

Automotive News

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A CALL TO ACTION

PART 3 OF A 4-PART SERIES: Food, cash, lobbying, even haircuts and manicures. Volunteers find creative ways to help others during the COVID-19 crisis. | PAGES 15-20 |



future product pipeline

PART 2 OF AN 11-PART SERIES
Japan's big three shuffle their plans, with fewer cars and more electrification. | PAGES 22-29 |



BLOOMBERG

□ **MORE ON MUSK**

- **Daily Drive:** A 3-part conversation at autonews.com/dailydrive
- **Q&A:** Nobody has ever made a good-looking minivan | **PAGE 10** |
- **Model Y:** Tesla crossover sets a very high bar | **PAGE 31** |

Tesla just wanted a weird truck, Musk says

CEO has no time for rivals, Autopilot flak

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Tesla CEO Elon Musk says the company conducted “zero” consumer research when designing its upcoming Cybertruck.

He says he doesn’t pay attention to competitors or know anything about other electric vehicles on the market.

And criticism that the Autopilot name is misleading for Tesla’s driver-assist system, which has been linked to a number of accidents? “Idiotic.”

In a wide-ranging interview with *Automotive News* Publisher Jason Stein last week, the 49-year-old Musk appeared unbothered by the product-related headaches that often vex his competitors or the billions of dollars that can hinge on his declarations. At one point he made a “stream-of-consciousness guess” that Tesla will start construction on a third U.S. assembly plant in four or

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REUTERS

China's parts factories delivered a decade of cost advantages. But global supply chains are changing.

Rising costs, tariffs, COVID-19 and the new allure of Mexico have cut into Chinese imports

PARTING WAYS?

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When global supplier Hyundai Mobis said last year it would shutter an overseas manufacturing facility and build a new electric-vehicle components plant in Ulsan, South Korea, it did not mention China.

But as it prepared to invest in Korea, the diversified Hyundai Motor Group-affiliated supplier also slashed production in Beijing.

It was a telling moment for China as a source of global auto parts and materials. It signaled that future industry growth may skip China in favor of other production locations.

While China continues to export billions of dollars worth of vehicle content annually to automaker customers in North America and elsewhere, a shift has occurred over the past two years. The China parts trade has been buffeted by multiple challenges at



BLOOMBERG

Trump: Billions in tariffs changed the game.



RETHINKING CHINA
AUTO INDUSTRY 2020



PART 5 OF A 5-PART SERIES

the same time, and volumes today are lower than in the past.

The trade battle with the Trump administration in Washington has resulted in U.S.-bound Chinese products being hit with punitive tariffs. Rival nations have stepped in to offer viable low-cost manufacturing locations to compete with Chinese factories. A promising new trade agreement

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□ **SPECIAL SECTION**
Technologies of Electrification

Going electric spurs the industry to create new parts, materials and design solutions. | PAGES 31-39 |



ABB sells EV chargers to networks.
Some put out 350 kilowatts.

EV fast charger technology floors it

Kilowatts accelerate in the race to refuel

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In the middle of the Mojave Desert, between Southern California and Las Vegas, lies the future of electric vehicle charging.

An EVgo station in Baker, Calif., promises a refueling experience that’s about as close to a gas station for EVs as currently possible. In fact, no EV on the market can handle all the power coming from the liquid-cooled cables of the 350-kilowatt direct-current charger.

DC chargers have become the next wave of technology in this second front in the battle for auto electrification.

While auto manufacturers and their suppliers figure out how to make EVs appealing to America’s gasoline-addicted consumers, the industry is also pushing for newer, better and faster technology to speed the recharging process.

At the Linq Hotel in Las Vegas, Tesla is also showing a big push forward. Its new V3 Supercharger unit in the hotel

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A SPECIAL SECTION

TECHNOLOGIES of Electrification

Electrifying the auto industry is generating a rush of new technologies and strategic approaches, from battery advances to vehicle architecture.



Tesla's Model Y, on sale since March, is a showcase of EV technologies competitors will benchmark.

How will Tesla rivals top this?

Model Y crossover teardown shows just how high the bar has been set for EV innovation

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DETROIT — Forget, for a moment, Tesla's missed production deadlines, its challenges with fit-and-finish and even the eye-brow-raising tweets that issue from its CEO.

When it comes to the nuts and bolts — or in this case, sensors and battery cells — of Tesla's Model Y electric crossover, says Sandy Munro, the product is the most technically advanced EV on the market.

It's really that advanced? Munro is asked.

It has no peer, says the president of Munro & Associates, a firm in Auburn

Munro: Tesla has fit-and-finish problems, but its newest products have "a depth I just don't see anywhere else."

Hills, Mich., that specializes in vehicle competitive teardowns. The only real competition, he says, is itself.

Until now, Tesla's star was its Model 3, the sedan it introduced in 2017 that is now reportedly the top-selling EV in the world — as well as the top-selling luxury car of any kind in the U.S., based on estimates. The Model Y, which went on sale in March based on the Model 3's architecture, has raised the bar.

"I thought the Model 3 was 10 years ahead of everybody else," Munro told *Automotive News* after examining the individual components and construction of the Model Y. "Then we tore apart the Model Y, and we're pretty much convinced the Model Y is another three or four years ahead."

Munro, a former Ford Motor Co. engineer and manager, has been providing competitive analysis to the auto industry for more than three decades. He markets his piece-by-piece teardowns to automakers and suppliers and is widely quoted for his insights into who is setting benchmarks and who is lagging.

But whether Tesla is wowing critics is not the issue for the industry at the moment.

The slowly emerging EV market is a competitive arena of technology — of who has the best and who offers the latest. New technical approaches are emerging as an increasing number of automakers commit to electrifying their fleets this decade.

That means today's segment leader now

INSIDE

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stands as the benchmark for what all other comers will have to match — or beat — to be competitive. Getting there requires advances to everything from the vehicle's battery cells, to its electric motor design, to a heating and cooling system that has been streamlined to help boost range and capability.

"They've got a depth I just don't see anywhere else," Munro said of Tesla's newest products, even as he offered unflinching criticism of the California company's manufacturing quality glitches, giving it low grades for fit-and-finish and its widely reported problems with paint.

But "the people who are buying these cars aren't buying them for that," he said. "They're looking for that million-mile battery. They're looking for the range."

Tesla was already an industry benchmark on battery range. The Model Y crossover's range, at 316 miles, is nearly the same as the 322 miles available on the Model 3, despite the crossover being heavier. This year, Tesla boosted the full-charge range of its Model S sedan to 402 miles, making it the first EV to crack the 400-mile threshold.

Tesla has even bigger plans for the Model Y, built in Fremont, Calif. Tesla is so confident in the new nameplate and its technology that it has built a factory in Shanghai and is constructing another in Berlin to build the Model Y for international markets, and it plans to build more Y's at a new plant in Texas. CEO Elon Musk has said he expects the crossover to outsell all of Tesla's other vehicles combined.

Here's a look at some of the technologies that define the Model Y and the Model 3 it is based on, which Munro says serve as the industry's current EV benchmark.

□ Heating and cooling

The Model Y is unique compared with other Tesla vehicles in that, instead of a positive temperature coefficient heater, it uses

TESLA

Heat pump module a significant change

continued from Page 31

a new-generation heat pump that benefits from an in-house-designed technology known as the Octovalve. The component bears its own stamped logo of an octopus with a snowflake on its head.

The Octovalve is the key valve assembly that controls and directs heating and cooling functions. It comprises a four-position stepper motor and eight separate ports. It's part of a system that includes a semisolid forged-aluminum refrigerant manifold.

Other EVs use heat pumps, but Munro said the introduction of the Octovalve makes the Model Y's heating, ventilation and air-conditioning system different from anything he's ever seen in a car and looks more like something from the aerospace industry.

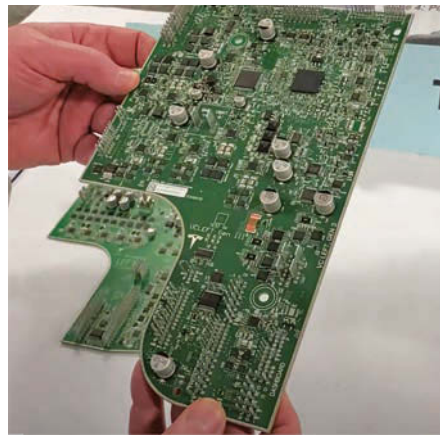
Speaking on a podcast this year, Musk said the Octovalve heat pump module is among the most "significant changes" to the Model Y — even though most customers will never notice it exists.

"The thing that's interesting about this heat pump is that it has a local heating loop," Musk said. "Heat pumps typically encounter issues around minus 10 to 20 [degrees] Celsius. ... Essentially, they can't get going."

"The solution the Tesla HVAC team came up with was to have a local heating loop. So the thing will basically just spin itself up and get hot locally before opening another valve that then tries to heat the cabin."

Munro said the system can heat or cool the cabin faster than a normal system. Additionally, it saves space and represents a reduction in parts — and therefore labor cost — compared with other EVs.

Further, boosting the ability to selectively heat and cool portions of the vehicle helps improve the range of the battery by reducing the amount of power needed for the system.



Sandy Munro said the Model Y's body control module has been upgraded over what's in the Model 3 to be smaller and more efficient.

□ Electronics

The Model Y has also moved the needle on the electronics front, Munro said after his analysis of the vehicle.

It uses a third-generation body control module with a more streamlined design, created by swapping out certain parts for greater efficiency. The result is a module that is smaller and more vertically integrated.

But also contained in the electronics is a technology that is not yet engaged. It is a processor chip — newly produced in-house — that will serve advanced autonomous driving functions when Tesla is ready to initiate them in the years ahead.

Tesla previously sourced chips from Nvidia. But last year the automaker revealed a chip of its own that Musk brashly labeled the "best chip in the world." Musk said each chip is capable of 36 trillion operations per second, an improvement over past Nvidia technology at 80 percent of the cost.

The Tesla system features two redundant chips located next to each other on the circuit



Tesla's in-house-designed Octovalve is the key valve assembly that controls and directs heating and cooling functions.

board to help guard against failure when the technology is deployed.

Despite projections from Musk that the launch of the technology is imminent, it's unclear when Tesla will enable its vehicles to drive themselves. Other automakers are taking more cautious approaches but have begun to roll out hands-free driver-assist systems that they believe are more safe than Tesla's current Autopilot driver-assist system.



"Secret weapon": Tesla opted for an aluminum rotor in its front induction motor on the Model Y, as opposed to copper in the Model 3.

□ Motor

Munro said Tesla also gained some efficiency in its front induction motor by switching to an aluminum rotor from a copper one in the Model 3. Munro called it Tesla's "secret weapon."

The vehicle's inverter/converter, which essentially helps manage the power for the electric motors, remains largely unchanged from the inverter module found in the Model 3.

□ Battery

The Model Y is powered by a 75-kilowatt-hour battery that is largely similar to the Model 3 battery. But Munro believes Tesla's batteries, supplied by Panasonic, are ahead of the competition because of their design.

Tesla uses thousands of cylindrical cells as opposed to a prismatic or "pouch cell" design. Munro says cylindrical cells are less expensive and don't need as much packaging or support to hold them in place.

"It's the difference between making a jelly roll vs. a grilled cheese sandwich," he said on a recent video, meaning the Tesla component is easier to manufacture. "One is very simple and fast, and the grilled cheese is a little more costly."

While the automaker in June inked a new three-year deal with Panasonic for battery supply, Tesla also has been working on producing its



Tesla makes the Model Y in Fremont, Calif., but is so confident that it is adding more factories.

own cells. The automaker last year acquired Maxwell Technologies, a California producer of batteries and ultracapacitors that uses a proprietary approach to battery science. The move is expected to improve battery performance on future vehicles.

□ Over the air

The industry is widely discussing the science of updating vehicles the way cellphones are enhanced, with updates arriving automatically "over the air."

Tesla is already there.

Have a problem with your brakes? Want to add Autopilot? Tesla can take care of issues in a matter of hours, often overnight.

The automaker's over-the-air software updates have paced the industry for some time. But the rest of the industry is catching up. General Motors last year said most of its global models will be capable of over-the-air software upgrades by 2023, and Ford plans to roll out the technology as part of its next-generation Sync infotainment system, starting this year with a number of vehicles, including the venerable F-150 pickup.

□ Charging network

One of Tesla's greatest advantages remains its dedicated charging network.

The automaker says there are nearly 17,500 of its Superchargers across North America, Europe and Asia. Late last year it began installing a third generation of the chargers to further expand and speed up the network.

The third-gen station can charge a Model 3 sedan at rates of up to 250 kilowatts, making it possible to gain 75 miles of range in five minutes, according to the company. In addition, the chargers no longer split power when multiple cars are charging at the same station.

Other automakers are scrambling to catch up.

Ford, in preparing to launch its eagerly awaited Mustang Mach-E electric crossover, claims to have created the largest charging network in North America by tapping into a number of existing stations.



The semisolid forged-aluminum refrigerant manifold is part of a heating and cooling system that helps extend battery range.

Ford says its FordPass Charging Network offers 13,500 public charging stations on the continent, with more coming. To achieve that number, Ford partnered with Electrify America and Greenlots.

□ Competition

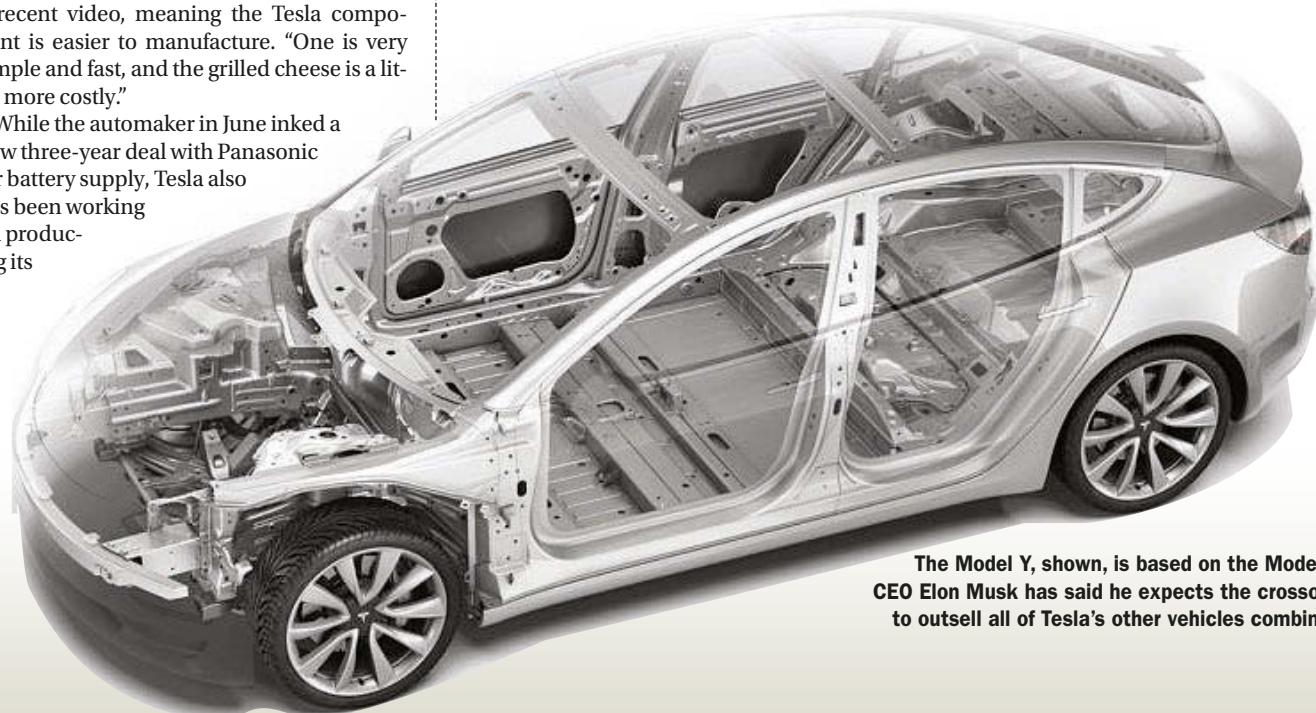
Tesla remains a small automaker compared with global competitors such as Ford, GM, Volkswagen, Nissan and Hyundai Group. Still, new EV offerings from more established brands are often referred to as "Tesla fighters," a nod to Tesla's sales success. The Audi E-tron, BMW i3, Jaguar I-Pace, Kia Niro and Nissan Leaf are all out for their own share of the growing EV market.

In making a competitive comparison between the Model Y and other EVs, Munro scored Tesla above average on such issues as battery kilowatt-hour rating, battery depletion percentage, range and voltage. However, on sticker price, he put the Model Y's nearly \$50,000 base price in about the middle of the pack.

Ford's Mustang Mach-E, looming this year, will bring a new challenge. And in July, Nissan unveiled its own Tesla fighter, the Ariya crossover.

Munro said he had not had the chance to study the Mach-E, but he thought it would be hard to top Tesla for a while.

"It's going to be a long, long time," Munro said, "before somebody catches up to it." **AN**



The Model Y, shown, is based on the Model 3. CEO Elon Musk has said he expects the crossover to outsell all of Tesla's other vehicles combined.