

Automobile



GREEN: Tesla Roadster 2.0 Sport: Charging Expectations

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Photography by Eric McCandless

If small cars are particularly adept at changing direction, you might assume that small car companies can react to customer demands quickly, too. In the case of Tesla Motors, that assumption is correct. A host of updates to the Tesla Roadster addresses almost every concern we had after spending a week with the electric sports car - this Silicon Valley company is clearly listening to what people have to say.

As you might expect from a start-up, Tesla is continually refining the design and manufacture of its cars, mostly with the goal of reducing assembly costs and increasing long-term durability. Some of the changes, such as revisions to the fender liners, are easy to understand. Others require a postdoctoral degree in electrical engineering to comprehend. Like, for example, how new windings in the electric motor's stator reduce the variance in magnetic-field strength through the rotor's travel. Huh? Exactly.

Luckily, many of the changes included in Version 2.0 are things you can see and touch inside the cabin. A new dashboard eliminates the aluminum parcel shelf and replaces it with a real, locking glove box. The center console has been completely redesigned, substituting the shifter with push buttons and housing the LCD touch screen that was previously located near the driver's left knee. The gauge cluster no longer has a separate tachometer (it's redundant when there's only one gear); that space is now occupied by a much more useful power gauge. The climate controls now look like a conventional car's, and the system itself has been redesigned for more cooling output. An optional "executive leather" package swathes much of the interior in hide, completing the cockpit's transformation from Spartan to chic.

Version 2.0 also uses a new 375-volt electric motor with different stator windings that allow more current to flow at lower speeds - resulting in 40 additional hp. A \$19,500 sport package (which, along with \$14,000 worth of optional carbon-fiber accents, was on the car we tested) includes reprogrammed power-management controls that allow higher peak torque (295 lb-ft instead of 273) and reduce the 0-to-60-mph time from the 4.7 seconds we measured in a prototype two years ago to 4.3 seconds in the Roadster 2.0.

Traction isn't an issue, as the Sport rides on Yokohama Advan A048s - essentially street-legal racing tires (although it was shod with Pirelli winter tires when we tested it in Michigan). The base car's tendency toward understeer has been reduced by adding almost an inch in width to each front tire and by fitting an adjustable antiroll bar and stiffer springs at the rear.

Thanks to adjustable, remote-reservoir Bilstein dampers at all corners, Sport drivers can set up their Tesla to ride how they like. At the factory default suspension settings, the Sport demonstrates exemplary body control but actually rides better than the regular car, progressively absorbing bumps that would bottom out the base suspension. Otherwise, the driving experience is similar: the Roadster remains a hilariously fast leadfoot's delight, combining Corvette-like initial acceleration with Lotus handling and useful cruising range. Not to mention unmatched efficiency.

Now, if the world's quickest car company could just hurry up and make an electric sedan at a more affordable price, Tesla might have the biggest blockbuster since the Ford Model T. Oh, wait, Tesla already announced it - it's the upcoming Model S.



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Rock Down Through . . . Electric Avenue

By Jason Cammisa

Last year, a partnership was announced between SolarCity, a solar power equipment provider, and Rabobank, N.A., a group of community banks owned by a Dutch financial services company, to install and operate free electric-vehicle charging stations between San Francisco and Los Angeles. The so-called "California E. V. corridor" is now open for business and consists of four charging stations at Rabobank branches along U.S. Highway 101. The 70-amp Tesla chargers used at the stations will provide a full charge in one-third the amount of time of other public charging stations (a depleted Roadster's battery can be fully charged in less than five hours).

California EV drivers can also take advantage of www.evchargermaps.com, a free Google Maps-based site that shows the location of charging stations throughout the state. Many are located in public parking garages and are free. Hey, when was the last time someone offered you a tank of gas to park in their lot?

How Far Will It Go?

By Don Sherman

Range anxiety is every electric car's bugaboo. To measure the Tesla Roadster 2.0 Sport's realistic operating distance, we selected the Range charging protocol, gave the battery pack an overnight dose of electrons, and drove on a mix of Michigan freeways and back roads until the full charge was depleted. Our goal was 200 miles.

First, we cruised 120 miles on local interstate highways at 70 mph. Entrance ramps and traffic dropped the average to 65 mph. Circling ever closer to the charger plug, we completed the run on suburban roads, where our average speed was 30 mph.

Some sacrifices were necessary to reach our 200-mile goal. For instance, we ignored the dude in the Chevy pickup itching for a drag race; instead, we accelerated as if a police cruiser was hard on our tail. We barely touched the brake pedal, instead relying on range-stretching regeneration to slow for traffic and stoplights. Instead of using the range-depleting climate-control system to warm the cabin above the ambient 37 degrees Fahrenheit, we bundled up and gritted our teeth. We avoided headlamp drain by conducting our test in daylight hours. Finally, we used a separate battery to power our test equipment.

A green bar graph labeled "ideal range" provides the crucial look into the Tesla's state of charge. At the beginning of our test, it reported a range of 245 miles. When the graph showed 72 miles of range left, the display changed to yellow, followed by orange at 46 miles. The final digital reading was 25 miles of remaining range. Thereafter, an ominous row of dashes (---) was displayed where the range digits normally reside - according to Tesla experts, the range-calculation algorithms are not dependable at very low charge states. We rolled the final feet toward the charging plug with 200 miles on the odometer and a thin sliver remaining on the bar-graph display.

Your mileage - and range anxiety - may vary.

Along the 101 with no emissions:

San Francisco 106 miles
Salinas 107 miles
Atascadero 48 miles
Santa Maria 66 miles
Goleta 103 miles
Los Angeles

On sale: Now

Price: \$110,950/ \$155,850 (base/as tested)

Motor: 375-volt air-cooled AC, 288 hp, 295 lb-ft
Battery: Lithium-ion, 53 kWh
Drive: Rear-wheel
Weight: 2800 lb
Weight Dist. f/r: 34.8/65.2%
Tires f, r: Pirelli 210 Snow Sport 195/50HR-16, Pirelli SottoZero 225/45HR-17

Test results:

0-60 mph 4.3 sec
0-100 mph 13.3 sec
1/4-mile 13.3 sec @ 100 mph
Top speed 119 mph (governed)
30-70 mph 3.9 sec
Peak acceleration 0.70 g
70-0 mph braking 195 ft
Peak braking 0.89 g



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THE LIFE AND TIMES OF NIKOLA TESLA

By Don Sherman

The Tesla Roadster's pioneering role should, by now, be indelibly etched in every car enthusiast's information bank. Tesla Motors has survived infancy and has a credible business plan. But the memories of the man, whose name is attached to the first viable electric car and the company that builds it, have become obscure. To rectify that, we offer this concise biography of Nikola Tesla, the man who energized the 20th Century.

1856 Tesla was born on July 10 during an electrical storm at the stroke of midnight in the rural reaches of Croatia. His father was a Serbian Orthodox priest and his mother, though illiterate, was an adept tool maker. Nikola had one brother and three sisters.

1877 Following eleven years of public schooling, Tesla studied electrical engineering at the Austrian Polytechnic in Graz but did not graduate. He later attended the Charles-Ferdinand University in Prague, Czechoslovakia. Tesla was fluent in Serbo-Croatian and several foreign languages.

1881-2 Tesla was the chief electrician and chief engineer for Hungary's first telephone system before relocating to Paris to work for the Continental Edison Company. During this period he conceived the AC induction motor and other devices using a rotating magnetic field.

1884 Tesla immigrated to New York City with only pennies in his pocket. A letter of recommendation from his previous employer to Thomas Edison said, "I know two great men and you are one of them; the other is this young man." Edison was so impressed he put Tesla immediately to work redesigning the DC generators at the Edison Machine Works. Generous compensation bonuses offered as a reward for his long hours and intense effort were later denied; when Tesla was refused a pay raise from \$18 to \$25 per week, he resigned. Tesla and Edison were arch rivals for the rest of their lives.

1885 Tesla earned his first US patent for an electric-arc lamp. During his lifetime, at least 272 patents were awarded to this genius by 25 countries.

1887 After a stint digging ditches out of necessity, Tesla formed his first commercial enterprise, the Tesla Electric Light and Manufacturing company. Without realizing what it would later be called, Tesla invented the X-ray-generating vacuum tube.

1888 Tesla demonstrated his brushless AC electric motor to the American Institute of Electrical Engineers and began collaborating with George Westinghouse on polyphase power systems. AC power prevailed over DC because the ease with which its voltage could be increased and decreased, thereby facilitating efficient long-distant power transmission. The practicality of AC power was the industrial revolution's major enabler.

1891 This year's bold ventures were becoming a naturalized US citizen and demonstrating the possibility of transmitting electrical energy without wires.

1893 Tesla demonstrated a radio transmitter well before Marconi achieved success (and a patent, later invalidated), with similar technology. At the World's Fair in Chicago, the public at large experienced AC electric lighting -- both incandescent and fluorescent -- for the first time thanks to Tesla and Westinghouse.

1897 Tesla was issued a patent for the breaker-point-and-coil ignition system used by millions of automobiles in the twentieth century.

1898 Tesla's Madison Square Garden demonstration of a radio-controlled boat marked one of the first uses of radio waves.

1899 During tests conducted at his lab in Colorado Springs, Tesla measured a resonance frequency of 8 Hertz for the earth's ionosphere, an assessment confirmed by scientists half a century later. His dramatic Tesla coils were capable of producing millions of volts of electricity and wirelessly illuminating fluorescent lights located 50 feet away. A year later, this lab was liquidated to pay debts.

1906 On his 50th birthday, Tesla demonstrated a 200-hp bladeless turbine. Subsequent examples of this technology -- essentially a series of round discs driven by the working fluid's (steam or water) boundary layer -- produced 5000 horsepower.

World War I years -- An obsessive-compulsive disorder victim, Tesla became fixated with the number three. He often walked around the block three times before entering a building. He insisted on three folded napkins beside his dinner plate and staying in hotel rooms identified by a number divisible by three.

1916 Tesla was issued a patent for the type of speedometer universally adopted for automobile use.

1917 Tesla received the Edison Medal named after his bitter rival. (Shortly before he died, Edison acknowledged that Tesla's AC power concepts were vastly superior to his own DC approach.) Tesla also conducted the first successful research that led to the development of radar. During the build up to World War II, Tesla offered his death ray weapon to Great Britain as a cost efficient defensive strategy.

1926 During a *Colliers* magazine interview, Tesla accurately forecast the cell phone, drone aircraft, electric locomotives, solar energy applications, and the rise of women in the work force.

1927 Tesla's last patent was for vertical take off and landing aircraft.

1931 In celebration of Tesla's 75th birthday, *Time* magazine featured the eccentric genius on its cover; seventy science and engineering luminaries provided congratulatory salutations. One of his closest friends was Mark Twain.

End Game -- Tesla's creativity took an odd turn from the eminently practical to the purely hypothetical. He imagined aircraft that needed no wings or on-board propulsion. His 'thought photography' machine was for transmitting ideas directly from the brain to recording and video devices. He also espoused teleportation, time travel, and anti-gravity airships. During the last ten years of his life, he believed that one white pigeon paid him daily visits. Tesla hated pearl ear rings and germs of any form. He refused to touch hair other than his own. He was celibate his entire life.

1943 Now destitute and reclusive, Tesla died of heart failure in his New Yorker Hotel suite. He was subsequently recognized as the true inventor of the radio. Attempts by various government agencies to seize his records and documents failed and most of them became missing. His ashes and a few of his papers reside at the Nicola Tesla Museum in Belgrade, Serbia.

1960 The SI (International System of Weights and Measures) unit for magnetic flux density became the Tesla. A major moon crater and a minor planet are also named after Tesla.

1986 The rock band *Tesla's* debut album was aptly titled Mechanical Resonance.

1997 A special issue of *Life* magazine recognized Nicola Tesla as one of the 100 most famous people of the last millennium.

In addition to the various Tesla breakthroughs already addressed, Tesla received US patents for:

- The electric meter
- An electric railway system
- A reciprocating engine
- A steam engine
- An ozone generating device
- The electric transformer
- Various means of transmitting electrical energy through natural media
- Radiant energy devices