# AUTOMOBILES

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## 2014 CURRENTLY AVAILABLE TECHNOLOGY

**NHTSA Level 2: Limited automation (available on some new vehicles)**

Currently, Advanced Driver Assist Systems (ADAS) enable cars to monitor and respond to their surrounding, mostly based on advanced sensor systems. Some ADAS solutions are already available (lane keeping, warning systems, adaptive cruise control, back-up alerts, parking assistance), while others are expected soon. These features allow partial automation ('hands-off' and 'feet-off') on highways, but could also improve operation in low speed environments. Predictions from major automobile manufacturers include ("Autonomous car", n.d.):

- Late 2014, Volvo will feature Adaptive Cruise Control with steer assist, which will automatically follow the vehicle ahead in queues.
- By 2015, Audi plans to market vehicles that can autonomously steer, accelerate and brake at lower speeds, such as in traffic jams.
- By 2015, Cadillac plans vehicles with "super-cruise": autonomous steering, braking and lane guidance.
- By 2015, Nissan expects to sell vehicles with autonomous steering, braking, lane guidance, throttle, gear shifting, and, as permitted by law, unoccupied self-parking after passengers exit.

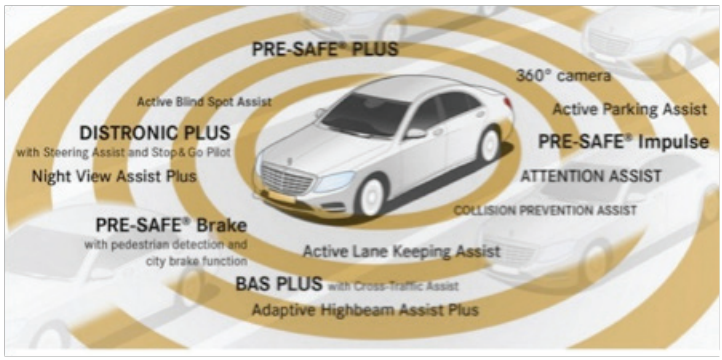
Limited automation cars could represent a significant share of total fleet as early as 2025-2030.


*ADAS of 2013 Ford Fusion*
*http://geeknewscentral.com*

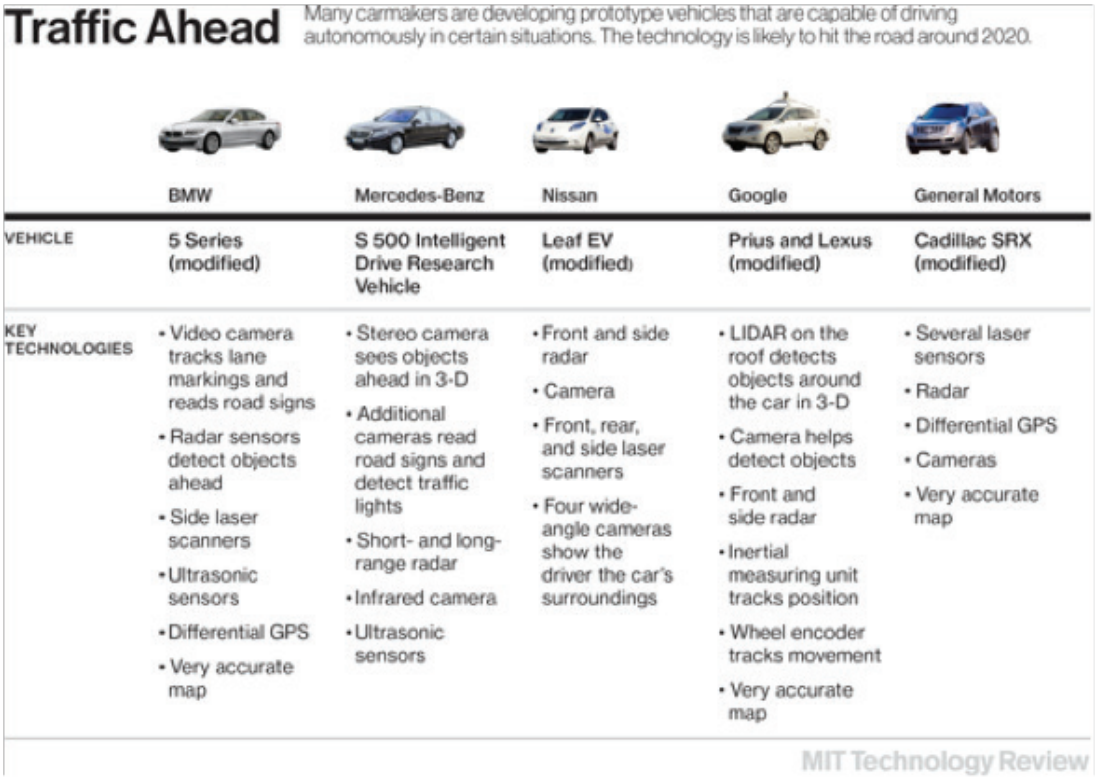
## 2020

**NHTSA Level 3: Limited Self-Driving Automation (The Google car is an example of this level of automation)**

The driver will be able to fully cede control of all safety-critical functions in certain conditions (mostly in highways) and retake control when car indicates to do so. Vehicles will use short-range wireless technologies to communicate with each other in real time. Coordinated platooning will be feasible, allowing vehicles to operate at closer distances to improve fuel consumption and traffic flow. Predictions from major automobile manufacturers include ("Autonomous car", n.d.):

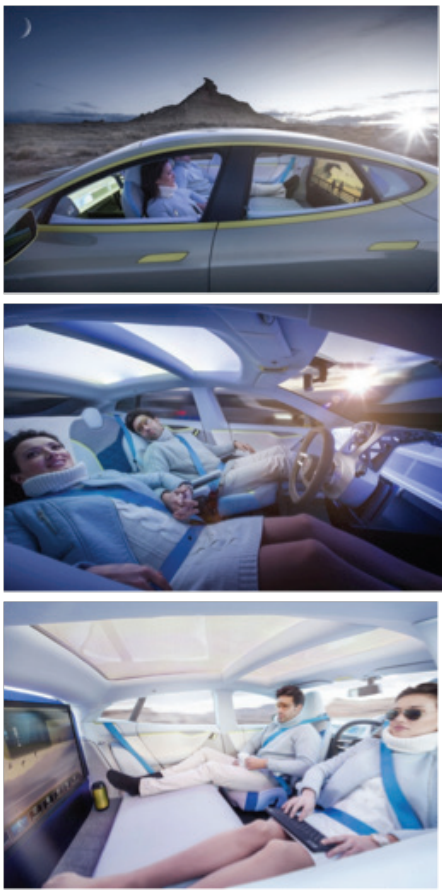



*2014 Mercedes-Benz S-class*
*http://www5.mercedes-benz.com/en/innovation*




*Key (limited) self-driving technologies by four major carmakers and Google.*
*Source: Knight (2013)*

- By 2017, Tesla plans an "autopilot" feature that handles 90% of miles driven.
- By 2018, Google expects to release their autonomous car technology.
- By 2020, Volvo envisages having cars in which passengers would be immune from injuries.
- By 2020, GM, Mercedes-Benz, Audi, Nissan, BMW and Renault all expect to sell vehicles that can drive themselves at least part of the time.
- Limited self-driving cars could represent a significant share of total fleet as early as 2030-2035.



*The potential transformations in the interior of a full self-driving car, as demonstrated by the Swiss design firm Rinspeed in the Geneva Motor Show on March 2014. Their concept car 'Xchange' was a Tesla model S.*
*Source: http://www.rinspeed.eu*

## 2030

**NHTSA Level 4: Full self-driving automation**

The vehicle will perform all safety-critical driving functions and monitor roadway conditions from the origin until the destination of a trip, including self-parking. The driver will provide destination or navigation input, without controlling or monitoring the vehicle at any time during the trip, thus unoccupied vehicles would also be possible at this stage. We may also expect a transition phase from limited to full self-driving vehicles. During that phase drivers will be still required to monitor the vehicle. Full self-driving cars are to be expected around 2030, according to a recent study (Juliussen & Carlson, 2014). They could represent a significant share of total fleet as early as 2040-45.

# 2050

During the 2050s, nearly all of the vehicles in use are likely to be self-driving cars, with full self-driving automation being a standard feature on most new vehicles (Litman, 2013; Juliussen & Carlson, 2014).

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NHTSA (policy on vehicle automation) http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development]


# GLOSSARY

**Adaptive cruise control:** a system that monitors distances to adjacent vehicles in the same lane, adjusting the speed with the flow of traffic.

**Lane keeping assist:** a system that monitors the vehicle's position in the lane, and either warns the driver when the vehicle is leaving its lane, or, less commonly, takes corrective actions

**Parking assist:** a system that assists the driver in the task of parallel parking.

**Collision avoidance (or prevention) assist:** an automobile safety system designed to reduce the severity of an accident. It uses radar and sometimes laser and camera sensors to detect an imminent crash.

**LIDAR (Light Detection and Ranging):** a remote-sensing technology that measures and maps the distance to targets, as well as other property characteristics of objects in its path. LIDAR allows the vehicle to generate a detailed 3D map of its environment. The LIDAR system used in the Google car cost $70,000.

**Platoon:** a group of vehicles that can travel very closely together, safely at high speed. Each vehicle communicates with the other vehicles in the platoon. There is a lead vehicle that controls the speed and direction, and all following vehicles respond to the lead vehicle's movement.

**Vehicle-to-Vehicle (V2V) communications:** the dynamic wireless exchange of data between nearby vehicles. Dedicated Short-Range Communication (DSRC) is currently the wireless medium for V2V communications.

**Vehicle-to-Infrastructure (V2I) communications:** the wireless exchange of critical safety and operational data between vehicles and infrastructure. Dedicated Short-Range Communication (DSRC) is currently the wireless medium for V2I communications. DSRC works in 5.9 GHz band with bandwidth of 75 MHz and approximate range of 1000 m


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