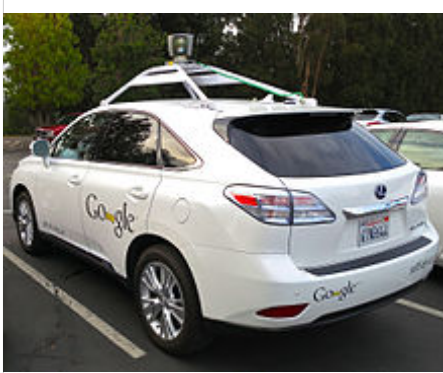
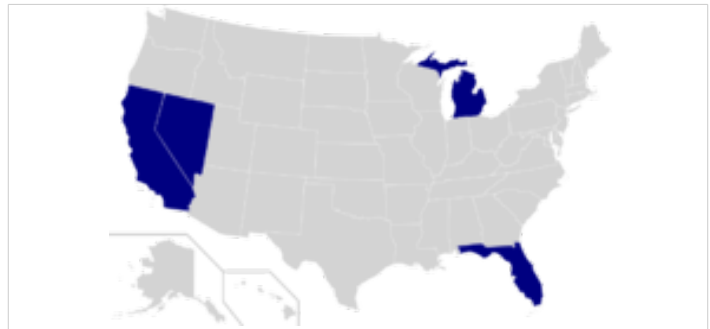


Google driverless car

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A Lexus RX450h retrofitted by Google for its driverless car fleet



In 2014, public road testing of driverless cars was legal in California, Michigan, Florida and Nevada. In addition, a law proposed in Texas would establish criteria for allowing autonomous motor vehicles.

The Google Self-Driving Car is a project by [Google](#) that involves developing technology for [autonomous cars](#), mainly [electric cars](#). The software powering Google's cars is called Google Chauffeur.^[1] Lettering on the side of each car identifies it as a "self-driving car". The project is currently being led by Google engineer [Sebastian Thrun](#), former director of the [Stanford Artificial Intelligence Laboratory](#) and co-inventor of [Google Street View](#). Thrun's team at Stanford created the robotic vehicle [Stanley](#) which won the [2005 DARPA Grand Challenge](#) and its US\$2 million prize from the [United States Department of Defense](#).^[2] The team developing the system consisted of 15 engineers working for Google, including Chris Urmson, Mike Montemerlo, and Anthony Levandowski who had worked on the [DARPA Grand and Urban Challenges](#).^[3]

[Legislation](#) has been passed in four U.S. states and [Washington, D.C.](#) allowing driverless cars. The state of [Nevada](#) passed a law on June 29, 2011, permitting the operation of autonomous cars in Nevada, after Google had been lobbying in that state for robotic car laws.^{[4][5]} The Nevada law went into effect on March 1, 2012, and the [Nevada Department of Motor Vehicles](#) issued the first license for an autonomous car in May 2012, to a [Toyota Prius](#) modified with Google's experimental driverless technology.^[6] In April 2012, [Florida](#) became the second state to allow the testing of autonomous cars on public roads,^[7] and [California](#) became the third when Governor [Jerry Brown](#) signed the bill into law at Google HQ in [Mountain View](#).^[8] In December 2013, [Michigan](#) became the fourth state to allow testing of driverless cars in public roads.^[9] In July 2014, the city of [Coeur d'Alene, Idaho](#) adopted a robotics ordinance that includes provisions to allow for self-driving cars.^[10]

In May 2014, Google presented a new concept for their driverless car that had neither a steering wheel nor pedals,^[11] and unveiled a fully functioning prototype in December of that year that they planned to test on [San Francisco Bay Area](#) roads beginning in 2015.^[12] Google plans to make these cars available to the public in 2020.^[13]



A Toyota Prius modified to operate as a Google driverless car, navigating a test course[20]

Road testing

In 2012, the test group of vehicles included six [Toyota Prius](#), an [Audi TT](#), and three [Lexus RX450h](#),^[14] each accompanied in the driver's seat by one of a dozen drivers with unblemished driving records and in the passenger seat by one of Google's engineers. By May 2015, that fleet consisted solely of 23 Lexus SUVs.^[21]

Google's vehicles have traversed [San Francisco's Lombard Street](#), famed for its steep [hairpin turns](#), and through city traffic. The vehicles have driven over the [Golden Gate Bridge](#) and around [Lake Tahoe](#).^[3] The system drives at the speed limit it has stored on its maps and maintains its distance from other vehicles using its system of sensors.^[22] The system provides an override that allows a human driver to take control of the car by stepping on the brake or turning the wheel, similar to [cruise control](#) systems already found in many cars today.^{[2][23]}

On March 28, 2012, Google posted a [YouTube](#) video showing Steve Mahan, a resident of [Morgan Hill, California](#), being taken on a ride in Google's self-driving [Toyota Prius](#). In the video, Mahan states "Ninety-five percent of my vision is gone, I'm well past legally blind". In the description of the YouTube video, it is noted that the carefully programmed route takes him from his home to a drive-through restaurant, then to the dry cleaning shop, and finally back home.^{[24][25]}

In August 2012, the team announced that they have completed over 300,000 autonomous-driving miles (500,000 km) accident-free, typically have about a dozen cars on the road at any given time, and are starting to test them with single drivers instead of in pairs.^[26] Four U.S. states have passed laws permitting [autonomous cars](#) as of December 2013: Nevada, Florida, California, and Michigan.^[27] A law proposed in Texas would establish criteria for allowing "autonomous motor vehicles".^{[28][29]}

In April 2014, the team announced that their vehicles have now logged nearly 700,000 autonomous miles (1.1 million km).^[30] In late May, Google revealed a new prototype of its driverless car, which had no steering wheel, gas pedal, or brake pedal, being 100% autonomous.^[31]

In June 2015, the team announced that their vehicles have now driven over 1 million miles, stating that this was "the equivalent of 75 years of typical U.S. adult driving", and that in the process they had encountered 200,000 stop signs, 600,000 traffic lights, and 180 million other vehicles.^[32] Google also announced its prototype vehicles were being road tested in Mountain View, California.^[33] During testing, the prototypes' speed cannot exceed 25 mph and will have safety drivers aboard the entire time.

Limitations

As of August 28, 2014 the latest prototype has not been tested in heavy rain or snow due to safety concerns.^[39] Because the cars rely primarily on pre-programmed route data, they do not obey temporary traffic lights and, in some situations, revert to a slower "extra cautious" mode in complex unmapped intersections. The vehicle has difficulty identifying when objects, such as trash and light debris, are harmless, causing the vehicle to veer unnecessarily. Additionally, the lidar technology cannot spot some potholes or discern when humans, such as a police officer, are signaling the car to stop.^[40] Google projects having these issues fixed by 2020.^[41]