

7  
ESSENTIAL SKILLS  
YOU DIDN'T LEARN  
IN COLLEGE

ASK A  
FLOWCHART:  
ARE YOU AN  
EVIL TWIN?

THE  
INSIDE STORY  
OF THE  
FACEBOOK MOVIE

# WIRED

THE AGE OF THE ELECTRIC CAR IS HERE.

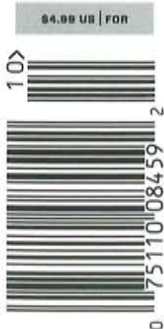
# CHARGED!



**4** NEW ELECTRIC CARS  
TESTED + RATED

How Elon Musk turned Tesla into the fast, flashy, high-voltage car company of the future.

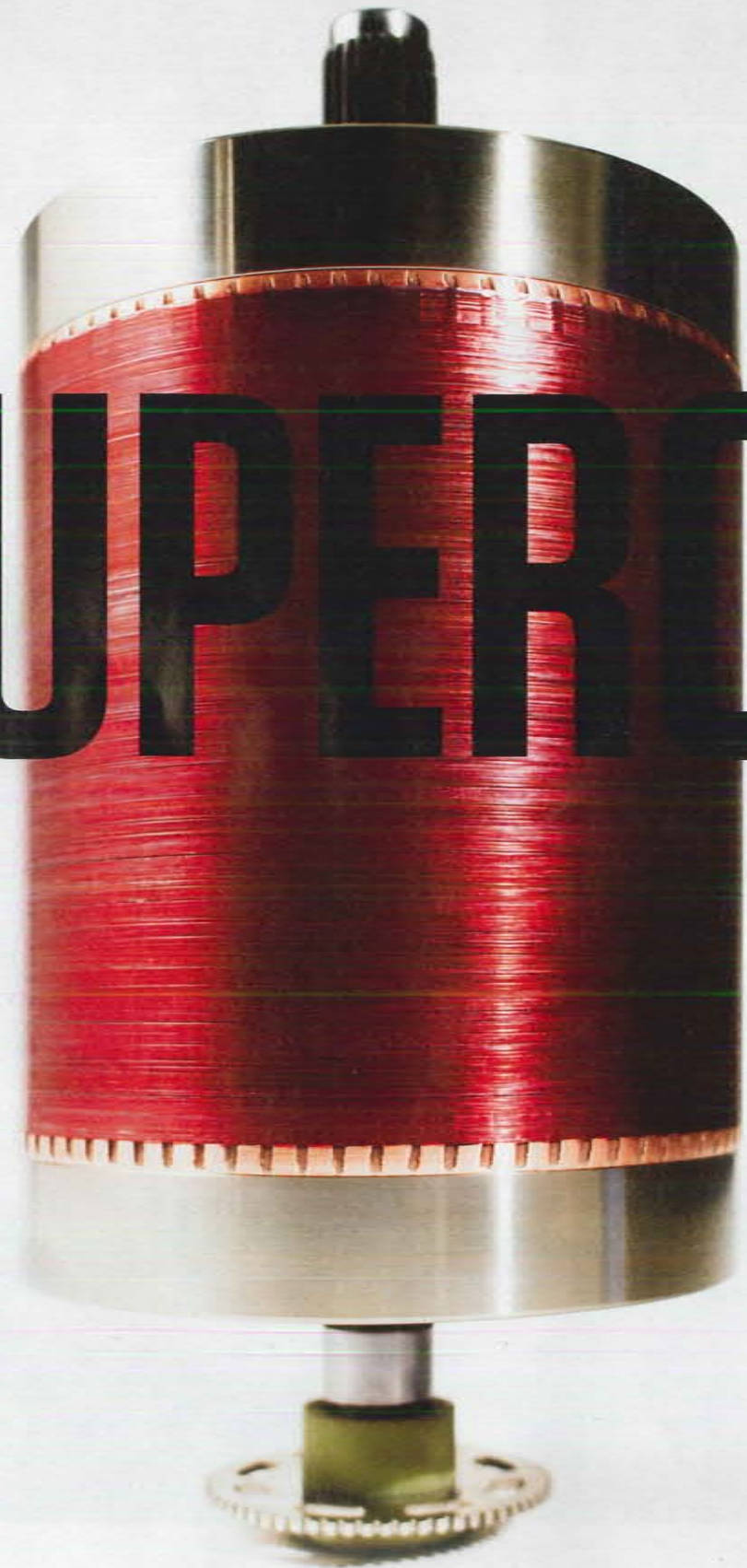
The forthcoming Tesla Model S



BY JOSHUA DAVIS

batteries included | oct. 2010

# SUPERCHARGED



The 12.8-inch rotor at the core of Tesla's Model S.



The age of the electric car is here. How Tesla Motors made zero emissions fast, flashy, and totally fun.



PHOTOGRAPH BY Nigel Parry

WARDROBE: LOUISE CHEN/SAGS FIFTH AVENUE; STYLIST: MICAH BISHOP/ARTIST UNITED; GROOMER: YAMARA BROWN/ARTIST UNITED



**ELON MUSK LOOKS LIKE A KID WHO JUST WALKED INTO A TOY FACTORY.** The 39-year-old CEO of upstart car company Tesla Motors stands on the main floor of the New United Motor Manufacturing plant and looks with awe from one giant piece of machinery to the next. The car factory, known as Nummi, is located in Fremont, California, but it's an industrial city unto itself. It encompasses 5.5 million square feet and contains a plastics molding factory, two paint facilities, 1.5 miles of assembly lines, and a 50-megawatt power plant. Since 1984, Toyota and General Motors had run Nummi together, producing as many as 450,000 cars a year here until it was shuttered in April. Now, in a remarkable turn of events, Musk owns the place. ¶ He seems as surprised as anyone at this development. For years, the exuberantly ambitious entrepreneur wasn't even allowed to visit. Plant managers apparently frowned on the idea of a potential competitor touring the facility. Not that they had much to fear: In 2009, Tesla managed to produce only

about 800 high-performance electric sports cars—a niche manufacturer in an industry that churns out millions of vehicles.

But Musk never intended to be a niche player. After making roughly \$180 million as a cofounder of PayPal, he helped get Tesla off the ground in 2004 with an initial investment of \$6.3 million. The startup's audacious business plan had three steps. First, develop a high-end, high-performance sports car to prove that electric vehicles were both cool and feasible. Second, roll out a luxury sedan that would compete with high-end brands like BMW and Mercedes. Third, produce hundreds of thousands of low-cost electric vehicles for the masses.

Musk has pulled off the first step. In 2008, Tesla released the Roadster, a two-seat sports car, and has since sold just over 1,300. By 2009, the government agreed to loan the company \$465 million from an alternative vehicle fund to launch phase two: Challenge the car industry head-on by mass-producing the Tesla Model S, a stylish four-door sedan powered

by more than 7,000 lithium-ion batteries. Just one problem: Musk didn't have a factory. Tesla was outsourcing most of the Roadster manufacturing, assembling the cars one by one in a garage behind its showroom in Menlo Park, California. (The building had once been a Chevrolet dealership.) Fabrication on a mass scale was obviously impossible there. Musk needed a legitimate facility like Nummi, but the plant had recently been valued at nearly \$1 billion—way beyond what a small startup could afford.

But in March of this year, Nummi plant managers got an unexpected call. Akio Toyoda, president of Toyota, had given permission for Musk to conduct a clandestine tour. Toyoda wanted to see whether Musk was interested in buying the factory and needed to keep it quiet to prevent media attention from scuttling a deal. At the time, the car industry was in the process of retrenching after the economic meltdown of 2008. GM had already pulled out of the plant after declaring bankruptcy in 2009, and Toyota planned to stop production in less than a month. There weren't too many people interested in buying a 200-acre white elephant of a car fac-

tory, so Toyoda opened the door for Musk.

On his first visit to Nummi, Musk donned a hard hat, a blue jacket, and plastic safety goggles and acted as inconspicuous as possible in the hopes of not being recognized. As a Nummi plant manager led him discreetly through the factory, he gawked at the massive scale of the place and tried to suppress his excitement. Hundreds of Toyota Corollas and Tacoma trucks rolled down the assembly lines. Thousands of people buzzed about. It was everything he had dreamed of for Tesla. He offered what he had budgeted for a more modest factory: \$42 million. A month later, to his astonishment, the offer was accepted.

Now, on his second visit to the plant—his first as its owner—Musk is trying to get his

bearings. Just five weeks earlier, Tesla had gone public, netting \$238 million and making it the first American car company to complete an initial public offering since Ford in 1956. As a result, the company has access to more than \$700 million, a significant portion of which will go toward retrofitting the facility. It's a daunting task. Musk walks past row after row of motionless robotic drills. A multiton crane stands idle beside a 60-foot-tall steel press. The ceiling soars high overhead, making even the press look somehow small. For a moment, Musk appears overwhelmed by what he's gotten himself into.

"Holy crap, this place is big," he says, but then he flashes a smile. "It's perfect."



## TO BUILD THE NEW TESLA MODEL S MUSK NEEDED TO BUY A FACTORY.

JUST THREE YEARS AGO, Tesla Motors was in big trouble. The company's inaugural product—the \$109,000 Tesla Roadster—was due to begin production in September 2007, but an internal audit done over the summer revealed that the cost to actually build the car had climbed to \$140,000. It was a money-loser before a single unit had been delivered.

Musk was the lead investor but wasn't running the company then, and he was taken aback by the state of affairs. He'd been led to believe that manufacturing the car would cost \$65,000 and decided to investigate the discrepancy himself. He visited the body panel fabricator in England and discovered that the facility didn't have the right tools to do the job. The car wasn't just too expensive—as things stood, it couldn't even be built.

At this point, Musk and other investors had sunk nearly \$100 million into the company and didn't have a single car to show for it. Martin Eberhard, CEO at the time and one of Tesla's founders, was demoted and in a matter of months left the company. Michael Marks, an investor and former head of electronics maker Flextronics, stepped in as interim CEO.

Marks immediately drew up a list of roadblocks standing in the way of the car being built. The transmission didn't work, the air-conditioning didn't work, the quality of the seats was unreliable—the list kept going. The situation, Marks wrote in an email, was "a lot scarier and [more] pressing than I thought." All work on the Roadster was put on hold—the company, Musk says, was in a "near-fatal financial situation." He had boasted that Silicon Valley smarts could beat hidebound old Detroit at its own game. Now that wasn't looking so easy.

At the end of 2007, Musk decided to put another \$20 million into Tesla. He wasn't ready to concede defeat, because for him there was more at stake than just creating a viable company. The combustion engine had made the world dependent on oil, resulting in climate change, massive transfers of wealth to oil-producing countries, and heightened geopolitical tensions. Musk believed that the auto industry had too much financial and psychic investment in the engine to admit that the 19th-century technology had outlived its usefulness. Tesla, however, could jump-start the electric car era and help solve the problem.

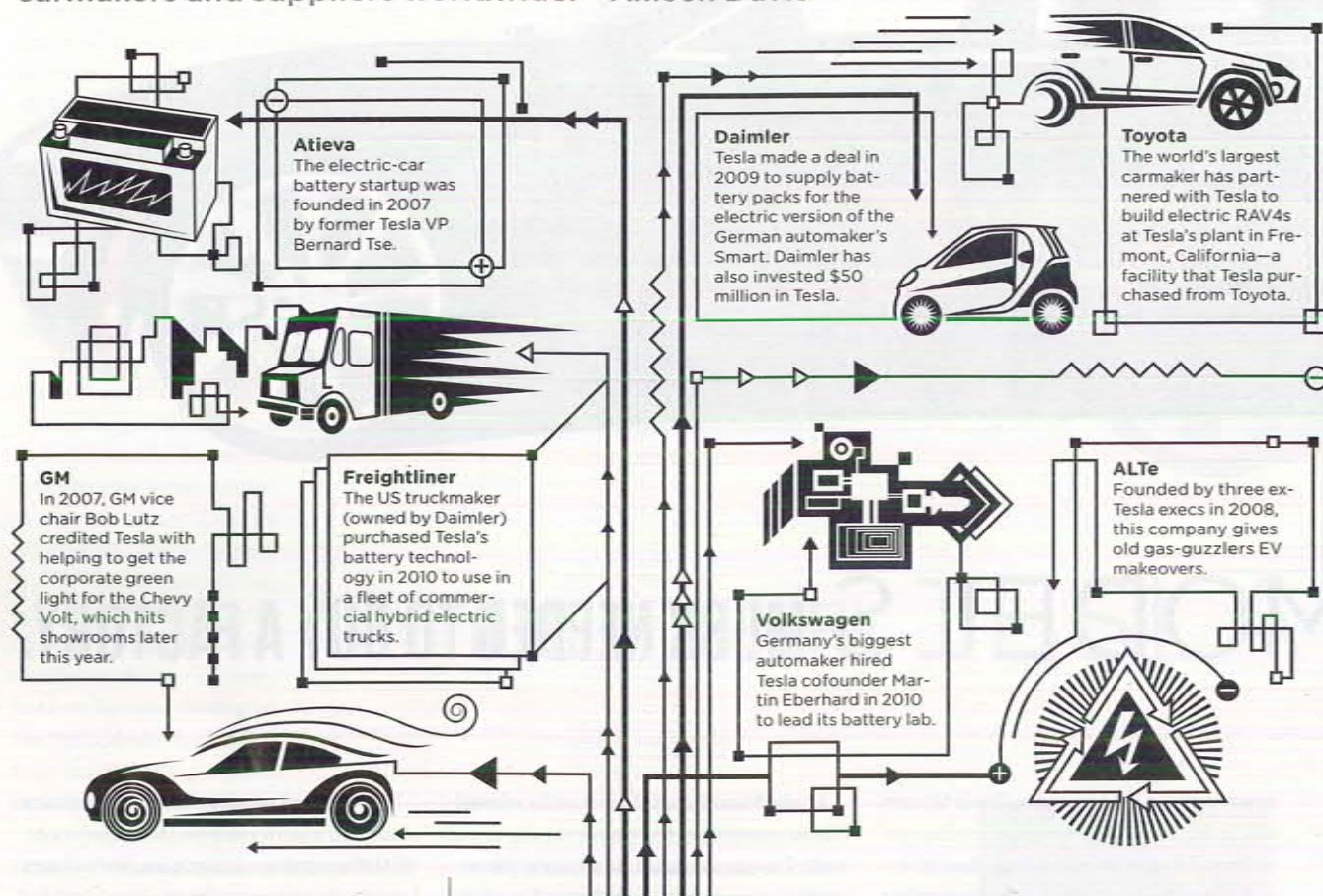
The impact of switching to electrics would be transformative, Musk believed. With the combustion engine, we've been largely stuck with oil to produce fuel for transportation. Electricity, on the other hand, can be produced in many ways—by



The sleek, roomy interior of Tesla's Model S.

a coal-powered plant, a nuclear reactor, a hydroelectric generator, a wind farm, or a solar array. In a world dominated by electric cars, all these power-producing technologies would be spurred to compete, encouraging innovation. What's more, an electric engine is inherently more efficient than a combustion engine: One gallon of gasoline could be used to generate enough electricity to power

**The Tesla Effect** Although it may be a tiny startup, Tesla Motors has energized the auto industry. Here's how the company has influenced carmakers and suppliers worldwide. —Allison Davis



an electric vehicle for hundreds of miles.

Despite the manufacturing challenges, Tesla's engineers had successfully designed a durable and powerful battery pack using lithium-ion laptop cells. It was no easy task. Lithium-ion batteries can explode if overheated, so the team came up with an innovative cooling system that circulates water and antifreeze in sealed tubes throughout the battery array. They installed sensors that would disconnect the battery within milliseconds in the event of a crash or if smoke, humidity, or water entered the pack. At the same time, it provided 200 kilowatts of juice—enough to let the 288-horsepower motor rocket the Roadster from 0 to 60 in less than four seconds.

The auto industry began to take notice of the little startup with the big ideas. In January 2007, GM unveiled a prototype electric vehicle called the Chevrolet Volt. In an interview with *Newsweek*, Bob Lutz, then GM's vice chair, said, "If some Silicon Valley startup can solve this equation, no one is going to tell me anymore that it's unfea-



sible." That same year, Daimler unveiled plans to develop an electric version of its Smart car. Suddenly, the major carmakers were moving into electrics so fast that Tesla risked being left behind by the wave it had generated.

Musk tried to accelerate the rollout of the Roadster by hiring Ze'ev Drori, a nonsense former Israeli paratrooper and microchip executive, to take over as CEO. While Drori focused on solving the Roadster's problems, Musk started to think about ways to bring in more income.

One option was to try to ride the electric wave by selling battery packs to the larger manufacturers. The income could keep Tesla alive long enough to eventually compete head-to-head. After all, electric vehicles were going to need batteries, and Musk was convinced that Tesla had the best power packs. Of course, most manufacturers weren't inclined to make a huge bet on a struggling startup.

Still, Musk tried. In September 2007, he flew to Stuttgart, Germany, and met with a group of Daimler executives, who listened skeptically as Musk told them how great his technology was. They weren't sold.

But two months later Musk got an email from Herbert Kohler, Daimler's head of advanced engineering, saying that he and some other Daimler execs would be in California in six weeks and would be willing to look at Tesla's technology.

It was all Musk needed. He immediately called JB Straubel, Tesla's CTO.

"We need to make an electric Smart car in six weeks," Musk said. "Can you do it?"

Straubel pointed out that it would mean he'd have to pull engineers off the Roadster at a time when they were still desperately trying to solve production problems. It was a tough call, but Musk believed that if they could prove themselves to Daimler, they could win a valuable contract. In addition to the much-needed cash, it would validate Tesla in the eyes of the world. They had to try.

Straubel had another question: Where was he supposed to get a regular, gas-powered Smart car to retrofit? At the time, Daimler didn't sell Smarts in the US.

With a bit of research, he discovered that the cars were sold in Mexico. He made a few calls and located a dealership in Tijuana with stock on hand. He hurriedly decided to send someone to fetch a car. A Tesla engineer suggested a friend who was fluent in Spanish, and, after a quick call, the guy agreed to make the trip south.

Straubel walked over to the finance department. "I need \$20,000 in cash in a bag right now," he said. "We're sending someone to Tijuana to buy a Smart car."

The finance person noted that a lot could go wrong with that scenario but got Straubel the money. Three days later, the engineer's buddy showed up at Tesla headquarters with a brand-new Smart car.

Straubel and his team removed the 83-horsepower gas engine and set to work building a custom battery pack that would fit in the tiny car's engine compartment. Next, they refashioned a Roadster motor to power it. When they got too tired, they napped underneath a staircase, but the pounding of feet overhead made it hard to stay asleep for long.

Finally, at one o'clock in the morning, five and a half weeks after setting to work, the reengineered Smart was fully assembled. Straubel got in the driver's seat and switched on the power. He goosed the accelerator and rocketed out of the garage and into the parking lot. When Straubel floored it, the front wheels lifted off the ground and the back tires left marks on the asphalt.

Straubel called Musk and told him the car was ready for the Germans.

**THE DAIMLER EXECUTIVES** sat down in Tesla's conference room midmorning on January 16, 2008. Musk walked them through a PowerPoint presentation that explained the advantages of the Roadster's technology. Kohler wasn't impressed. He wasn't here to talk about a flashy, limited-run show car. He wanted to know if Tesla could mass-produce battery packs quickly for the Smart. His frosty demeanor indicated that, in his opinion, it didn't seem likely. "We've actually got something to show you," Musk said and asked the Daimler execs to follow him.

Kohler spotted the shiny new Smart sitting in the middle of the garage and didn't smile. It might have seemed like a gimmick at first—Musk managed to get a Smart into the US. Big deal.

"It's electric," Musk said. "What do you mean?" Kohler asked. "We put in a Tesla battery and motor." Kohler examined the car. Straubel had been careful not to alter its shape or interior, so it was impossible to tell that it had been modified.

Kohler got behind the wheel and Musk hopped in the passenger seat. When the German stepped on the accelerator, the car bolted out of the garage and disappeared. Straubel waited nervously with the other Daimler executives. After 15 minutes, the Smart tore back into the garage. Straubel noticed that the normally taciturn Kohler was trying hard not to smile.

"Let's explore a partnership," Kohler told Musk.

**OVER THE COURSE** of 2008, Tesla solved the production problems on the Roadster and, one by one, the cars started to hit the streets. The reviews were glowing. *Car and Driver* called it a "revelation" and *Motor Trend* gushed. | CONTINUED ON PAGE 176



## Supercharged

CONTINUED FROM PAGE 145

"The Roadster is a cool automobile technically, a cooler automobile to drive, and an historic game-changer in our perception of battery-electric vehicles." Musk accumulated hundreds of orders for the \$109,000 car. It looked like the company might survive after all.

Musk, however, wasn't interested in just surviving. Though he said the company could reach profitability if it focused just on the Roadster and the battery pack business, he didn't rein in his ambition. The point, after all, had never been to supply fast cars to rich people. The point was to transition the world to electric transportation. He obviously didn't think small. His other main business, a rocket company called SpaceX, aimed to replace the space shuttle and eventually take people to Mars. With Tesla, the Roadster was simply a proof of concept that set Musk up for the next step in his business plan: the Model S.

The difficulties Musk encountered with the Roadster hadn't made him wary of innovation. In fact, in the summer of 2008 he got bolder: To rev up the sedan effort, he hired Mazda's lead North American designer, Franz von Holzhausen, and told him that he wanted a four-door car that seated seven.

"That's an SUV, not a sedan," von Holzhausen responded.

Musk countered that von Holzhausen had a rare opportunity to design something new. The Roadster was based on a modified Lotus chassis that was manufactured in England and shipped to Tesla for final assembly. With the Model S, they were going to build their own chassis from the ground up. Since this new platform didn't have to accommodate exhaust pipes, thermal shielding to protect against engine heat, or bulky catalytic converters, there would be a lot of extra space. That meant it was theoretically possible to put in a third row of seats. Musk didn't just

want to build a functioning electric sedan—he wanted to redefine what a sedan could be.

Given the positive response to the Roadster, Musk was confident that he would be able to raise another \$100 million that summer to send the Model S into production. Goldman Sachs was arranging the financing and sounded bullish. Then the subprime mortgage crisis began to spiral out of control. Suddenly major banks were on the verge of collapse. The last thing investors wanted to do was put money into a startup car company. By October, Goldman had made little progress, and Musk told them to give up.

Week after week through the fall of 2008, Musk watched Tesla's bank balance drop. His team had been able to bring down the cost of producing the Roadster to approximately \$95,000 by renegotiating supplier contracts and redesigning parts to be simpler. Still, Tesla had presold the car in 2007 to hundreds of buyers at a discount price of \$92,000. Costs were continuing to drop—they could make it to profitability if they didn't go out of business first—but by the end of the year, Tesla had less than \$500,000 in the bank. They were in danger of not making payroll. Bloggers mounted a Tesla deathwatch.

Musk was down to the last \$20 million or so of his personal fortune. Tesla and SpaceX had consumed the rest. If he held on to the \$20 million, he could walk away and still be rich. He was 37 years old—he had plenty of time to try something less risky.

He called his younger brother, Kimbal, who had invested more modestly in Tesla, and told him that the company needed another cash infusion. The two had made millions together in 1999 when they sold Zip2, an online media services company, to Compaq. Kimbal, who lives in Boulder, Colorado, was about to order a coffee at Starbucks when his phone rang. He stepped outside into the cold to talk.

"You really think it's rational to put more money in?" Kimbal asked, implying that maybe it was time to move on.

"We're so close," Musk said. Kimbal could hear the stress in his brother's voice. Musk's marriage to novelist Justine Musk had just fallen apart, and one of his SpaceX rockets had recently failed to reach orbit in a botched launch. Still, Musk wanted to take on more risk.

"Daimler's almost there," he said. "The Roadster's almost there. We can't quit now."

Musk knew what needed to happen: Make the Roadster profitable and build battery packs for Daimler, then use that revenue to stay alive long enough to get loans from the government and launch the Model S. He was ready to put the last of his money in, but if any one of those things didn't come through, it'd be over. It didn't matter. Musk was convinced he could pull it off. He had asked Drori to step down as CEO and took over the role himself. He was going all-in.

"Elon has huge steel balls," his ex-wife notes on her blog. "He truly does."

Kimbal actually found himself believing they could make it and agreed to put in more of his own money. Musk soon persuaded most of his other investors to pony up emergency funds, raising a total of \$40 million. The company was going to have one last shot.

But underneath the bravado, Musk wondered if he would have to start over with nothing. He soon got a taste of what that would be like when he found himself borrowing money from friends to pay his living expenses. "At that point, every day was like eating glass and staring into the abyss of death," he says.

**The emergency funds** kept Tesla afloat, and almost immediately things started to unfold just as Musk had predicted. In January 2009, Daimler finally felt confident enough to buy 1,000 battery packs for the Smart in a deal worth more than \$40 million for Tesla. Then, in May of that year, Daimler agreed to buy a nearly 10 percent stake in the company for \$50 million, giving Tesla a valuation of more than \$500 million. More important, a pioneer of the internal combustion engine was vouching for the tiny electric car startup.

Throughout the financial turmoil at the end of 2008, von Holzhausen had focused on designing the Model S. In March 2009, he'd finished a prototype. It was certainly no ordinary sedan. The car had the sexy, sloping lines of a Porsche and the muscular stance of a BMW. The company unveiled it in front of hundreds of people at Musk's rocket factory near Los Angeles. When von Holzhausen dramatically pulled a silver sheet off the car, it sparkled under white spotlights.

"You'll see that this isn't some show car that doesn't do what it says it'll do," Musk told the crowd. "It'll go fast with a lot of people in it."

Musk got behind the wheel and began zipping guests up and down the street. The car impressed. It featured a sleek 17-inch touchscreen on the center console, and since it lacked a combustion engine, there was room under the hood for a spacious storage area. The battery pack was flat, rectangular, and tucked under the floorboard, which meant that it didn't infringe on the passenger space, giving the car a nice, open feel. And with the cargo area in the front, there was space in the rear for an extra row of seats facing backward. Just as Musk had asked: room for seven. Removing the design constraints of a combustion engine opened up the sedan to new possibilities.

The turnaround continued. Three months after the Model S unveiling, the federal government announced that it would loan Tesla \$465 million to bring the sedan to market as part of the Advanced Technology Vehicles Manufacturing Loan Program. Established manufacturers received substantially more to develop their electric vehicle programs. Ford, for instance, was awarded \$5.9 billion, and Nissan got \$1.6 billion. Musk relished pointing out that, unlike Tesla, those recipients of larger loans weren't even selling electric vehicles. Then again, he had never mass-produced a car. The loans would give him the opportunity to do just that. But there was a hitch: The money wouldn't be disbursed until he found a place to build the car.

**One morning this April**, Musk walked out of his Bel Air house wearing a tie covered in fake blood. Deepak Ahuja, Tesla's CFO, was flabbergasted. For days, the team had been preparing for a breakfast meeting with Akio Toyoda, exchanging emails on the fine points of Japanese business etiquette, including how to bow and the proper two-handed procedure for presenting a business card. Now, minutes before the Toyota president was due to arrive, Musk was wearing a Halloween joke tie emblazoned with pumpkins, skeletons, and fake blood. He was going to ruin everything.

Ahuja glanced nervously at Diarmuid O'Connell, Tesla's vice president of business development. O'Connell didn't know what to say. They stood awkwardly for a moment in front of the house while Musk started tapping out an email on his iPhone.

Then Musk looked up at them and broke

into a broad smile. "I got you guys!" he blurted and started laughing. Musk wanted to diffuse the apprehension of meeting the president of the world's largest carmaker, and the bloody tie seemed to do the trick. Ahuja and O'Connell started laughing, too.

Musk took the tie off as a convoy of Toyota Sienna minivans and a Lexus limousine pulled up his driveway. Bodyguards stepped out of the vehicles, followed by a flood of Toyota executives. For a moment, nobody knew what to do. Toyoda had called the meeting to discuss "business opportunities," but nobody had met him before. Musk

## Musk wanted to diffuse the apprehension of meeting Toyota's president—a bloody tie did the trick.

fidgeted with his phone while Ahuja wondered whether he should bow.

O'Connell spoke up first and introduced Musk. Toyoda stepped out of the crowd and everyone started shaking hands. So much for bowing, Ahuja thought.

Toyoda noticed Musk's red Roadster in the driveway, and the conversation quickly turned to the car.

"You want to take it for a spin?" Musk offered.

In a matter of minutes, the 53-year-old Toyoda had the accelerator floored, pinning Musk's head to the seat. Toyoda was a certified Toyota test driver and had competed at the 24-hour Nürburgring endurance race in Germany. Musk could tell. Toyoda chatted in a relaxed way as he whipped the car around corners in the hills above Sunset Boulevard. Musk tried to focus on the conversation. Toyoda said he wanted his company to be more entrepreneurial. That's why he had wanted to meet Musk and give the Roadster a try in the first place. He liked the fact that Musk had managed to bring the vehicle to market. Plus, it seemed like a fun car.

When they got back to Musk's house, they ate breakfast, then Toyoda cleared his schedule for the rest of the morning and got back in the Roadster with Musk. He wasn't done driving the car.

Toyoda piloted them onto the 405 freeway—the top was off and the wind whipped

their hair as they accelerated. They sped south, toward SpaceX, while Toyota's limo and fleet of minivans attempted to keep up. At the rocket factory, the two men hunched over Musk's computer and gleefully watched rocket-launch videos like a pair of 12-year-olds. Musk asked if Toyota wanted a frozen yogurt—there was a fro-yo cart in the factory. It sounded good, and a few minutes later they were eating yogurt amid hulking rocket fuselages. It was a lot of fun.

Four weeks later, Toyota decided to invest \$50 million in Tesla. The auto giant also signed on to develop prototype electric

vehicles with the startup and indicated that it would support Musk's \$42 million offer for the billion-dollar Nummi factory in Fremont.

During the press conference announcing the deal at Tesla headquarters, Toyoda took the microphone and talked about getting to drive the Roadster and how it had impressed him. He decided to work with Tesla, he said, so that Toyota could learn from the small company's "spirit" and "energy." When asked by a Reuters reporter why he had chosen to partner with Tesla among all the electric car startups, Toyoda looked over at Musk. "Musk-chan," he said. "I love him."

**"What's the disengage force?"** Musk asks. He's watching a computer simulate the fabrication of a Model S part at Tesla's vehicle engineering department. The big, single-room office is filled with more than 100 engineers. Desks are clustered by sub-specialty—aerodynamics, suspension, interiors—and Musk does a weekly walk-through to monitor progress. Now he wants to know exactly how a metal stamping machine will release a body panel.

"The press is spring-loaded," replies the manufacturing engineer running the simulation. He's been with the company only three weeks. Before he arrived, nobody was focused on how to optimize the metal stamping process. It's something Tesla is figuring out as it goes.

The clock is ticking. Musk says Model S production will start in 2012, less than two years from now. To help him pull it off, Musk has hired an impressive roster of seasoned automotive engineers and manufacturing specialists. Gilbert Passin, the former Toyota executive in charge of the Nummi factory, joined Tesla in January. Peter Rawlinson, formerly a top engineer with Jaguar and Lotus, is now Musk's top Model S engineer.

Rawlinson is tasked with rapidly finalizing the sedan's specifications in advance of fabrication, and he hosts Musk's walk-throughs. He guides his boss over to the "noise, vibration, and harshness" team, whose job is to minimize all three unwanted attributes. The engineers replay their latest simulation, which shows that the Model S will be quieter and smoother on the road than most other cars.

"Sweet," Musk says while examining the data. "We're gonna have the highest torsional frequency ever."

Roger Evans, a noise, vibration, and harshness engineer, points out that the battery pack

actually makes his job easier. Evans spent 15 years at Ford trying to make cars and trucks quieter. Out of necessity, Ford's designers placed a tunnel in the frame of their combustion vehicles to make room for exhaust pipes and a driveshaft. It makes a car less stiff and creates more noise, but there was nothing to be done about it. Now Evans doesn't have to contend with exhaust pipes and a driveshaft—the car's underbelly is perfectly flat, resulting in increased rigidity. The battery pack sits in a 9-inch-deep rectangular metal frame that's bolted onto the floor of the car, adding even more stiffness. The vehicle has a vibration specialist's ideal contours, and Evans seems almost giddy as he explains to Musk the platonic ideal he's achieved.

Rawlinson's other engineers pull up simulations that show the car will feature superb aerodynamics, road handling, and safety attributes. On the computer, the car performs better than an Aston Martin, costs significantly less, and can stow a surfboard.

"I just hope we get good correlation with our predictive models," Rawlinson tells Musk.

In other words, Rawlinson hopes that they can actually build a car as cool as the one on their computer screens.

**At the Nummi plant** the following week, Musk dons a hard hat and surveys his new factory. A 60-foot-tall wrecking machine tears down a wall, making way for what will eventually be a Tesla assembly line. Right now, it's just a dusty pile of rubble.

Passin, head of manufacturing, leads the way into the plastics factory, a separate building filled with hulking bumper-making machines. The contraptions are so big, Musk and four Tesla executives walk inside one to inspect it. They're surrounded by metal walls designed to slam together to mold bumpers. The unit is off and the walls are far apart, but there is a sense that they could pound in at any moment. It feels like standing inside a gargantuan trash compactor.

Musk seems to like the space. "The great thing about this place is that it sets us up for the next generation after the Model S," Musk says. "We could have 250,000 cars coming out of here in five years."

That is, if Musk can pull off the Model S. The factory is currently set up to produce cars made of steel and uses magnets to lift and position parts. To cut down on weight, the Model S will be built out of aluminum, which isn't magnetic. Passin plans to retrofit machinery with suction cups to work around the problem.

There are plenty of other obstacles: Tesla has to hire a workforce, deal with the unions, and wrangle parts suppliers for which 20,000 cars is still a small number. And if and when the Model S does roll off the line, Tesla will have to face a marketplace crowded with electric car competition from big-league manufacturers like GM and Nissan.

None of this seems to bother Musk.

Tesla's financial situation has turned around, he explains. He finally has the capital and the infrastructure to transform the company.

Not that the road ahead is totally smooth.

"I'm not staring into the abyss of death anymore," Musk says. "I'm just eating glass now." **W**

Contributing editor **JOSHUA DAVIS** ([www.joshuadavis.net](http://www.joshuadavis.net)) wrote about flushless urinals in issue 18.07.

## WIRED EXCHANGE

### MONITOR YOUR BODY FAT, HYDRATION, MUSCLE MASS, & MORE!

More Than Just Scales, Fitness Assessment Instruments from  
TANITA - The Leader In Body Composition Monitors!

ALL TANITA BODY COMPOSITION MONITORS ARE FDA CLEARED!

NEW!  
Radio  
Wireless  
Model



**BC-1000**

- Multiple Display Options
- Weight Capacity - 440 lbs

NEW!  
Blue  
Backlit  
LCD  
Display



**IRONMAN BC-549 Plus**

- Extra Large Platform - 13.4" Wide
- Weight Capacity - 440 lbs

NEW!  
Most  
Sensitive  
Model  
on the  
Market



**IRONMAN BC-350**

- Ultra-Thin Profile & Lightweight
- Weight in 0.1 lb Increments

**TANITA**

FREE UPS ground shipping on all orders over \$39!  
[www.TheCompetitiveEdge.com](http://www.TheCompetitiveEdge.com) | 866-859-3343

PROMO CODE: **W1010** for extra savings!

**competitive edge**  
edge.com

Prices valid on the BC-549 Plus, BC-1000 and BC-350 used 12/31/10, while supplies last. Free shipping continental US only. Ironman, Ironman, Ironman, and W are registered trademarks of World Trainers Corporation. ©2010 TheCompetitiveEdge.com. All rights reserved.



## The Most Advanced Air Purifier



[www.rabbitair.com](http://www.rabbitair.com)

888.866.8862 Call for a free brochure