-80 miles** in twenty minutes	Installed along highways	Charging station

Road Tripping

"…even though electric vehicles may be the way of the future, the future—including its necessary infrastructure—isn't here quite yet."

- 5 tips for EV road trippers
  1. **Drive in a way that maximizes your range**
  2. **Plan charging stops around activities or meal breaks**
  3. **Use available apps and map out your mileage and stops in advance**
  4. **Be flexible and have a backup plan**
  5. **EVs are generally better for urban adventures than going 'off the grid'**

  With proper planning, patience, and good understanding of your car's underlying technology, road tripping can be a very enjoyable experience.

Cold Weather

EV drivers wrestle with cold weather sapping their battery range

- Cold weather driving reduces range for all EVs
- Your car's systems should compensate for weather conditions in calculating range available, planning charging stops, etc.
- Cold weather also reduces charging speed, or in some cases might prevent charging altogether (source)

My approach: When the temperatures are low (below 50°F), I'll precondition the battery (while on wall power) before driving.

Other Options

- PHEVs (ex. Toyota Prius or RAV4 Prime)
  - This is an electric vehicle with a gas tank and engine that's there just in case you need it, plus a medium size battery
  - Issue: the fuel and engine are always there whether you need them or not

- HEV (ex. Toyota Camry or RAV4 Hybrid)
  - This is a gas-powered vehicle with a small battery used primarily to provide additional power when needed and improve fuel economy
  - Issue: Hybrids don't always improve fuel economy over their ICE counterparts – it depends…

What is the ‘EV Mandate’?

- The April proposal from the Environmental Protection Agency (EPA):
  - EPA Administrator Michael Regan announced the new standards, which would take effect in 2027, saying the federal government isn’t requiring automakers to adopt electric vehicles but indicating that is one preferred path.
- Not everyone is happy:
  - Oil companies are vehemently opposed to such a program – surprise?
  - Others claim the administration is trying to force the public to embrace more expensive electric vehicles against their will
    - Rep. Tim Walberg – ‘the proposed rule is an electric vehicle mandate... and it's unaffordable, unattainable and unrealistic for American consumers.“
- Goldman Sachs estimates that EV sales would make up around 50% of all new car sales by 2030 and 70% by 2035.

There’s work to be done

- Car companies continue building gas-powered cars as a majority of US consumers remain skeptical of EVs and because bigger SUVs and trucks remain their major source of profits
- We need
  - Development of new materials used in battery production
  - New battery designs and effective battery recycling operations
  - More efficient powertrain units and thermal management
  - Vehicle weight reduction for better efficiency while improving safety
  - Availability of more 'affordable’ EVs
  - Broad adoption of the NACS charging standard
  - Build-out of the EV charging infrastructure, thanks in part to the Biden administration's 'National Electric Vehicle Infrastructure' Program (NEVI)

4 Stages of EV Acceptance

- 4 Stages
  1. Learning now to drive your new EV
  2. Learning how to charge your EV
  3. Dialing in ‘settings’ that best fit your driving style (then tweak)
  4. Optional: ‘Customize your ride’ – make it your own…

  And there’s a 5th stage for techies:

  You EV is a computer on wheels, and there’s all kinds of information available to those who care (a topic for another class)

  Or just drive and enjoy your new EV!

Buy vs. Lease

- Since new cars have gotten so expensive, and technology keeps evolving, leasing is a viable option for EVs
- I purchased by Model 3 from ‘inventory’ since it was a really good deal and a federal tax incentive was available
- However, prices keep coming down on new EVs and resale value is often not great, making a lease a better financial decision in some cases – do the math
- Another benefit of a lease is you don’t have to be as concerned about the longevity of your battery (using best charging practices)

Tesla lease deals – April 2024

- **Model 3**: $329 per month for 36 months with $2,999 due at signing on RWD models

- **Model Y**: $399 per month for 36 months with $2,999 due at signing on RWD models

Apps & Accessories

- If you purchased an EV and want to modify it, there are any number of aftermarket items available. Here are a some I thought were necessary for my Tesla Model 3:
  - Brake and ‘Go’ pedal covers
  - Screen protector
  - Screen swivel mount
  - Console organizers
  - Larger SSD for camera recording
  - Floor mats
  - Mud flaps
  - Front hood seal
  - Skid plates
  - Tow hitch
  - Automatic garage door opener…

Local Tesla clubs

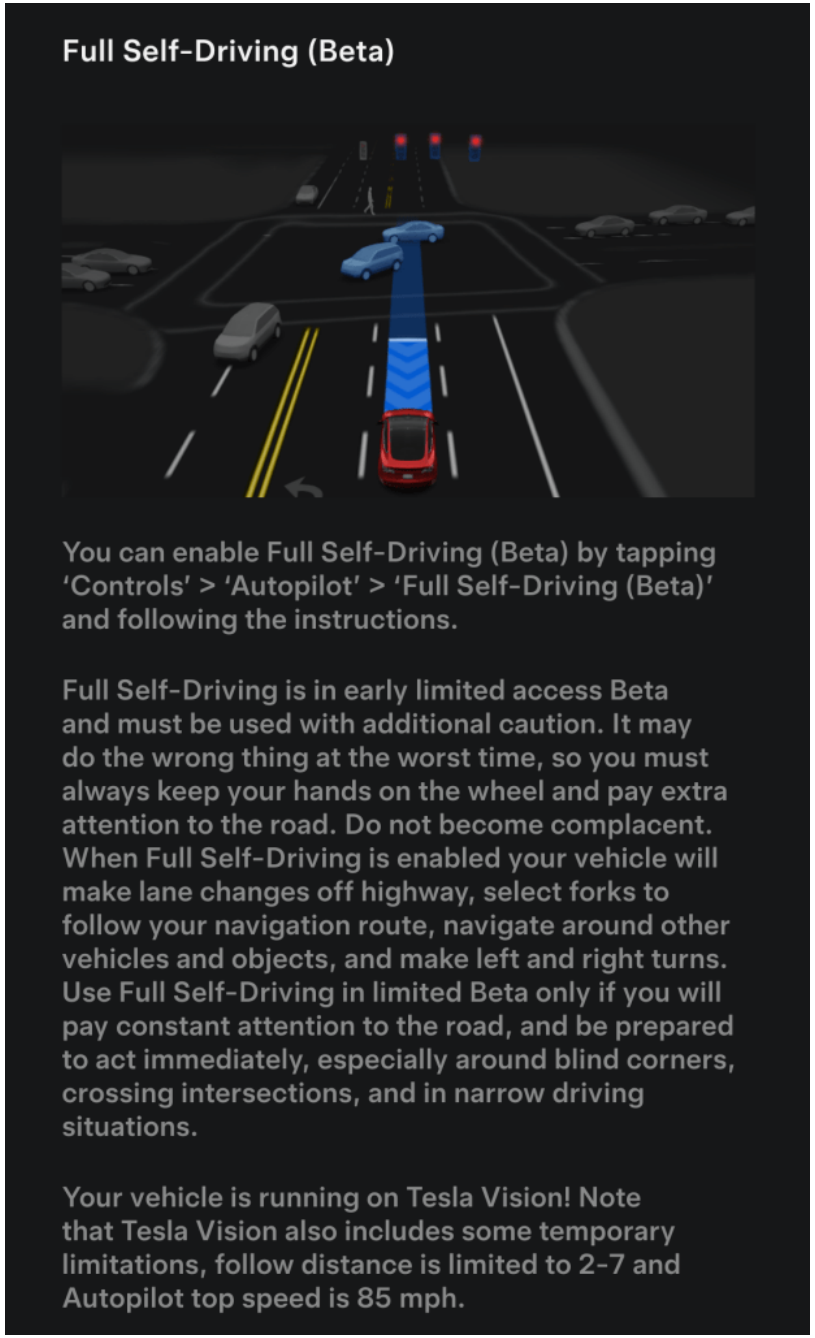
www.dvto.club

Welcome to the Delaware Valley Tesla Owners Club

www.tocpa.club

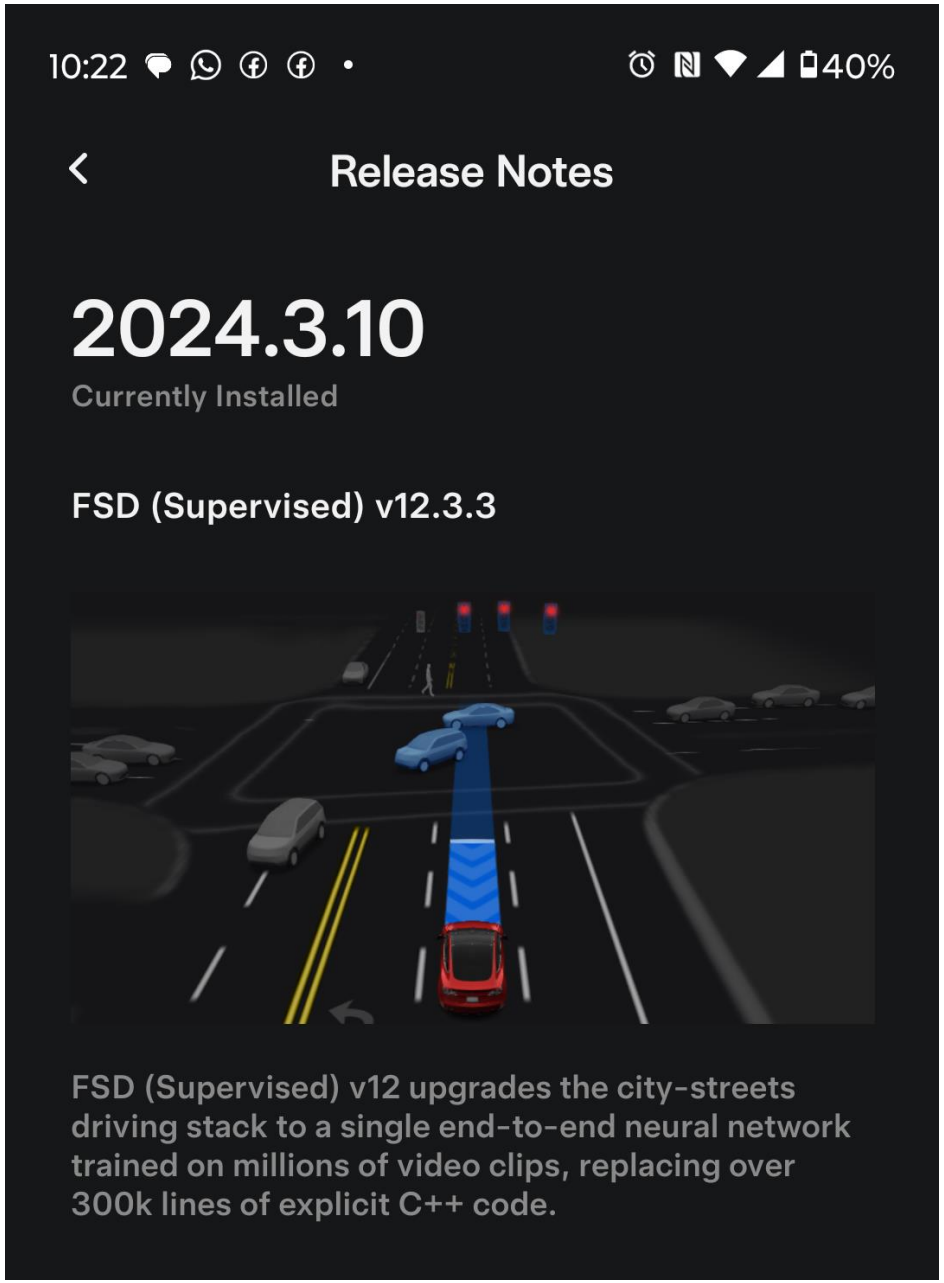
FSD V12 (Beta)

- Tesla released a beta version of Full Self-Driving (FSD) software in October 2020 in the United States.
- The beta version extended "Navigate on Autopilot"- like machine-controlled driving and navigation to "local roads".
- By September 2020, the FSD beta had expanded to approximately 160,000 testers in the United States and Canada.
- In November 2022, the FSD beta was extended to all owners in North America who had purchased the option.

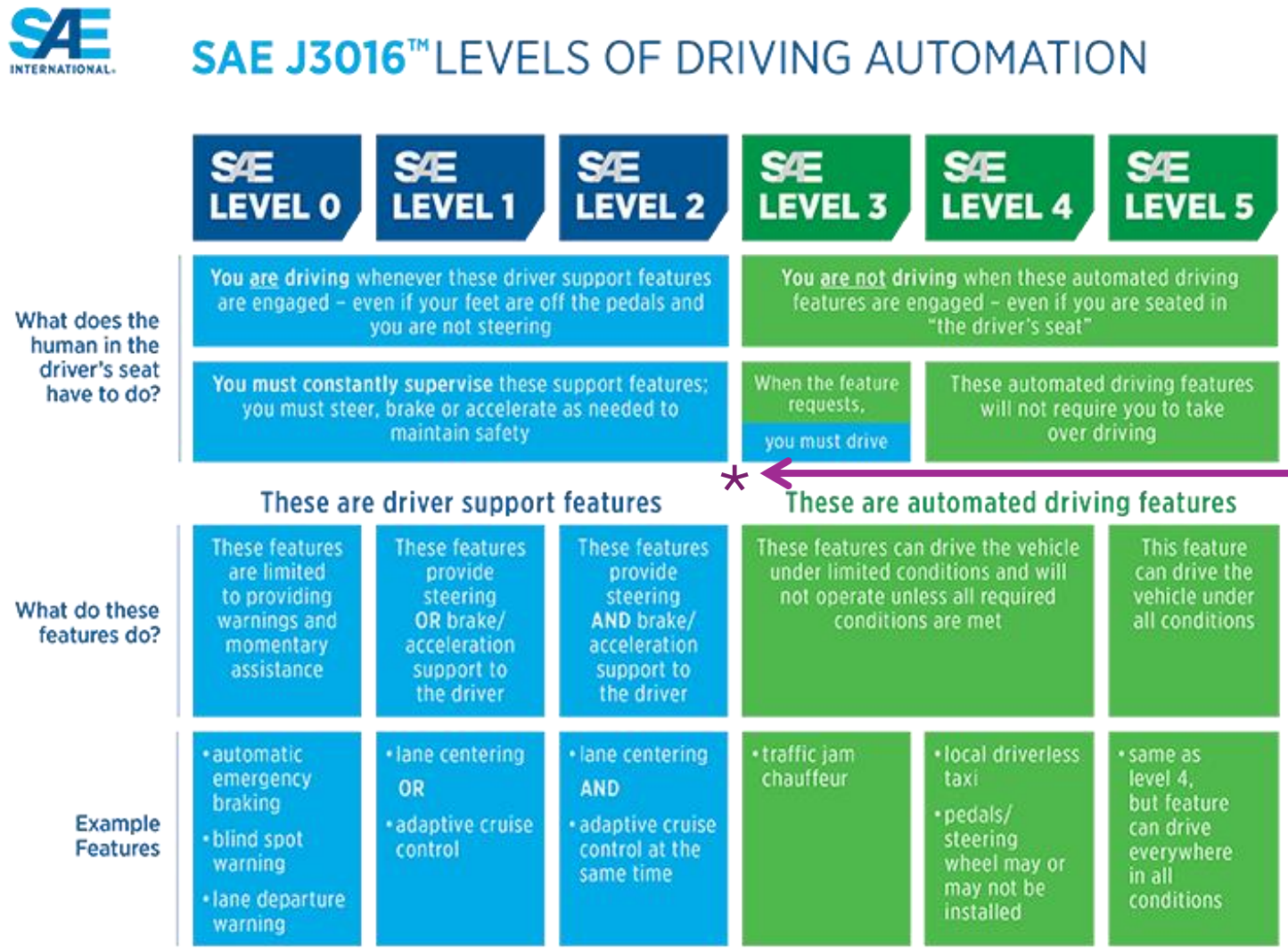


FSD V12 (Supervised)

- Tesla announced a free one-month trial of FSD, and Musk has reportedly mandated a demonstration of FSD to all prospective buyers in the US.
- FSD version 12.3. 3, released on March 30, replaced the word "beta" with "supervised".
- Then Tesla late Friday cut the price of Supervised Full Self-Driving to $99 a month from $199…



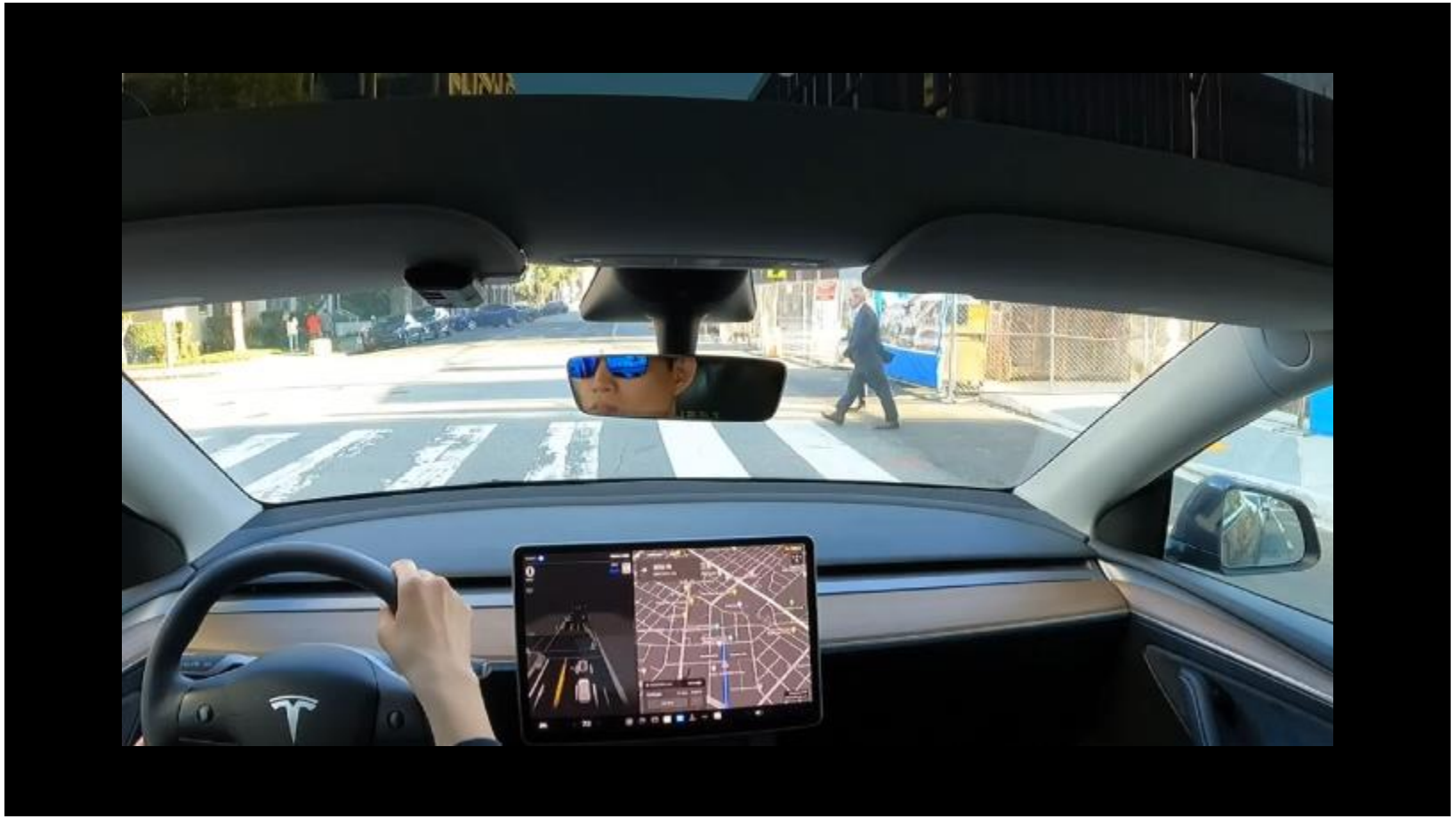
Autonomous Driving Levels (source)



*

FSD V12 is here!

And a short video...



Thank You