

JEREMY WHITE AARIAN MARSHALL GEAR JUN 8, 2023 1:00 PM

A Leaked Tesla Report Shows the Cybertruck Had Basic Design Flaws

The “alpha” version of the EV company’s first pickup had problems with braking, handling, noise, and leaks, according to an internal presentation.

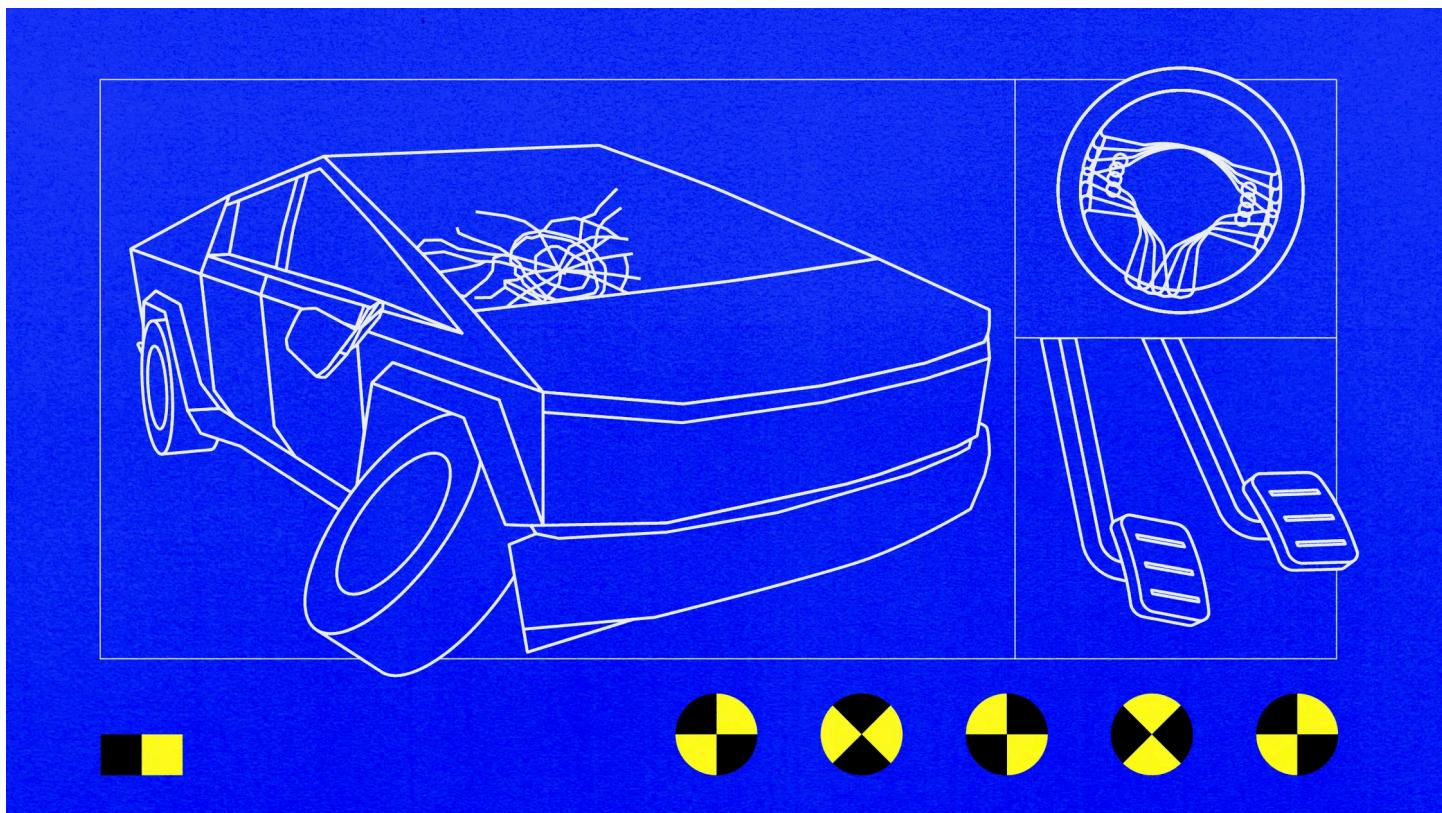


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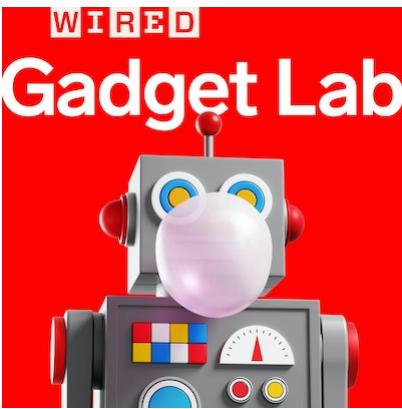
IN NOVEMBER 2019, Tesla CEO Elon Musk stepped onto a stage in California to launch a new kind of EV: the Cybertruck, an angular cyberpunk-styled pickup with bodywork made of brushed stainless steel and “unbreakable” glass. What happened next has entered into public relations folklore. Under the glare of the cameras, the demo truck’s windows smashed not once, but twice during a demonstration of their strength. Musk first swore, then joked: “There’s room for improvement.” That off-the-cuff remark could have been a fitting mantra for the entire project.

Not that this faltering start has deterred Tesla’s devoted fans, of course. Since then, an estimated 1.8 million customers have put down their \$100 deposits to reserve a Cybertruck. The vehicle was supposed to start rolling off production lines in 2021. But two years on, the trucks still haven’t been delivered, and for most customers, they won’t be until 2024 at the earliest.

In May, the German newspaper *Handelsblatt* began reporting on the “Tesla Files”: thousands of internal documents provided to it by a whistleblower. Among those documents was an engineering report that might give some insight into why the vehicle has taken so long to come to market. The report, dated January 25, 2022, which WIRED has examined, shows that the preproduction “alpha” version of the Cybertruck was still struggling with some basic problems with its suspension, body sealing, noise levels, handling, and braking.

“Been driving latest Cybertruck prototype around Giga, Texas,” Musk tweeted that same day. “It’s awesome!”

The contents of the report do not deal a fatal blow to the Cybertruck. As one veteran automotive engineer, who spoke on condition of anonymity to prevent backlash from Tesla fans, says, the company has enormous financial resources which will allow it to address the issues detailed in the report. However, he said, “my first reaction is I am astounded. These are classic mechanical automotive engineering challenges that you have in pretty much any vehicle. I’m blown away that they would be struggling so much with the basics.”



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Tesla hasn't launched a new consumer vehicle since 2020, and it's widely seen as falling behind other automakers, who have stepped up their EV development to meet surging demand. Most car companies refresh their lineup every three to five years—Tesla's Model S is now more than 10 years old. Audi, by comparison, expects to launch more than 20 new cars by 2026. But while analysts say that finally producing the Cybertruck will be mostly a symbolic victory for Tesla—which still must nail the launch of new battery packs, roll out safe Full Self-Driving software globally, and build a truly affordable car—the delays still matter. The hype machine needs new products.

"You need something new to reinvigorate the story. Whether that's the humanoid robot, the Tesla Semi, the Cybertruck, Full Self-Driving, all of those are fair game in the eyes of the Tesla PR machine to keep the narrative going about continued growth," says Jeffrey Osborne, a managing director and senior research analyst who covers Tesla at the financial services firm Cowen. "The logical [first] one of all of those is the Cybertruck."

Tesla did not respond to requests for comment.

The internal dynamics and NVH—noise, vibration and harshness—report leaked to *Handelsblatt* contains test results measuring the performance of the alpha version of the Cybertruck against projections made using computer-aided design (CAD) simulations, and against internal benchmarks. In summary, it presents a picture of a prototype vehicle that's leaky, noisy, and has poor handling and braking.

"It's an alpha-stage vehicle, so it's not surprising that it's some way off its targets," says Andy Palmer, the former COO of Nissan and CEO of Aston Martin Lagonda, who has more than 40 years of experience in the automotive industry. Palmer says he's surprised at the frankness of the report. "You'd be giving the engineers that wrote this stuff a good bollocking. You don't normally write this down."

The report says that the alpha version of the Cybertruck had to be hand-sealed, but that “there are a number of areas that we do not have a clear path to sealing” in a production version of the vehicle. This is an issue not just for keeping the weather out, but for noise in the cabin. Data in the report shows that the alpha version was significantly noisier than engineers had projected based on their designs, and that testers had identified 21 potential noise leaks in the body of the vehicle.

Tesla cars have a history of leaking, and the report hints that the Cybertruck’s unusual design may have complicated engineers’ attempts to properly seal it. “Body manufacturing and paint shop processes have struggled to seal bodies for optimal NVH performance in the past, and the Cybertruck design presents new challenges,” the report says.

Handling was also a concern for the alpha Cybertruck. The report noted a number of issues, including “excessive mid-speed abruptness and chop,” “high head-toss accelerations,” and “structural shake.” It said that the truck experienced “excessive lateral jerk during low-speed maneuvering” and that it needed to address problems with steering refinement and body roll. The EV’s strafe mode, a feature that allows the wheels to turn to allow the car to “crab walk” sideways had “only basic functionality.”

Braking performance was one of the worst areas of the report. Tesla’s engineers were aiming for a score of 7, or “fair,” on the Society of Automotive Engineers rating scale, but the alpha version achieved only a 4, or “poor” rating. According to the report, in January 2022, the Cybertruck’s brake pedal pressure pad was still under design, and so the alpha experienced “excessive pedal travel and inconsistent stop,” and “excessive pitch during friction braking,” braking during turning issues, as well as power braking instability.

“The brake performance seems serious. I’m surprised they’re not further forward,” Palmer says, after being apprised of the content of the report. Normally, the chassis, including the braking system, is the first thing that engineers work on, ahead of the body and other systems. “So to be only on prototype parts at this stage is quite late.”

The report also details the results of kinematics and compliance (K&C) testing, which is used to evaluate the ride and handling performance of an automobile. During a typical K&C test, the vehicle body is fixed while controlled forces or

displacements are applied to the wheels. The results of such tests yield vehicle suspension parameters, such as camber and toe, a measurement that determines how much the wheels are turned in or out from a straight-ahead position. The report showed that the alpha Cybertruck's performance showed a "significant gap to targets."

The report lists problems against potential solutions, some of which are illuminating. The front of the vehicle had some issues where there was "no solution without modifying suspension design." Against the problem of "too high camber gain," resulting in, among other things, tire wear and alignment change with ride height, the entry on the solutions column bluntly states "possibly none."

There are indications within the report of the problems that Tesla has had in building a truck that can compete with other electric vehicles in its category.

Torsional stiffness is the ability of a car's body to withstand twisting. When turning, if the torsional stiffness is too small, the body will fail. Too large, and it will be difficult to turn and tend to understeer. The alpha truck's performance was significantly off target, which might be concerning for Tesla, according to Palmer. "What's surprising about that is it's really hard to fix. It's fundamental. In your development, you can simulate it fairly accurately. So I'm surprised it's so far off," he says. "It's a biggie, too, because fixing it adds weight and compromises the design of the vehicle."

Tesla has been making electric cars since 2008, but experts say building a truck presents a completely different engineering challenge. Other manufacturers, like Ford, whose F-150 Lightning electric pickup began production in April 2022, have decades of experience in the category. Other electric truck-makers, including General Motors' Chevrolet and GMC brands, and Rivian have or likely will beat the Cybertruck to market.

Tesla has promised specs that would significantly outclass the F-150 Lightning in terms of range and towing capacity. But the company has to start from scratch in engineering or procuring many of the Cybertruck's parts, against competitors who can reuse or evolve parts from other models. The Lightning is an electric version of a truck that has outsold all others for more than 45 years in the US.

"Tesla is going to have to enter the truck market against the one thing that the US companies seem to know how to do really well, which is build pick-up trucks," says Mike Ramsey, an analyst with the tech research and consulting firm Gartner.

On top of that, Musk himself has stated that the Cybertruck is a hard vehicle to make. “You can’t just use conventional methods of manufacturing,” he said on an earnings call in May. “We had to invent a whole new set of manufacturing techniques in order to build an exoskeleton car rather than an endoskeleton car, so it is clearly not trivial.”

The unique styling of the truck, with its angular plates and stainless steel alloy construction, mean it’s not only hard to manufacture, but will probably be hard to repair, experts say.

Stainless steel is not easy to shape or mold, “Hence the look as if it’s the output of a student in an in-class ‘Pop Quiz Number 1’ for the course ‘Intro to Car Design,’” says Raj Rajkumar, a professor of electrical and computer engineering at Carnegie Mellon University. The material requires specialized welding techniques, and it doesn’t flex easily, which could be dangerous in a crash, when force usually absorbed by a “crumple zone” could be transferred to cabin occupants instead, Rajkumar says.

Experts have noted that the odd shape of the vehicle, and particularly its sharp edges, will make it hard for the Cybertruck to meet pedestrian protection rules in Europe, and possibly in other markets. “These long, unbroken sheets of metal, with the sharp lines and a humongous windshield, make me think there’s going to be some real issues with potentially passing safety regulations, especially outside the US,” Gartner’s Ramsey says.

Addressing all of these manufacturing and engineering issues is likely to have substantially pushed up the price of the Cybertruck. Musk initially said the pickup’s price would start below \$40,000. However, by 2021 those attractive price estimates had already been removed from Tesla’s website. Musk told shareholders last year that the vehicle’s specifications and pricing had changed since its introduction in 2019.

Now, in the \$100 preorder agreement, Tesla merely states that “the Final Price Sheet will be provided to you as your delivery date nears.”

Exactly when that date will be remains an open question. On an earnings call on January 26, 2022, one day after the date on the leaked report, Musk announced that the Cybertruck would be delayed until “probably next year,” arguing that launching a new vehicle would disrupt the company’s production schedules. “If we were to introduce new vehicles, our total output will decrease,” Musk said on

the call. Tesla has since pushed back mass production of the Cybertruck once again, to 2024, despite Musk declaring in a YouTube interview in July 2022, just five months after the NVH report, that the design was “finally locked,” adding, with an audible sigh, “We got too carried away.”

The leaked report only details structural design issues that the truck was experiencing in 2022, and it doesn’t cover other key factors, such as electric motor or battery performance, nor the vehicle’s software. In late May, Handelsblatt reported that among the documents it had received were thousands of customer complaints concerning the erratic behavior of Tesla’s Full Self-Drive (FSD) features. In the US, the National Highway Traffic Safety Administration, a government agency responsible for road safety, is investigating the FSD system. The agency compelled Tesla to recall Full Self-Driving software earlier this year. Tesla did not agree with the agency’s conclusions, but updated its software through automated uploads to customers’ cars.

Have you worked for Tesla? Is there something you think we should know? Email the authors at Jeremy.White@wired.com or Arian.Marshall@wired.com.

The documents contained in the leaks to *Handelsblatt* also included private information, including employee salaries and customer bank details. The data protection authorities in the Netherlands, where Tesla has its European headquarters, are investigating the leak. Under the European Union’s privacy law, companies can be fined up to 4 percent of their annual revenue for data breaches. In May, Facebook was fined €1.2 billion (\$1.3 billion) by Ireland’s Data Protection Commission over transfers of user data from Europe to the US.

Tesla’s share price collapsed last year, falling from more than \$400 in late 2021 to below \$110 in January 2023. However, it has rallied in the last few months to around \$200. It is still the most valuable car company in the world, and the global leader in EV sales.

While the Cybertruck delay is not a good look for Tesla, the truth is that Musk and his company may have more important priorities. Investors are more interested in seeing the company hit its sales targets of 1.8 million vehicles this year, up from 1.2 million last year; completing its Mexico manufacturing facility on time by 2025; making progress on gigafactory projects in the US, China, and Germany;

and on successfully launching other new models, including a more affordable car, priced at around \$30,000.

“[Musk] has a lot of balls in the air,” Tom Narayan, analyst and head of global autos practice at RBC Capital Markets, says. “Cybertruck is on the list of things that are a priority, but it’s not up there. I don’t think it was ever going to be a high-volume vehicle.”

It is astronomically unlikely that Tesla will cancel the Cybertruck project. The engineering challenges detailed in the 2022 report were serious but not terminal, and could be fixed with enough money—which Tesla has plenty of. “There’s no way they’re not going to be able to find a way to get the Cybertruck acceptable for the market,” the automotive engineer says. “It may not be the quietest EV out there, but who cares? They’re going to sell them. People have been waiting years for them.”

And, it has loyal customers, some of whom have a cultlike devotion to the brand and its founder and aggressively defend it against critics on Twitter—the platform, worth an estimated \$15 billion, that Musk spent \$44 billion to buy last October. But whether, when the trucks finally start rolling off production lines en masse, buyers will get what they’re waiting for remains to be seen.

“There’s this reality distortion field, because Tesla has had so many delays before, and people are so used to Elon Musk’s wishful thinking around products and capabilities.” Ramsey says. “Now no one believes him in the first place.”

Update: An earlier version of this story incorrectly dated Elon Musk's “It's awesome!” tweet to January 26, 2022 instead of January 25.

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