



Pocket Genius

# CARS



FACTS AT YOUR FINGERTIPS



 Pocket Genius

# CARS



**FACTS AT YOUR FINGERTIPS**



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First American Edition, 2016  
Published in the United States by DK Publishing,  
345 Hudson Street, New York, New York 10014

Copyright © 2016 Dorling Kindersley Limited  
DK, a Division of Penguin Random House LLC  
16 17 18 19 20 10 9 8 7 6 5 4 3 2 1  
001-290046-January/2016

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A catalog record for this book  
is available from the Library of Congress.  
ISBN: 978-1-4654-4237-6

DK books are available at special discounts when purchased in bulk for sales promotions, premiums, fund-raising, or educational use. For details, contact: DK Publishing Special Markets, 345 Hudson Street, New York, New York 10014  
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Printed and bound in China

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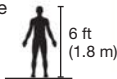


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### Scales and sizes

The *Cars in space* section of this book contains scale drawings of space rovers against a human body to show their size.



1931 La Salle

# What is a car?

A car is a vehicle that is specifically designed to carry people. Its basic structure is made up of a steel frame called a chassis. A typical car has four wheels and is powered by an engine, which uses fuel of some kind.

**Steering wheel** moves the wheels to change the car's direction

**Wiper** cleans dirt off the windshield and gives the driver a clear view of the road ahead

**Dashboard** features controls and instruments, such as the speedometer and the fuel gauge

**Hood** covers the engine

**Battery** powers electrical systems, such as lights and ignition

**Grille** allows air into the radiator, helping to keep the engine cool

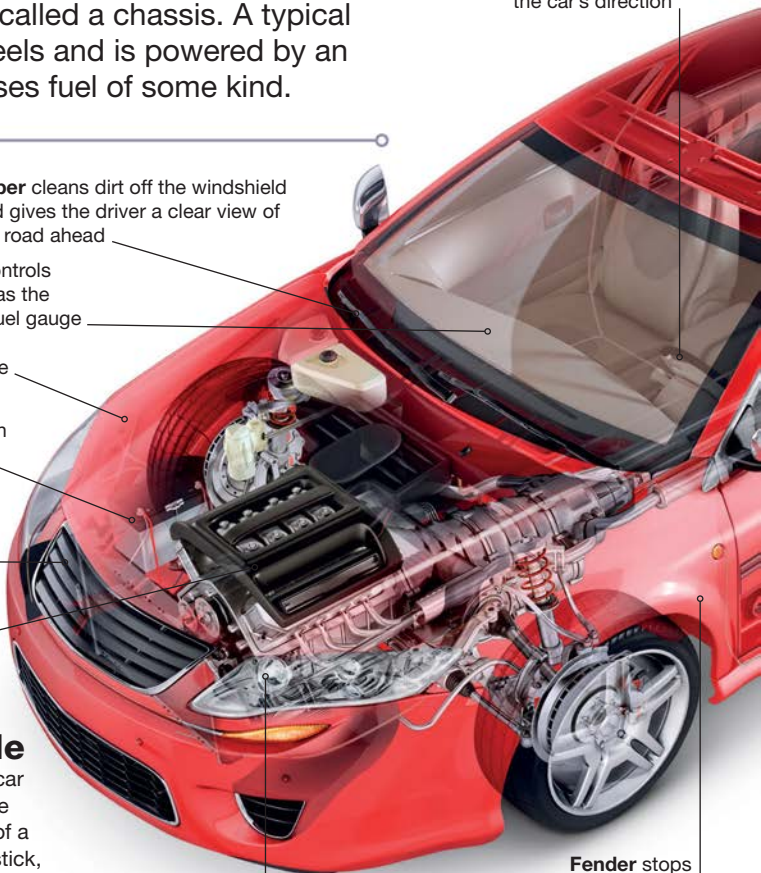
**Engine** powers the car's movement

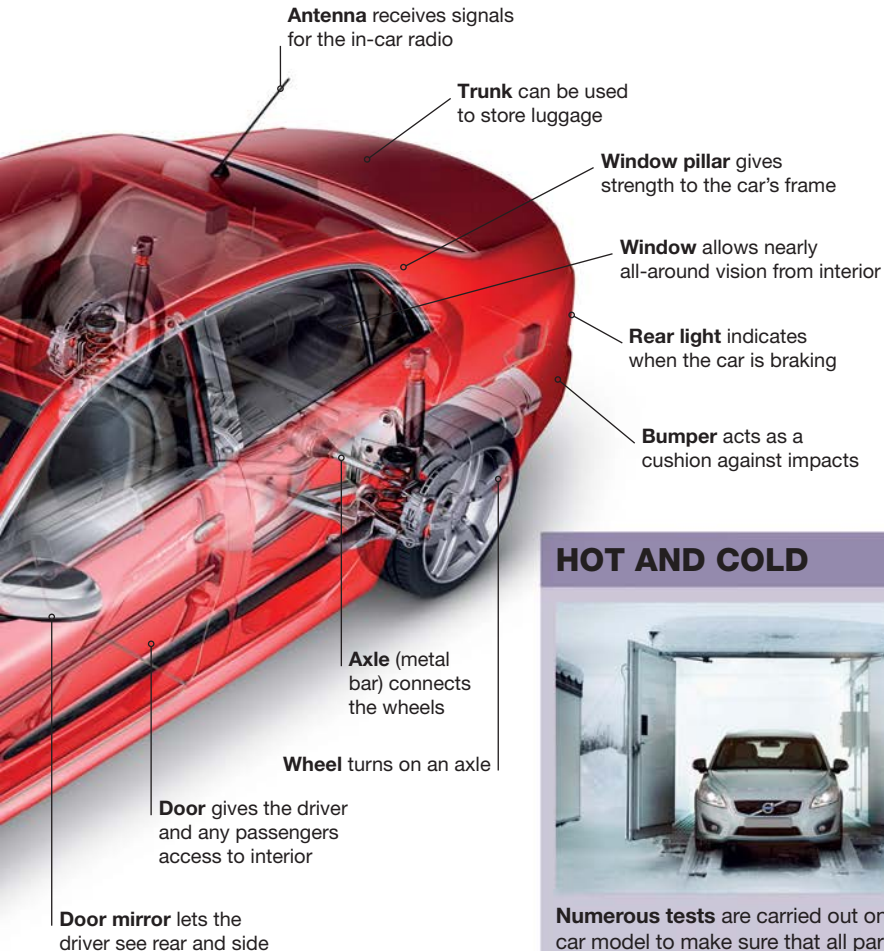
## On the inside

All the functions of a car are controlled from the interior with the help of a steering wheel, gear stick, and foot pedals. The seats are padded for comfort.

**Headlight** lights the road at night

**Fender** stops spray and grit flying from off the tires





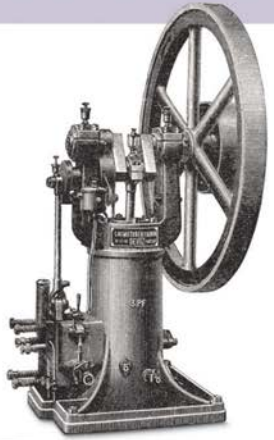
## HOT AND COLD



**Numerous tests** are carried out on a new car model to make sure that all parts perform as expected in extreme weather conditions. This car is being tested to check if all its parts work efficiently in freezing conditions.

# History of the car

Cars have come a long way since the first self-propelled vehicle hit the road in 1769. Over the years, numerous inventions and technological developments have helped to shape the cars that we drive today.



Otto cycle engine

**1769:** Nicolas Cugnot of France invents a steam-powered cart, with a top speed of 2.5 mph (4 kph).

**1876:** Nikolaus August Otto of Germany creates an internal combustion four-stroke engine.

1750–1850

1860

1870

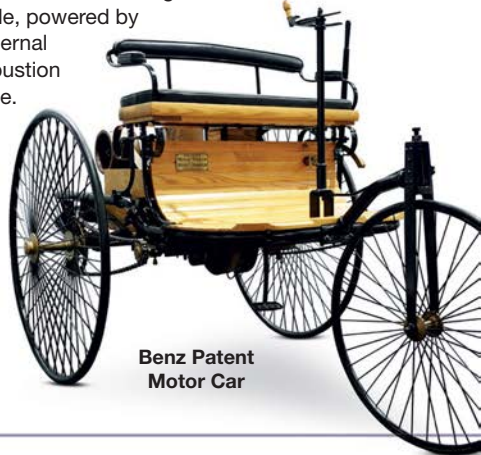
1880



**1865:** The UK's new "Locomotives on Highways Act" states that all mechanized vehicles must have three drivers, go no faster than 4 mph (6.5 kph) on the road, and follow a man walking ahead, waving a red warning flag.

**1885:** Karl Benz designs and builds the world's first gas vehicle, powered by an internal combustion engine.

Steering tiller



Benz Patent Motor Car





**Motorized carriage**

**1886:** Gottlieb Daimler of Germany fits a gas engine to a horseless carriage, creating the world's first four-wheeled gas car. It reaches 10 mph (16 kph).

1890

1900

**1889:** In France, René Panhard and Émile Levassor become the world's first car manufacturers, building motor vehicles for sale.

**1891:** René Panhard builds the first car with an engine at the front.

**Panhard's Phaeton**



## GAME CHANGERS

**Certain cars** changed the history of the car industry. Hugely popular in their day, these cars are now prized classics.



### **BENZ VELO**

Before 1894, each new car was unique. The first car built to a standard design was the Benz Velo—134 identical Velos were produced.

### **MERCEDES-BENZ 260D**

The first diesel passenger car—the Mercedes-Benz 260D—arrived in 1936.

By 1939, there was a 15-month waiting list for the car.



### **THE BEETLE**

Volkswagen started the mass-market production of the Type 38 (later called the Beetle) in Germany, in 1938.

### **FERRARI 125 SPORT**

In 1947, the Ferrari 125 Sport was launched—the first car under the Ferrari brand name.



### **THE AUSTIN MINI**

An affordable small car, the Austin Mini had a spacious interior. It was launched as an alternative to the slow and unsafe microcars (very small cars) of the 1950s.



**1900:** Wilhelm Maybach creates the Mercedes 35 hp race car, with a top speed of 53 mph (86 kph).

**1923:** Alfred Sloan, president of General Motors, introduces the idea of changing a car's style every year.



1900

1910

1920

1930

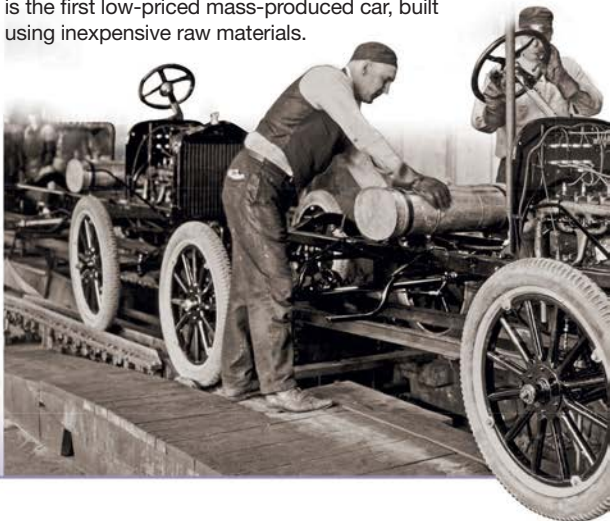
1940

1950

**1901:** The two-seater Oldsmobile Curved Dash arrives. It is the USA's first mass-produced gas-powered car, with 425 cars built in its first year.



**1908:** The iconic Ford Model T is launched. It is the first low-priced mass-produced car, built using inexpensive raw materials.





Pontiac GTO

**1964:** The Pontiac GTO, regarded as the first “muscle car,” is produced, launching an era of “muscle cars” in the USA.

**1997:** Toyota unveils the Prius—the world’s first commercially mass-produced and marketed hybrid car—in Japan.

**2008:** India’s Tata Motors launches Nano—a rear-engined, gas-driven car. It was advertised as the world’s cheapest new car.

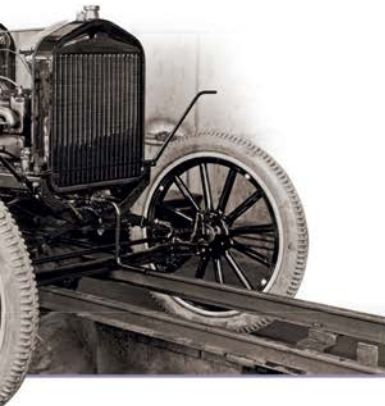


1960      1970      1980      1990      2000      2010      2020

**1972:** Victor Wouk builds the first full-powered, full-size hybrid test vehicle, based on a 1972 Buick Skylark from General Motors.

**1981:** The Mercedes-Benz W 126-series S-Class sedan becomes the first car with a driver airbag fitted as standard.

**2008:** BYD, a former Chinese battery manufacturer, launches the F3DM—the world’s first mass-produced plug-in hybrid sedan car.

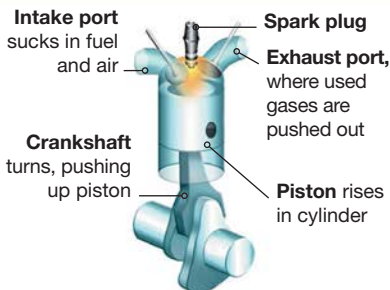


F3DM



# How an engine works

Most cars today are powered by an internal combustion engine. This is so-called because inside (“internal”) the engine, small explosions (“combustion”) make pistons move. This moves other parts to turn the car’s wheels.



## Engine cylinders

Internal combustion engines contain cylinders. When the engine fires, a rod called the crankshaft pushes a piston up into each cylinder, squeezing a fuel-air mixture. A tiny explosion results, pushing the piston down again. This is repeated along all the cylinders, keeping the crankshaft turning.

## From engine to wheels

The crankshaft collects power from the cylinders and transfers it to the wheels via the gearbox. In a front-wheel drive car, as shown here, the gears inside the gearbox turn to pass on the power to two places—the front axle, which controls the front wheels, and the drive shaft, which works the rear axle and the rear wheels.



## TYPES OF ENGINE

**Internal combustion engine** designs vary in the number of cylinders they have, and how they are arranged.



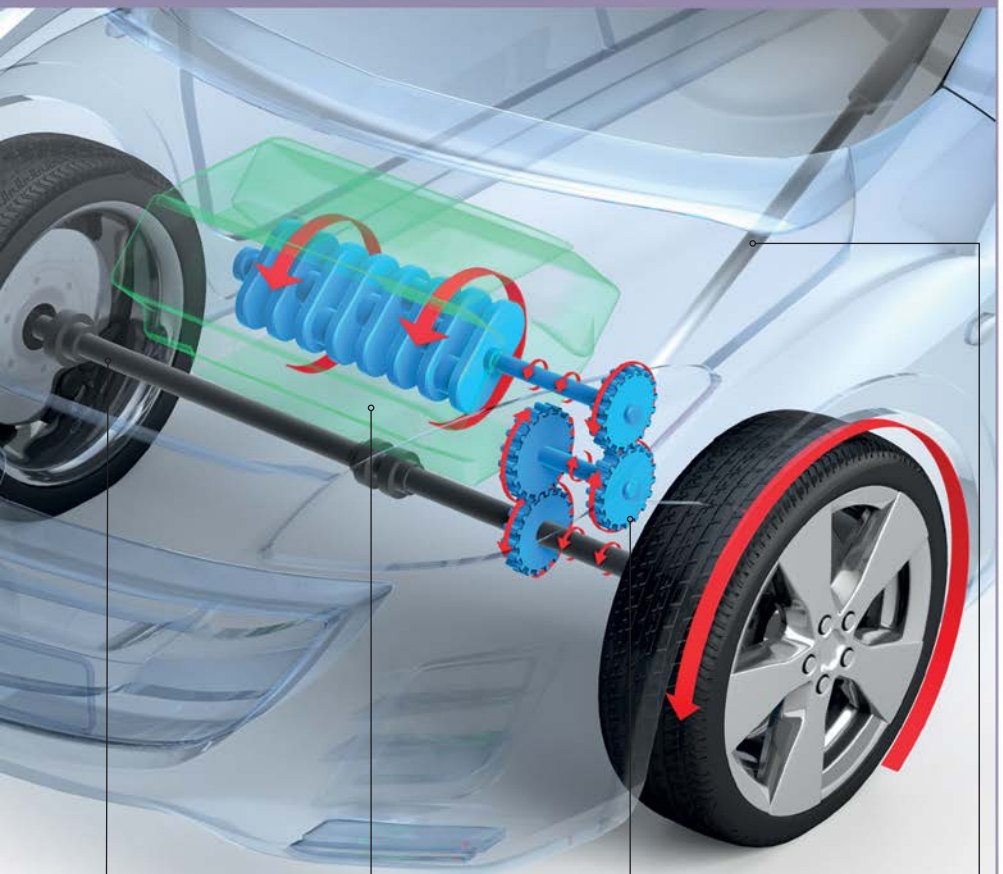
In a **flat-four**, two cylinders are placed horizontally on each side of the crankshaft, providing extra balance.



A **straight-four**, or inline, is the most common layout. It has an upright, or slanting, row of four cylinders and makes efficient use of fuel.



In a **V6 engine**, two rows of three cylinders are arranged in a “V.” It is good for high-performance and racing cars.



**Front and rear axles** (rodlike parts) transmit power to the wheels

In **front-wheel drive** (where only the front wheels are powered), the engine is always in the front

**Gears** alter the engine's power so the wheels turn at the speed the driver needs

The **drive shaft** carries power to the rear wheels

# Inside a factory

Car production is a complex process. Cars are built on an assembly line, where the procedure is split into many stages, involving robots as well as humans. Several quality checks and tests are carried out before the cars are finally transported to the showroom.



## Freshly painted

After the car's body is put together, it is prepared for painting. Robots spray several layers of paint onto it. After the final coat, the car is placed on a conveyor that takes it to be "baked" at high temperatures, which makes the paint more durable.

## Making the car body

Metal sheets (usually steel or aluminum) are cut and molded to form the body panels and roof of each car. These are welded onto the car's frame by robots. Each car is then given its own vehicle identification number (VIN).



## Finishing the job

After being painted, cars are moved along the assembly line to be fitted with parts. The engine and gearbox are pushed into place from underneath. Robots then fix the doors and wheels to the chassis. At this stage, all other components of the car, such as the steering wheel and electrical systems, are fixed to their respective places.



## Ready to go

The cars then go through various tests to check that all the different components—such as the brakes, engine, and steering wheel—are functioning properly. Finally, each car is cleared to be sent to the showroom.






# New car, old car

Around 60 million cars are produced each year. After leaving the factory, the cars are transported to showrooms where they are put on sale, or exported for sale in other countries. A car owner may resell his vehicle, or send it to a scrapyard if it is beyond repair. At the scrapyard, different parts of the car are recycled to be used again.


Cars can be driven on and off a **car carrier**



## Leaving the factory

New cars are delivered locally by train or in car transporters. They are also exported on ships called car carriers. A large car carrier can hold 8,000 cars. The biggest car carrier, the *Triple-E*, can carry 36,000 cars!

Each car has a **protective cover** while being transported





## Goodbye, car!

Few cars end up in landfill. Most go to a scrapyard to be stripped for spare parts that can be used to repair other cars. Fluids, such as oil and antifreeze, are sent for recycling, along with the tires and metal body parts.



Crushed cars

## Crush that car!

The remains of old or smashed cars are often squashed. They are then easier to transport to a recycling plant for melting down.



## RECYCLING

Most countries have recycling laws. About 80 percent of a car can be recycled.



**A car's engine** may be reconditioned (restored) or the metal may be recycled.



**The chassis** (base) of a car is usually melted down for the metal it contains.



The **heavy metals** and chemicals in car batteries can also be reused.

# Safety measures

New cars undergo a lot of tests to make sure they are safe to drive. One of the most valuable of these tests is the use of crash test dummies—life-sized models of people. The results from these tests are recorded and analyzed to improve a car's design as well as safety features, such as airbags and seat belts.



## Smart dummies

More than 130 sensors are fitted to each crash test dummy. During safety tests, these sensors record all sorts of important data.

An adult **dummy** usually weighs up to 170 lb (77 kg) and is 6 ft (1.8 m) tall

**Airbag** inflates to cushion the impact if a crash occurs

**Crumple zone** absorbs some of the impact in head-on collisions







## Track testing

Various track tests study how a new car will perform on the road. For example, a “moose” test studies how well a car can swerve to avoid obstacles that may suddenly appear.



## Safety belt

Seat belts ensure that a car’s passengers do not fall out of their seats in the event of a crash. It is the law to wear a seat belt in most countries.

## What if it crashes?

Modern cars are built to absorb the impact of a crash. For this, each end of the car has a crumple zone—an area designed to crush and crumple on collision. Airbags are additional safety features, which quickly inflate to cushion the front seat occupants in the event of a crash.

**Tire** needs good tread (grip) and correct air pressure to steer and brake efficiently

**Engineers use mist or  
smoke illuminated by**

# **lasers**

**to study the way air flows around  
a car in a wind tunnel**



**WIND TUNNEL TESTING**

A wind tunnel is a huge, tubelike structure with huge electric fans at one end that create high speed winds. A car undergoing the test is parked inside this tunnel. Different instruments help to study the airflow around the car and test how aerodynamic it is. Cutting through the air accounts for around 15 percent of a car's fuel use, so wind tunnel testing is important to a car's designers.







# Early cars

The earliest cars were steam-powered. They were usually simple carriages equipped with an engine, because car makers were heavily influenced by the design of horse-drawn carriages. Inventors then tried to build cars suitable for everyday use, which led to the appearance of engines powered by gas and electricity. Many other innovations, such as the windshield wiper and steering wheel, followed.



## FUEL METER

In 1914, car manufacturer Studebaker installed the first dash-mounted gas gauge, showing how much fuel was in the car. These became a standard feature in the 1920s.

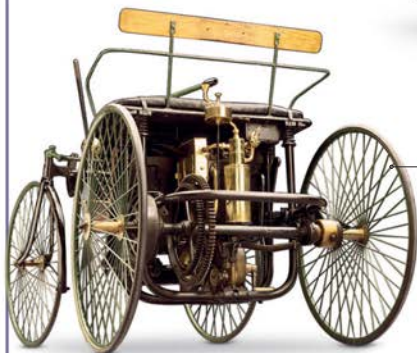
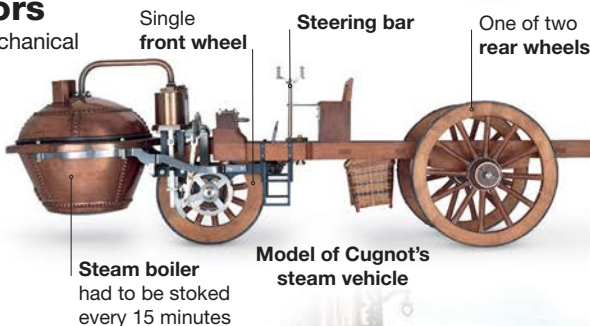
# Cars from the past

Early powered vehicles were “horseless carts” driven by steam, and the first designs were inspired by carriages. The late 19th century saw several technological developments, but the age of cars truly began in 1908 with Henry Ford’s moving assembly line for his Model T.



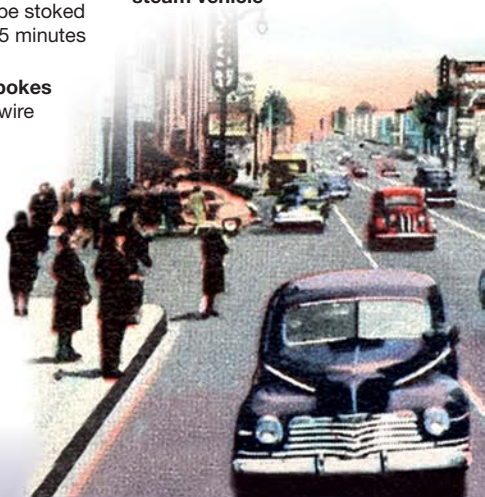
## Making way for motors

The first working self-propelled, mechanical vehicle was built in France in 1769 by Nicolas Cugnot (1725–1804). It was steam-powered and could carry four people, but was slow and unstable.



## Shaping up

In 1889, Gottlieb Daimler unveiled his gas-powered car—the first vehicle to be designed specifically as a car. Until then, carriages were equipped with engines to be used as cars.







## Model T

Henry Ford's moving assembly line revolutionized car manufacturing by making the mass production of vehicles faster and more organized. The Ford Motor Company sold more than 15 million Model T cars between 1908 and 1927.

## Changing face

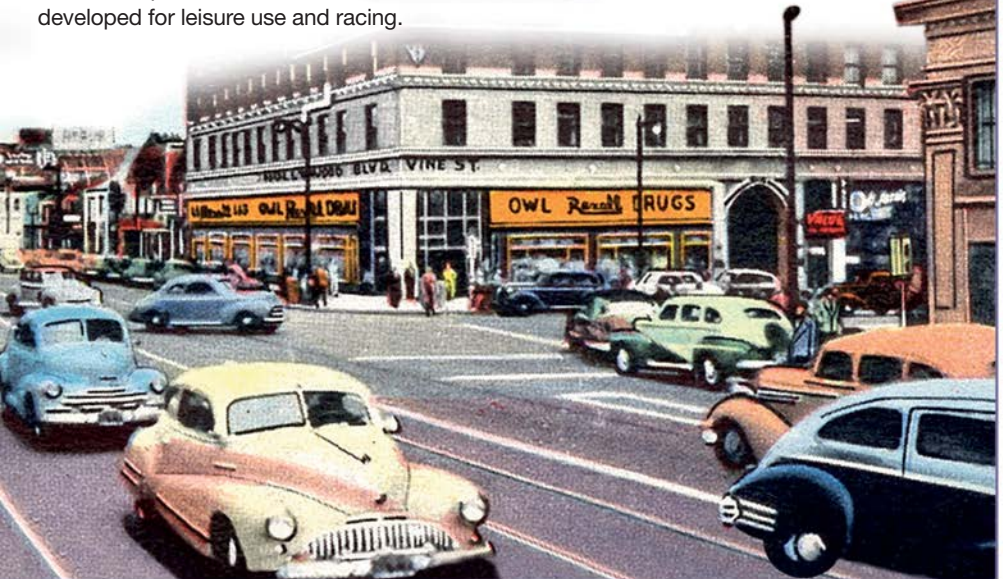
The 1920s were a golden age for the car industry as cars became smaller and more affordable and reliable, attracting more buyers.

Sports cars, such as this 1927 OM 665 Superba, were also developed for leisure use and racing.



## After the war

By the 1950s, the market for cars had grown as companies began to sell their models to international markets as well. Many American families owned a car and the roads became busier.





# Before 1920

Building the first cars was a remarkable feat. However, manufacturing them in large numbers and convincing the public to buy these new types of vehicle proved to be hard. Until about 1920, the US was producing the most cars, followed by France, the UK, and Germany.

## Peugeot Type 5

The Type 5 was the second gas car model that Peugeot came out with after the Type 2. It had face-to-face seating. In 1894, this car took part in the world's first motor car competition.

---

**YEAR** 1894

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**ORIGIN** France

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**ENGINE** 565 cc, twin-cylinder

---

**TOP SPEED**

11 mph  
(18 kph)



## Arrol-Johnston 10 HP Dogcart

Developed by George Johnston in Glasgow, Scotland, the Dogcart was the first car to be built in the UK, remaining in production for a decade. The model was designed with its engine placed below the floor of the car.

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**YEAR** 1897

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**ORIGIN** UK

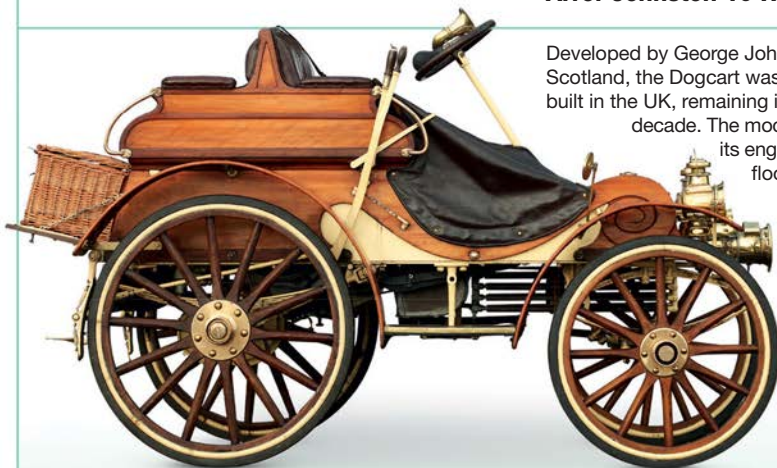
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**ENGINE** 3,230 cc,  
flat-two

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**TOP SPEED**

25 mph (40 kph)



## Mercedes 60 hp

One of the most advanced cars of its time in terms of engineering and design, the Mercedes 60 hp was among the fastest cars in the early 1900s. Its design was aimed at improving passenger comfort.

**YEAR** 1903

**ORIGIN** Germany

**ENGINE** 9,236 cc, straight-four

**TOP SPEED** 73 mph (117 kph)



## Rolls-Royce Silver Ghost 40/50 hp

At first, only one car in the 40/50 hp series was called Silver Ghost. Later, all cars of this model were given this name. It became known as a reliable car and was produced until 1925.

**YEAR** 1906

**ORIGIN** UK

**ENGINE** 7,036 cc, straight-six

**TOP SPEED**  
75 mph (121 kph)





## FOCUS ON... SERVICES

The increase in the sale of cars led to growth in other businesses, such as gas stations, repair shops, and motels.



▲ Before the first gas station was built in 1905 in Missouri gas was sold at pharmacies.



▲ As long-distance travel became common, motor hotels—or motels—began to appear along major American roads, providing cheap accommodation for travelers.



▲ Other roadside businesses, such as diners and similar places to eat, also thrived.

# 1920–1935

As affordable car models became available in the 1920s, the demand for cars gradually grew. Sports and race cars also gained popularity. By the 1930s, smaller, more aerodynamic, and more technologically advanced cars were being produced.

## Bugatti Type 35B

The Type 35 was a successful race car and could also be driven on roads. A member of the Type 35 family, the Type 35B was the last version to be produced in the series.

**YEAR** 1927

**ORIGIN** France

**ENGINE** 2,262 cc, straight-eight

**TOP SPEED** 127 mph (204 kph)



## Duesenberg Model J

The fastest and most powerful car in the American market at the time it was produced, the Model J was designed to appeal to the rich and famous. It was also launched in Europe, where it proved a worthy competitor to the big, luxurious cars already available there.

**YEAR** 1928

**ORIGIN** USA

**ENGINE** 6,882 cc, straight-eight

**TOP SPEED** 119 mph (192 kph)



## Ford Model Y

Made in the UK for markets outside the US, the Ford Model Y was seen as Ford's first "foreign" car. It sold well enough to give Ford the leading position among car manufacturers.

**YEAR** 1932

**ORIGIN** UK

**ENGINE**  
933 cc,  
straight-four

**TOP SPEED**

57 mph  
(92 kph)



*This step is called  
a running board*



# Only 14

egg-shaped, three-wheeler  
**Brütsch Mopettas**  
were ever built



**MICROCAR**

Designed in 1956, the Brütsch Mopetta was the smallest of a number of microcars (very small cars) built by Egon Brütsch.

It measured 67 in (1.7 m) long and 35 in (0.9 m) wide and was powered by a 50-cc engine. With a body made completely from fiberglass, it weighed just 172 lb (78 kg).



# The 1940s and 1950s

During World War II (1939–45), cars were largely produced for military purposes. After the war, affordable and simple family cars were in demand. By the 1950s, however, there was a call for glamour, performance, and style.

## Willys MB Jeep

Made for the military, this Jeep was a light, four-wheel drive (where the engine powers all four wheels) utility vehicle for cargo transport and surveillance. It is an iconic World War II car.

**YEAR** 1941

**ORIGIN** USA

**ENGINE** 2,199 cc, straight-four

**TOP SPEED**  
60 mph (97 kph)



## Dodge Coronet

The Dodge Coronet was available in a four-door and a two-door model. This car's clutch was replaced by a fluid-drive transmission, which was operated by a foot pedal. This meant that the driver could stop the car and then start it again in any gear, without using the gear stick or clutch.

**YEAR** 1949

**ORIGIN** USA

**ENGINE** 3,769 cc, straight-six

**TOP SPEED** 80 mph (129 kph)





## Chevrolet Bel Air

Compared to the first Bel Air 1950 model, the 1955 Chevrolet Bel Air boasted a more stylish design, attractive chrome features, and a better engine. The combination made it one of the most desirable cars of its time, and it continues to be prized by collectors.

**YEAR** 1955

**ORIGIN** USA

**ENGINE** 4,343 cc, V8

**TOP SPEED** 100 mph (161 kph)

*Two-tone paintwork highlights car's sleek appearance*

*Hooded headlight was a new style feature on this model*



## Renault Dauphine

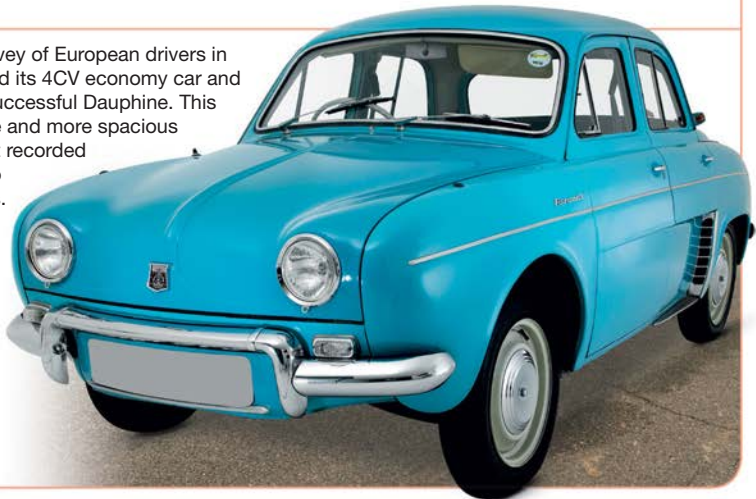
After conducting a survey of European drivers in 1951, Renault improved its 4CV economy car and launched the hugely successful Dauphine. This car had a larger engine and more spacious interior than the 4CV. It recorded worldwide sales of two million cars in 12 years.

**YEAR** 1956

**ORIGIN** France

**ENGINE** 845 cc, straight-four

**TOP SPEED** 66 mph (106 kph)



# The 1960s and 1970s

In the 1960s, cars with simple, almost boxlike, designs became popular. Cars were more compact or more luxurious, while also increasing in their performance and power. In the 1970s, efficiency improved further and safety measures, such as seat belts and airbags, were introduced.

## Mini Cooper

The Mini was a small, energy-efficient car that was launched in 1959. In 1961, Formula 1 car designer John Cooper improved its design—adding disk brakes, a powerful motor, and wider wheels—and created the Mini Cooper.

**YEAR** 1961

**ORIGIN** UK

**ENGINE** 1,275 cc, four-cylinder

**TOP SPEED** 100 mph (161 kph)

*Although only 10 ft (3 m) long, the Mini had enough room inside for a whole family*



**Jaguar XJ6**

Perhaps one of the most significant cars in the company's history, the XJ6 replaced most of Jaguar's sedans. Its design was said to offer a perfect balance of comfort, performance, and power.

---

**YEAR** 1968

---

**ORIGIN** UK

---

**ENGINE** 4,235 cc, six-cylinder

---

**TOP SPEED** 124 mph (200 kph)

**Citroën SM**

In 1968, Citroën purchased the Italian luxury car manufacturer Maserati. Their collaboration resulted in the Citroën SM in 1970. This car combined Citroën's aerodynamic design with Maserati's powerful V6 engine.

---

**YEAR** 1970

---

**ORIGIN** France

---

**ENGINE** 2,670 cc, V6

---

**TOP SPEED** 142 mph (229 kph)





# Modern cars

From the 1980s, cars were increasingly equipped with new technology, such as parking assistance. Existing features, including the steering wheel and dashboard, were improved. Today, cars are often built with extra features, such as navigation systems and rearview cameras. Engines are more powerful and fuel efficient than in the past and can handle longer distances.



## **OFF-ROADING**

Sport utility vehicles (SUVs) are designed for “off-roading,” where cars are driven on rough terrains, such as in and around forests and over sand.

# All shapes and sizes

A buyer chooses a car for its features, depending on individual requirements. A family may need more seats, a larger trunk, and four or even five doors, as opposed to two. Some people may opt for additional features, such as a sunroof.

## Door design

Most car doors are hinged and can be opened manually or, in heavier models, electronically. Some cars have child-safety locks on their rear doors, so that passengers, especially children, do not accidentally open the doors from inside.



*The hatchback is a fifth door and opens upward*

## Roof design

Most cars have a solid roof. They may be fitted with a sunroof (sliding pane). Convertible cars have a retractable roof that folds away or a detachable roof that is taken off.





## Trunk space

The trunk space of an station wagon is designed for carrying bulky loads, but even small cars have enough space for carrying shopping bags and luggage.



*Retractable roof folds back into the trunk*

## BOX DESIGN

The **box design** of a car shows how the car's three main areas—its engine, passenger space, and trunk space—are divided into different sections.



In a **one-box** design, the whole interior of the car—including the engine and trunk—is designed as one compartment.



A **two-box** design is one in which the engine forms a separate compartment from the passenger and trunk space.



A **three-box** design divides the car into three sections—the engine, passenger space, and trunk space.



## FOCUS ON... REAR DESIGN

Sedans are grouped according to the shape and slope of the rear section of the car.



▲ In a fastback, the slope stretches from the roof to the base of the trunk.



▲ In a notchback sedan, the trunk lid and the roof are parallel to the ground. The lid extends back horizontally from the rear windshield.



▲ In a hatchback, the trunk lid covers the entire rear. The rear windshield lifts up with the lid.

# Sedans

Sedan cars have a fixed roof and an enclosed trunk, and most models have four doors. Types of sedan include large family cars, compacts with a smaller rear space, luxury models with powerful engines, and high-performing sports sedans.

## Maserati Biturbo

The Maserati brand, known for its high-priced models, wanted to introduce a supercar-style vehicle that was more affordable. The result was the two-door Maserati Biturbo. The car sold well at first, mainly because of its luxurious interior. However, because of technical problems, including engine failures and oil leaks, sales dropped.

**YEAR** 1981

**ORIGIN** Italy

**ENGINE** 1,996 cc, V6

**TOP SPEED** 132 mph (212 kph)

The 1984 version of the Maserati Biturbo, with a modified engine, was named the Worst Car of 1984 by *Time* magazine in 2007.





## Chrysler LHS



Chrysler's first true sports sedan (a car that combines the design of a sports car with the luxury of a sedan), the Chrysler LHS is known for its aerodynamic shape, which greatly reduces wind noise inside the car. Its luxury features and good engine performance add to its appeal.

**YEAR** 1994

**ORIGIN** USA

**ENGINE** 3,518 cc, V6

**TOP SPEED** 136 mph (219 kph)

## Bentley Arnage



The sporty, high-end Bentley Arnage was the first car for Bentley Motors to have a completely new design since 1980. Equipped with a special V8 engine, it was a fast and elegant car. The last Bentley Arnage was produced in 2009.

**YEAR** 1998

**ORIGIN** UK

**ENGINE** 4,398 cc, V8

**TOP SPEED** 150 mph (241 kph)

## Volvo S60

This Volvo was designed to compete with German-made sedans. A number of speed-record attempts and track racing events have shown how powerful the car is. The S60 is even used as a patrol car by some police forces.

**YEAR** 2000

**ORIGIN** Sweden

**ENGINE** 2,484 cc, straight-five

**TOP SPEED**

130 mph (210 kph)



## Toyota Camry

The Toyota Camry has been one of the best-selling sedans in the US since 1997. The redesigned model has more room inside, although a smaller trunk space, than earlier versions of the car.

**YEAR** 2007

**ORIGIN** Japan

**ENGINE** 2,362 cc, straight-four

**TOP SPEED** 130 mph (210 kph)



Toyota has a tradition of using the word “crown” in the names of most of its cars. “Camry” comes from a Japanese word for crown.



## BMW 335i

The 335i is extremely powerful. It is the first car in BMW's 3 Series to have a turbocharged gas engine (extra-powerful yet compact). However, like all German cars, its top speed is artificially limited to 155 mph (250 kph)—high enough for driving on the autobahn (highways that do not have a speed limit).

**YEAR** 2007

**ORIGIN** Germany

**ENGINE** 2,979 cc, straight-six

**TOP SPEED** 155 mph (250 kph)

*Headlights swivel in the same direction as the steering wheel*



## Jaguar XJ

Although the Jaguar XJ is a full-sized sedan, its aluminum body makes it lighter than even a standard medium-sized car. Its glass roof extends over the rear seats.

**YEAR** 2010

**ORIGIN** UK

**ENGINE** 5,000 cc, V8

**TOP SPEED** 155 mph (250 kph)

*Sensors on the windshield automatically activate windshield wipers when it rains*



### Toyota Corolla Altis

Toyota made the first Corolla in 1966. The 2011 model is the 12th variation. Like all the Corollas in the past, the Altis' design is focused on reliability over style and technology, though the new engine is smoother and more fuel-efficient.

---

**YEAR** 2011

---

**ORIGIN** Japan

---

**ENGINE** 1,987 cc, straight-four

---

**TOP SPEED** 115 mph (185 kph)



### Audi A3

The demand for Audi cars in China was one of the factors that led the company to design a sedan version of the A3 series. It has a high-performance engine and a luxury design, but less luggage space than the hatchback version.

---

**YEAR** 2013

---

**ORIGIN** Germany

---

**ENGINE** 1,781 cc, straight-four

---

**TOP SPEED** 151 mph (243 kph)



### Honda Amaze

The mid-sized Honda Amaze is the sedan version of the hatchback Honda Brio. Although the Amaze shares the same engine as the Brio, its color options and overall layout, it is set apart by a much larger trunk.

---

**YEAR** 2013

---

**ORIGIN** Japan

---

**ENGINE** 1,198 cc, straight-four

---

**TOP SPEED** 87 mph (140 kph)







### Mercedes-Benz C220 CDI AMG Sport Edition

The C-Class is the second-smallest sedan produced by Mercedes. The AMG Sport Edition has a range of performance features from AMG, the in-house racing engine division of Mercedes-Benz.

**YEAR** 2014

**ORIGIN** Germany

**ENGINE** 2,143 cc, straight-four

**TOP SPEED** 144 mph (232 kph)



# Hatchbacks

A hatchback gets its name from the sloping door at the back of the car's body—called a hatch—that opens upward. This door is hinged at the top, and it covers a trunk, or luggage space, at the rear. Because they are smaller than sedans, hatchbacks are easier to park, which makes them a popular choice for people living in cities.

## Fiat Uno

Among small family cars (superminis), the Fiat Uno stands out for its modern seating design, with slightly elevated seats, earning it the nickname “the ultimate supermini.” Its aerodynamic design, spacious interior, and fuel efficiency earned it the European Car of the Year award in 1984.

---

**YEAR** 1983

---

**ORIGIN** Italy

---

**ENGINE** 1,301 cc, straight-four

---

**TOP SPEED** 104 mph (167 kph)



The Fiat Uno is the most-produced Fiat car: more than 8,800,000 cars have been built over eight years.



### Peugeot 205 GTi



With this model, Peugeot became one of the first brands to create a successful sporty hatchback. Its features include alloy wheels, additional driving lights, and larger bumpers.

**YEAR** 1984

**ORIGIN** France

**ENGINE** 1,905 cc, straight-four

**TOP SPEED** 121 mph (195 kph)

### Volkswagen New Beetle

This car was inspired by the original “bug-shaped” Volkswagen Beetle. The New Beetle shares many similar features with its ancestor, such as large round rear lights and a rounded roof.

**YEAR** 1998

**ORIGIN** Germany

**ENGINE** 1,984 cc, straight-four

**TOP SPEED** 115 mph (185 kph)



## Maruti Suzuki Swift

The Japanese Suzuki Swift was sold in various markets worldwide before being launched in India as the Maruti Suzuki Swift. Its European-style curvy body and sporty performance made it a popular choice among hatchbacks.

**YEAR** 2005

**ORIGIN** India

**ENGINE** 1,197 cc,  
straight-four

**TOP SPEED**  
100 mph  
(160 kph)

*Stretched rear light*



## Peugeot 107

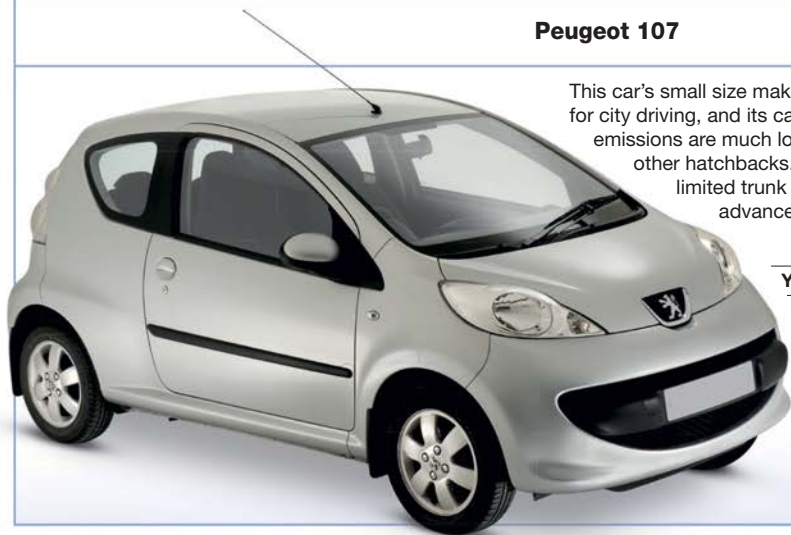
This car's small size makes it ideal for city driving, and its carbon dioxide emissions are much lower than most other hatchbacks. However, it has limited trunk space and lacks advanced safety systems.

**YEAR** 2005

**ORIGIN** France

**ENGINE** 998 cc,  
straight-three

**TOP SPEED**  
98 mph  
(158 kph)





## Honda Fit Sport

Unlike the earlier Honda Fit models, the Sport has four different seat options. This allows owners to increase trunk or seating space based on their requirements.

**YEAR** 2007

**ORIGIN** Japan

**ENGINE**

1,497 cc,  
straight-four

**TOP SPEED**

114 mph  
(183 kph)



## Tata Nano

The world's cheapest new car, the Tata Nano is manufactured by Tata Motors in India. Its design includes cost-saving features.

For example, its engine is made of aluminum instead of cast-iron.

The engine is positioned in the car's trunk and can only be accessed from inside the car.

**YEAR** 2009

**ORIGIN** India

**ENGINE** 624 cc,  
straight-two

**TOP SPEED**  
65 mph (105 kph)



## Hyundai i20

With features including six airbags and a braking system that reduces the risk of skidding, the Hyundai i20 has a high safety rating.

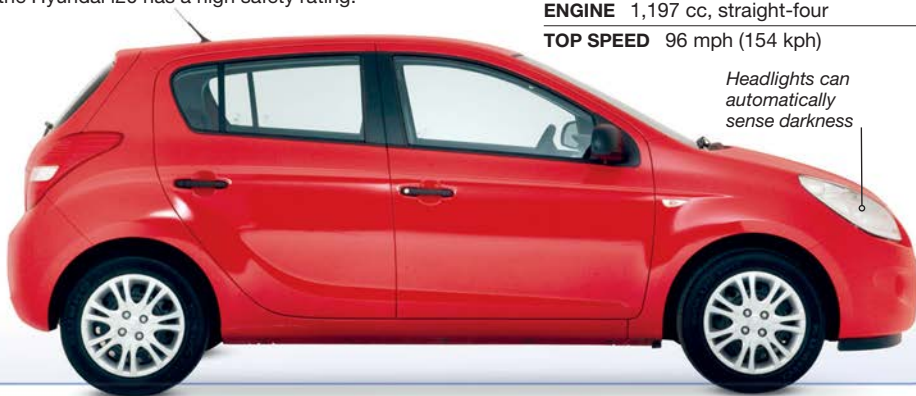
**YEAR** 2008

**ORIGIN** South Korea

**ENGINE** 1,197 cc, straight-four

**TOP SPEED** 96 mph (154 kph)

*Headlights can automatically sense darkness*



## BMW 530d Gran Turismo

The combination of the stylish features of a sedan and the sporty look of a coupe gives this car a unique look. An automatic feature turns the engine off when the car stops, saving fuel.

**YEAR** 2010

**ORIGIN**  
Germany

**ENGINE**  
2,993 cc,  
straight-six

**TOP SPEED**  
153 mph  
(246 kph)



## Mercedes-Benz A 250

The first Mercedes-Benz A-Class was produced in 1997. The 2012 edition, Mercedes-Benz A 250, is longer, wider, and lower than most of the earlier models. It has a spacious interior and a big trunk.

**YEAR** 2012

**ORIGIN** Germany

**ENGINE** 1,991 cc, straight-four

**TOP SPEED** 149 mph (240 kph)

*Sporty, "shooting brake" design combines features of an estate and a coupe*

*Sliding sunroof made of glass*

A special "Attention Assist" system can detect if the driver is feeling sleepy and sound an alert.



# Convertibles

A convertible car has a movable roof, or top, which means it can be changed from a closed-top to an open-top model. This feature is controlled either manually or automatically.



## FOCUS ON... TOPS

Convertibles have one of two types of roof: a hard top or a soft top.

### Mazda MX-5

Inspired by the design of British sports cars in the 1960s, the Mazda MX-5 was one of the most successful convertibles of its time. It is famous for its “pop-up” headlights, which lift from the hood when in use.

---

**YEAR** 1989

---

**ORIGIN** Japan

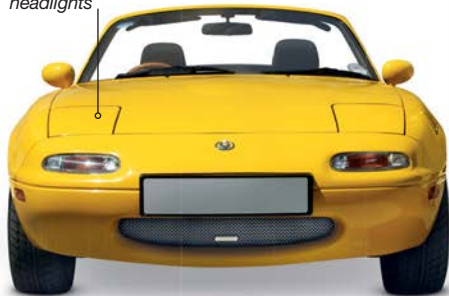
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**ENGINE** 1,597 cc, straight-four

---

**TOP SPEED** 114 mph (183 kph)

“Pop-up”  
headlights



### Lotus Elise

This stylish, two-seater convertible is recognized by its distinct “bug-eyed” headlights. Its bonded aluminum chassis and fiberglass panels help to reduce both its weight and the cost. At 1,600 lb (725 kg), it weighs half as much as an average saloon.

---

**YEAR** 1996

---

**ORIGIN** UK

---

**ENGINE** 1,796 cc, straight-four

---

**TOP SPEED** 150 mph (240 kph)







▲ A hard top is made out of a rigid material, such as plastic, steel, or aluminum. A car may have a detachable (removable) or a retractable (foldable) hard top.



▲ A soft top is made out of a tough fabric, such as canvas or vinyl. The fabric is mounted on a folding frame.

### Aston Martin DB9 Volante

This soft-top Aston Martin comes with a safety feature called “roll-hoops,” which protect the occupants if the car were to roll over. These hoops are hidden in the rear headrests and pop out when sensors detect that the car might face an accident.

**YEAR** 2011

**ORIGIN** UK

**ENGINE** 5,935 cc, V12

**TOP SPEED** 306 mph (190 kph)

*Aluminum  
body panels*

*Hard body cover  
into which the  
soft top folds down*



### Infiniti G37 Convertible

The hard top of the Infiniti G37 is made up of three hinged panels. When the top goes down, these panels fold into the trunk, leaving little space for anything else.

---

**YEAR** 2009

---

**ORIGIN** Japan

---

**ENGINE** 3,696 cc, V6

---

**TOP SPEED** 155 mph  
(250 kph)



### Volkswagen Golf Cabriolet MK6

The design of this convertible is based on the hatchback version of the Volkswagen Golf. Its folding fabric top can open in only 9.5 seconds, even when the car is driven at a speed of 19 mph (30 kph).

---

**YEAR** 2011

---

**ORIGIN** Germany

---

**ENGINE** 2,480 cc,  
straight-five

---

**TOP SPEED** 130 mph  
(209 kph)



### Porsche 911 Carrera S Cabriolet

The Porsche 911 Carrera S Cabriolet has an electronic screen, called a “wind-deflector,” which pops up behind the rear seats. It cuts down wind and noise levels in the car when the top is down.

---

**YEAR** 2012

---

**ORIGIN** Germany

---

**ENGINE** 3,800 cc,  
flat-six

---

**TOP SPEED** 187 mph  
(301 kph)





*Electrically operated, folding fabric roof*

### **Chevrolet Corvette Stingray Convertible C7**

This convertible has an aluminum frame that makes it 100 lb (45 kg) lighter than previous, steel-framed models. The soft top also reduces weight.

**YEAR** 2014

**ORIGIN** USA

**ENGINE** 6,200 cc, V8

**TOP SPEED** 180 mph (290 kph)





**The two Volkswagen Car  
Towers in Germany each house**

**400 cars**



**CAR TOWERS**

The cars produced at the world's largest car factory—Autostadt, in Germany—are stored in the two 20-story Volkswagen Car Towers. The cars from the factory are delivered on a conveyor belt and moved around the tower by elevator. Cars can travel up and down the tower at a speed of 4.5 mph (7 kph).

# Coupes

In the 19th century, coupes were horse-drawn carriages with a seat for two people. Today, the word “coupe” refers to a car with at least two seats, and, typically, two doors and a fixed, sloping roof. Some also come in hatchback and four-door versions.

## Audi TTS

Light and fast, the Audi TTS comes with a magnetic suspension system, which adapts to uneven road surfaces for a smoother ride.

---

**YEAR** 2008

---

**ORIGIN** Hungary

---

**ENGINE** 1,984 cc, straight-four

---

**TOP SPEED** 155 mph (250 kph)



## Rolls-Royce Phantom Coupe

The aluminum body of the Phantom Coupe is lightweight but strong. The car shares many features with its saloon version, such as a luxurious interior and powerful engine. Its doors are hinged at the rear rather than front. The navigation cameras give a 360-degree view of the surroundings, making parking and reversing easier.

---

**YEAR** 2008

---

**ORIGIN** UK

---

**ENGINE** 6,752 cc, V12

---

**TOP SPEED** 155 mph  
(250 kph)



## Bentley Continental GT Speed

The front grille of the Bentley Continental GT Speed has been designed to improve engine cooling. The smaller-than-usual steering wheel makes it easy to manoeuvre the car.

**YEAR** 2007

**ORIGIN** UK

**ENGINE**

5,998 cc, W12

**TOP SPEED**

202 mph (325 kph)







## FOCUS ON... TRUNK LIDS

The design of the trunk lid in station wagons varies. It can be hinged at the top, side, or bottom.



▲ In a split-gate trunk lid, the rear window swings upward and the lower lid downward.



▲ As the name suggests, a side-hinge trunk lid has a single door that is hinged on the side.



▲ A dual-hinge trunk lid has a pair of doors that are hinged on each side, and open outward.

# Station wagons

A station wagon is a type of sedan with a roof that extends to the rear. Unlike a sedan, it does not have a separate trunk. Instead, there is a space behind the rows of seats where luggage can be kept, which can be accessed through a rear door.

## Mercedes-Benz E-Class W124

The Mercedes-Benz E-Class W124 has an aerodynamic design that reduces fuel consumption. It has only one windshield wiper, but it can reach to most of the windshield.



The W124 is a well-made car that typically lasts for up to 300,000 miles (500,000 km).

**YEAR** 1985

**ORIGIN** Germany

**ENGINE** 4,192 cc, V8

**TOP SPEED** 155 mph  
(250 kph)





## Jaguar X-type Sportwagon

*Hooded, oval headlights*



The first station wagon created by Jaguar, this car is based on the X-type sedan. However, the rear doors and body structure are fully redesigned. To avoid the typical “boxy” look of a station wagon, the roof is made to slope down toward the rear.

**YEAR** 2004

**ORIGIN** UK

**ENGINE** 2,967 cc, V6

**TOP SPEED** 122 mph (196 kph)

## Ford Mondeo Mk IV



The windshield of the fourth generation Ford Mondeo is designed to keep out the Sun’s heat. Its front grille vent opens when the car is being driven, to keep the engine cool. Once the car picks up speed, the vent closes.

**YEAR** 2007

**ORIGIN** Germany

**ENGINE** 2,261 cc, straight-four

**TOP SPEED** 121 mph (195 kph)

## BMW Mini Clubman

The BMW Mini Clubman has a dual-hinge boot lid and an extra “club door” on the driver’s side, which is hinged from the rear. The club door can be opened after the front door to make it easier to get to the rear seats.

**YEAR** 2008

**ORIGIN** UK

**ENGINE** 1,598 cc, four-cylinder

**TOP SPEED** 125 mph (201 kph)



## Ford Focus ST Wagon

This station wagon’s unique Sport Steering System helps the driver to turn by increasing the sensitivity of the steering wheel. This feature is also useful when parking in tight spaces.

**YEAR** 2012

**ORIGIN** Germany

**ENGINE** 2,500 cc, straight-five

**TOP SPEED** 154 mph (248 kph)



## Mercedes-Benz CLS Shooting Brake

The spacious Shooting Brake was the second car in the world, after the Mercedes CLS, to have LED headlights, which use less energy and are brighter than standard bulbs.





### Audi A6 Avant

The 2011 Audi A6 Avant consumes 18 percent less fuel than the previous model of the car. This is because its chassis is made mainly of aluminum, which makes it lighter in weight.

---

**YEAR** 2011

---

**ORIGIN** Germany

---

**ENGINE** 2,995 cc, V6

---

**TOP SPEED** 155 mph (250 kph)

---

**YEAR** 2012

---

**ORIGIN** Germany

---

**ENGINE** 4,633 cc, V8

---

**TOP SPEED** 155 mph (250 kph)



### Hyundai i30 Wagon

The Hyundai i30 Wagon has a spacious interior and can carry more luggage than the model's hatchback version. It even has an underfloor compartment for extra storage space.

---

**YEAR** 2013

---

**ORIGIN** South Korea

---

**ENGINE** 1,591 cc, straight-four

---

**TOP SPEED** 119 mph (192 kph)



# Minivans

Also known as multipurpose vehicles (MPVs), minivans are tall, spacious cars that can carry five to eight passengers. Like the front row, the middle and back rows are often made up of individual seats, which can be folded or removed.

## Mitsubishi Space Wagon

This was one of the first minivans. It came in five- and seven-seat versions. It was sold under different names, including the Chariot, the Nimbus, and the Expo.

---

**YEAR** 1984

---

**ORIGIN** Japan

---

**ENGINE** 1,725 cc, straight-four

---

**TOP SPEED** 97 mph (156 kph)



## Ford Windstar

The Windstar was Ford's first minivan with front-wheel drive (where the engine's power goes to the front wheels only). Smoother performance and handling gave it an edge over other minivans of its time.

---

**YEAR** 1994

---

**ORIGIN** USA

---

**ENGINE** 3,797 cc, V6

---

**TOP SPEED** 116 mph (187 kph)





## Volkswagen Sharan

This car gets its name from a Persian word meaning “carrier of kings.” Around 670,000 Sharan cars were made over 15 years.

**YEAR** 1995

**ORIGIN** Portugal

**ENGINE** 2,792 cc, V6

**TOP SPEED** 110 mph (177 kph)



## Renault Kangoo 1

The rear seats of the adaptable Renault Kangoo can be removed to make more room. Because it is a tall car, it can be used if an occupant needs to fit in a wheelchair.

**YEAR** 1997

**ORIGIN** France

**ENGINE** 1,390 cc,  
straight-four

**TOP SPEED** 97 mph  
(156 kph)



## Mercedes-Benz Viano

The minivan version of the Mercedes-Benz Vito van—the Viano—has a stylish interior, most models being equipped with storage cabinets and a folding table. It is a spacious car that comes in three different body lengths.

**YEAR** 2004

**ORIGIN** Spain

**ENGINE** 2,143 cc, straight-four

**TOP SPEED** 117 mph  
(188 kph)

*Indicator lights mounted  
on side mirrors*



A variant called Marco Polo has a closet, a rear seat that can be turned into a bed, and a pop-up roof for more headroom.



## Volkswagen Touran

The 2006 Volkswagen Touran is an improved version of the 2003 model. One of the most interesting additions is that of ParkAssist technology, which parks the car automatically, without the driver holding the steering wheel. The ParkAssist gauges the speed and available space and avoids surrounding objects.

**YEAR** 2006

**ORIGIN** Germany

**ENGINE** 1,984 cc, straight-four

**TOP SPEED** 125 mph (200 kph)



## Peugeot 5008

Peugeot's first medium-sized minivan, the 5008 is one of the more spacious, yet stylish, cars of the type. The middle seats can be folded down all the way to the floor, providing more luggage space. Top-of-the-line models have a glass roof that extends all the way to the rear.

**YEAR** 2009

**ORIGIN** France

**ENGINE** 1,598 cc, straight-four

**TOP SPEED**  
121 mph (195 kph)



## Chevrolet Orlando



Originally introduced as a concept car in 2008, the Chevrolet Orlando is relatively compact for a seven-seater. It has three rows of tiered seating, which allows a clear view for passengers on the back seats as they sit slightly higher than those in the front.

---

**YEAR** 2010

---

**ORIGIN** USA

---

**ENGINE** 2,384 cc,  
straight-four

---

**TOP SPEED** 125 mph  
(200 kph)





### Citroën C4 Picasso

The C4 Picasso draws on features of Citroën's recent concept cars, with LED running lights in the front and a rounded nose. Its unusual windshield creates a sense of space, and improves visibility for the driver.

*Wide-angle windshield*




---

**YEAR** 2013

---

**ORIGIN** France

---

**ENGINE** 1,598 cc  
straight-four

---

**TOP SPEED** 116 mph  
(187 kph)

### Toyota Prius V

With the Prius V, Toyota has expanded its range of Prius hybrid (powered by gas and electricity) models to four. This one has a larger body than the other Prius models, and also features a unique roof, made of a lightweight resin, which is 40 percent lighter than a glass roof of the same size.

---

**YEAR** 2011

---

**ORIGIN** Japan

---

**ENGINE** 1,798 cc straight-four

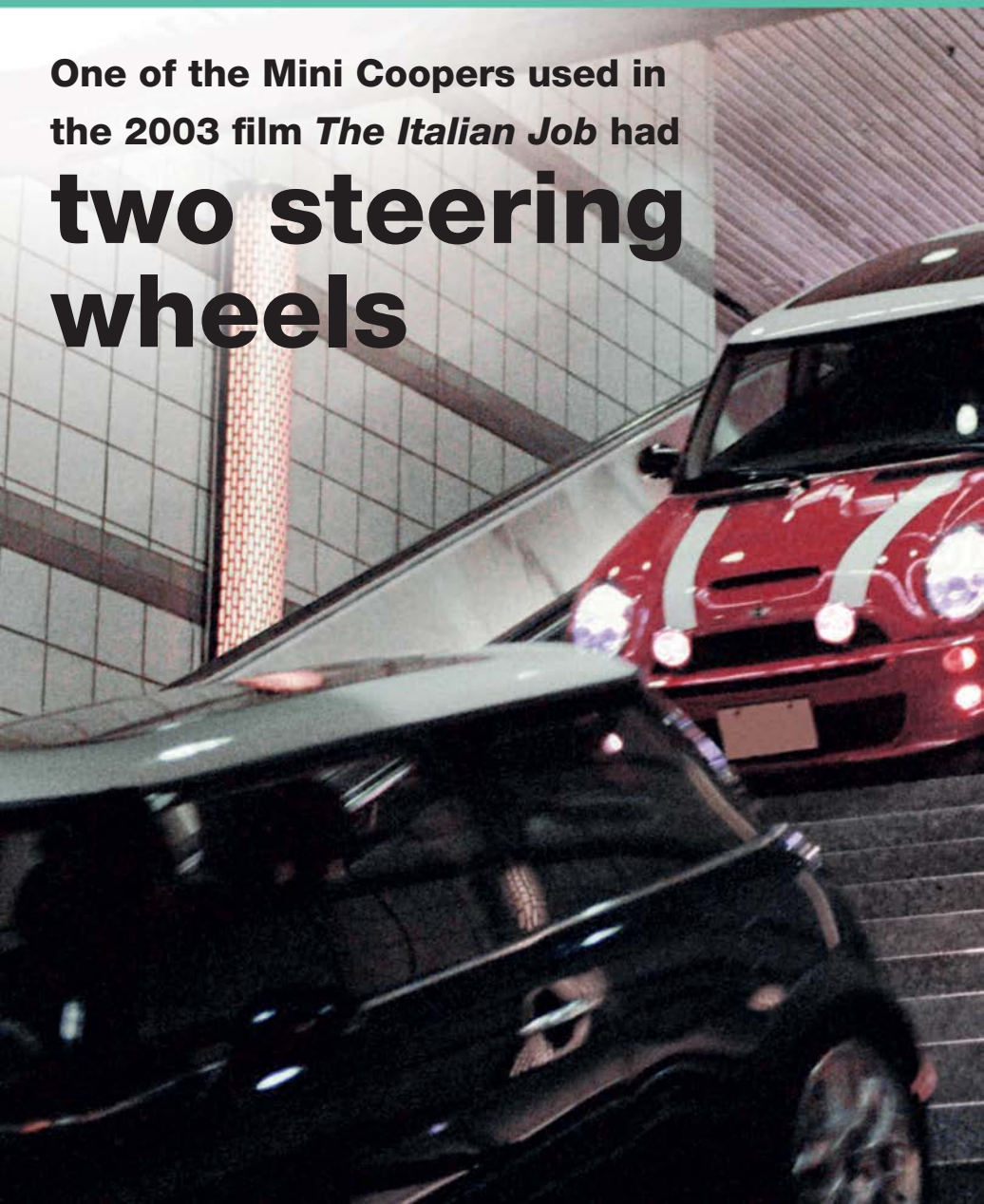
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**TOP SPEED** 103 mph (166 kph)



One of the Mini Coopers used in the 2003 film *The Italian Job* had

# two steering wheels



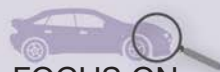
**AN UNUSUAL FEATURE**

Many movies feature car stunts, including car-chase scenes and car jumping stunts. For one such scene in *The Italian Job* (2003), a Mini Cooper was custom-built with two steering wheels. This helped the actors to perform while a stuntman actually drove the car.



# SUVs

A sport utility vehicle (SUV) is designed to cope with driving on rough terrain. Most SUVs have four-wheel drive, in which the engine powers all four wheels instead of only the front or the rear wheels. The first SUVs were based on military vehicles.



FOCUS ON...

## SIZE

SUVs can be divided into three broad groups, based on their size: mini, compact, and full-size.

### Lexus GX J120

The GX J120 was Lexus's third SUV. The exterior of this eight-seater was inspired by the Toyota Land Cruiser Prado, with both cars sharing similar dimensions.

**YEAR** 2003

**ORIGIN** Japan

**ENGINE** 4,664 cc, V8

**TOP SPEED** 122 mph (197 kph)







▲ A mini SUV, such as the Nissan Juke, is usually less than 13 ft 9 in (4.2 m) long.



▲ A compact SUV, such as the Toyota RAV4, is typically 14–15 ft (4.25–4.6 m) long.



▲ A full-sized SUV, such as the Mercedes-Benz GL Class, is usually at least 17 ft (5 m) long.

## Hummer H2

The H2 was the second vehicle in the Hummer range. Just as the H1 before it, its design was based on the US military vehicle, the Humvee. The Hummer H2 has the frame of a light truck and is wider than typical city cars.

**YEAR** 2003

**ORIGIN** USA

**ENGINE** 5,967 cc, V8

**TOP SPEED** 109 mph (176 kph)



## Nissan Armada

Built on the same body framework as Nissan's pickup truck Titan, the Armada is a full-size SUV. It can seat up to eight people.

---

**YEAR** 2004

---

**ORIGIN** Japan

---

**ENGINE**

5,552 cc, V8

---

**TOP SPEED**

120 mph  
(193 kph)



## Mercedes-Benz GL Class

The seven-seater GL boasts a number of luxury features, such as heated rear seats. Larger than comparable cars, it has a higher roof and a huge trunk space with a capacity of 53 gallons (200 liters).

---

**YEAR** 2006

---

**ORIGIN** Germany

---

**ENGINE** 2,987 cc, V6

---

**TOP SPEED**

124 mph (199 kph)



## Jeep Patriot

One of the cheapest SUVs available in its size, this compact SUV retains all of the features of a typical Jeep, including round headlights, vertical windows, and a wide radiator grille.

**YEAR** 2007

**ORIGIN** USA

**ENGINE** 1,968 cc, straight-four

**TOP SPEED** 117 mph (188 kph)



## Chevrolet Tahoe

The Tahoe was revised in 2007 with a new hood and grille, new door panels, and new seat designs. It can seat nine people, but the third row of seats cannot fold flat. This gives it limited trunk space.

**YEAR** 2007

**ORIGIN** USA

**ENGINE** 5,300 cc, V8

**TOP SPEED** 112 mph  
(180 kph)



### Audi Q5

Audi's first compact SUV has an innovative roof rack with sensors that allow the car to automatically adjust its center of gravity when the rack is loaded, helping the car to stay balanced.

---

**YEAR** 2009

---

**ORIGIN** Germany

---

**ENGINE** 2,967 cc, V6

---

**TOP SPEED** 140 mph (225 kph)



### Ford Escape Hybrid

The Ford Escape was the first hybrid SUV, launched in 2004. It was given a face-lift in 2009, with added features, such as improved interior lighting and heated front seats.

---

**YEAR** 2009

---

**ORIGIN** USA

---

**ENGINE** 2,488 cc, straight-four

---

**TOP SPEED** 102 mph (164 kph)



### BMW X5 xDrive50i





The xDrive is a powerful car with a new turbocharged diesel and gas engine. The headlights and fog lights sit high and close to the radiator grille, giving it a rugged appearance. Some optional features include a Lane Departure Warning, which identifies the car's movement away from marked lanes with the help of side-mounted cameras. The steering wheel starts vibrating to alert the driver in such situations.

**YEAR** 2011

**ORIGIN** Germany

**ENGINE** 4,395 cc, V8

**TOP SPEED** 131 mph (210 kph)





# Luxury cars

Luxury cars are owned as status symbols, commanding steep price tags and possessing extravagant features. Often, just a few cars of a particular model are produced, making them even more exclusive. Sometimes made-to-order, these cars promise high levels of passenger comfort, customized interiors, and an enhanced driving experience.



## **TRAVELING IN STYLE**

Most luxury car brands provide the option of personalized accessories, such as luggage, which are often customized to match the car's interior.

# Luxury cars

Luxury (top-end) cars are sleek, very expensive, high-performance machines. These exclusive vehicles are bought by wealthy people as a sign of social status. Such cars are decorated using the finest materials and come with optional extravagant features.

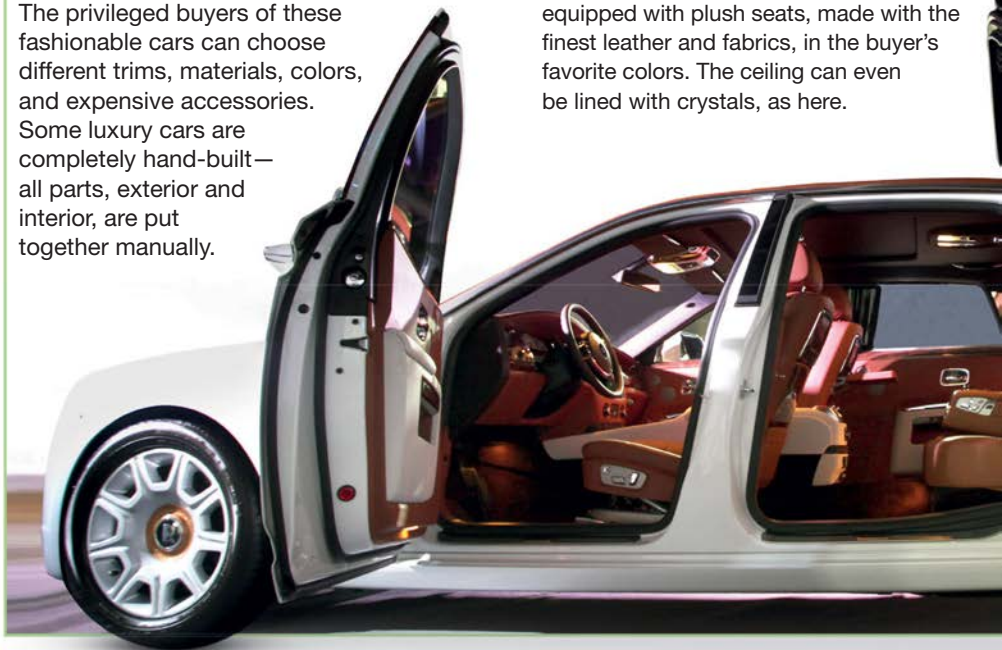


## Choosing the best

The privileged buyers of these fashionable cars can choose different trims, materials, colors, and expensive accessories. Some luxury cars are completely hand-built — all parts, exterior and interior, are put together manually.

## Interior style

The interior of a luxury car can be equipped with plush seats, made with the finest leather and fabrics, in the buyer's favorite colors. The ceiling can even be lined with crystals, as here.







## Personalization

In addition to choosing from trims available from the car manufacturer, buyers can add personal touches to their vehicles. Some may opt for placing their initials or signature on the seats or car exterior, while others have their car's dashboard styled with inlays of wood from their trees.

## Wheels

There are different types of upmarket wheel designs available. Wheels can be coated with gold or studded with diamonds.



## ACCESSORIES

**Expensive accessories** are standard in luxury cars and are often personalized.



**“Infotainment systems,”** include touchscreen or voice controls, Wi-Fi connectivity, surround-sound streamed music, and mobile charging points.



**Minibar and glass holders** can be installed in the car so refreshments are available.

# Limousines

Usually longer than a standard car, a limousine is often associated with wealth, because of its luxurious appearance. A typical limousine has a separate compartment for the driver and is driven by a chauffeur. This expensive car is often hired for special events, such as weddings and parties.

## Hummer H2 Limousine

This eight-wheeled Hummer H2 stretch limousine (longer than typical limousines) can carry up to 16 passengers. Like other limousines, it can be equipped with lights and music systems.



## Volvo S80 Limousine

Based on the S80 sedan, the S80 limousine was developed by Volvo in collaboration with Nilsson Karosserifabrik. It is available in four- or six-door variants. A five-door version of the S80 is also used as a hearse.

**YEAR** 2002

**ORIGIN** Sweden

**ENGINE** 2,922 cc, straight-six



**YEAR** 2003

**ORIGIN** USA

**ENGINE** 6,200 cc, V8



### Range Rover Limousine

The stretch version of a popular SUV, the Range Rover limousine has been designed for luxury. It comes with a "jet door"—a door that opens upward like the door of a small jet plane.

**YEAR** 2002

**ORIGIN** UK

**ENGINE** 4,999 cc, V8



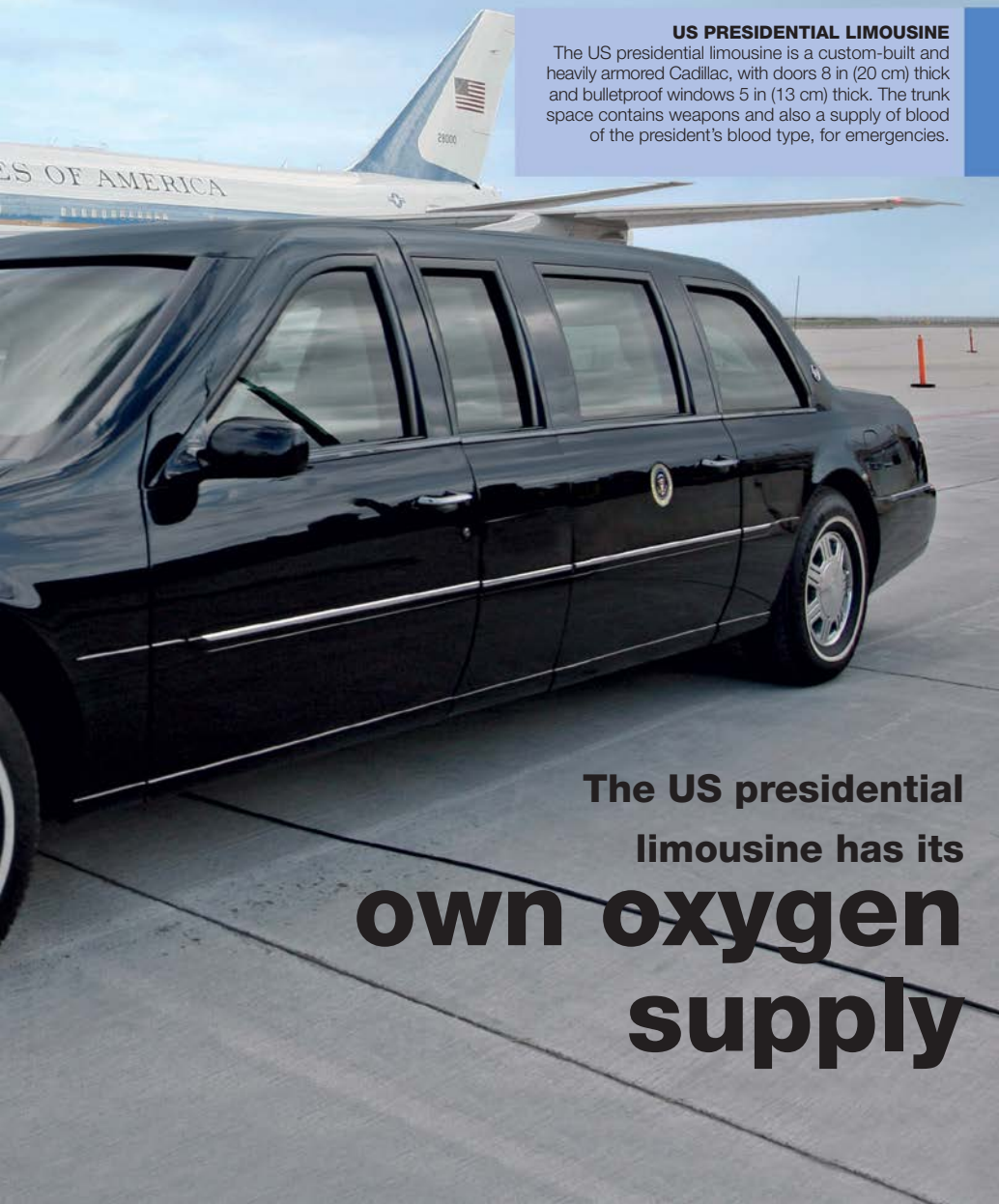
*Jet door*





**US PRESIDENTIAL LIMOUSINE**

The US presidential limousine is a custom-built and heavily armored Cadillac, with doors 8 in (20 cm) thick and bulletproof windows 5 in (13 cm) thick. The trunk space contains weapons and also a supply of blood of the president's blood type, for emergencies.



The US presidential  
limousine has its  
**own oxygen  
supply**

# Grand tourers

A grand tourer, or GT, is a stylish car that can be driven over long distances. It is capable of high speed, but, unlike a sports car, it has a luxurious interior built for comfort. The name refers to an 18th-century tradition of grand tours, where young people from wealthy families took a cultural tour across Europe.

## Jaguar XJS V12

The sleek XJS has a padded top. With a popular two-door, full convertible style and a V12 engine, this model became one of the most successful grand tourers of its time.

**YEAR** 1988

**ORIGIN** UK

**ENGINE** 5,343 cc, V12

**TOP SPEED** 150 mph (241 kph)



## Ford Mustang GT



Automobile designer Patrick Schiavone remodeled the Mustang in 1993 to create the Ford Mustang GT. This new version boasted style elements from earlier models, and a high-performance V8 engine. It earned the title 1994 Motor Trend Car of the Year.

**YEAR** 1994

**ORIGIN** USA

**ENGINE** 4,942 cc, V8

**TOP SPEED** 136 mph (219 kph)

## Porsche 911 Carrera Cabriolet

In 1998, Porsche's 911 sports car received its most significant upgrade since its launch in 1963. The latest model featured a new water-cooled engine.

**YEAR** 1998

**ORIGIN** Germany

**ENGINE** 3,600 cc, flat-six

**TOP SPEED** 170 mph (274 kph)



## Ferrari Enzo

*Sleek side panels add to aerodynamic design*



Ferrari's Enzo is named after the company's founder, Enzo Ferrari. This car is inspired by cutting-edge Formula 1 design and technology. Its compact size, reduced weight, revolutionary cabin design, and a gear shifting time of 150 milliseconds makes it the ultimate sports car for the road.

---

**YEAR** 2002

---

**ORIGIN** Italy

---

**ENGINE** 5,998 cc, V12

---

**TOP SPEED** 226 mph  
(363 kph)

## Pontiac GTO

The Pontiac GTO can accelerate from 0 to 60 mph (97 kph) in about 5 seconds. The addition of bright wheel spokes and a spoiler adds a sporty edge to its appearance.

---

**YEAR** 2006

---

**ORIGIN** Australia

---

**ENGINE** 6,375 cc, V8

---

**TOP SPEED** 175 mph (282 kph)



## Audi R8

The two-seater R8 uses Audi's trademark Quattro four-wheel drive system. It has an aluminum, lightweight chassis, and has a more spacious interior than other sports cars. Its superior technology and smooth ride makes it a true rival to the iconic Porsche 911.

---

**YEAR** 2006

---

**ORIGIN** Germany

---

**ENGINE** 5,204 cc, V10

---

**TOP SPEED** 196 mph (315 kph)





### Nissan GT-R SpecV

A special variant of the Nissan GT-R, the GT-R SpecV is 132 lb (60 kg) lighter than the standard version. This car features some carbon-fiber body panels, no rear seats, and a titanium exhaust—a lightweight alternative to a steel one.

**YEAR** 2007

**ORIGIN** Japan

**ENGINE** 3,799 cc, V6

**TOP SPEED** 193 mph (311 kph)



## Dodge Challenger

The long-hood design of the Challenger is a tribute to the compact, powerful American cars of the 1970s. However, its performance matches that of modern-day cars. While it offers a smooth ride and handles well, many feel the interior does not match up to the dramatic exterior.

---

**YEAR** 2008

---

**ORIGIN** USA

---

**ENGINE** 6,059 cc, V8

---

**TOP SPEED** 145 mph  
(233 kph)



## Mercedes-Benz SLS AMG

This model was the first Mercedes-Benz car to be designed in-house by its development wing—AMG. The most iconic feature of the two-door grand tourer is its “gull-wing” doors, which open upward.

---

**YEAR** 2010

---

**ORIGIN** Germany

---

**ENGINE** 6,208 cc, V8

---

**TOP SPEED** 197 mph  
(317 kph)





### Chevrolet Camaro 2SS

The Camaro 2SS is known for its sleek exterior and powerful performance. Its short side window, small, high-mounted taillight, and low roofline with sloping windshield add to the appeal.

**YEAR** 2010

**ORIGIN** USA

**ENGINE** 6,162 cc, V8

**TOP SPEED** 155 mph (250 kph)







# Racing and sports cars

From long-distance rallies to high-speed track-based competitions, car racing has been popular since cars first appeared. While sports cars are powerful enough to be raced occasionally if the owner wants to, race cars are set apart by their speed and design, and they are raced by highly skilled drivers.



## **RACING TIRES**

Different tires are used for different conditions: intermediate tread tires for wet tracks; heavy tread tires for standing water; and slick tires for dry tracks.

# The world of racing

The first car races were organized in the 1890s, to prove the speed and reliability of the vehicles involved. Soon it became a popular source of entertainment, and different categories of races were introduced. Today, car racing is an international sport.



## Stock car racing

Stock car races are typically held on an oval track. NASCAR (National Association for Stock Car Racing) is the largest body that organizes these races. The Sprint Cup Series is the most popular NASCAR race in the United States.



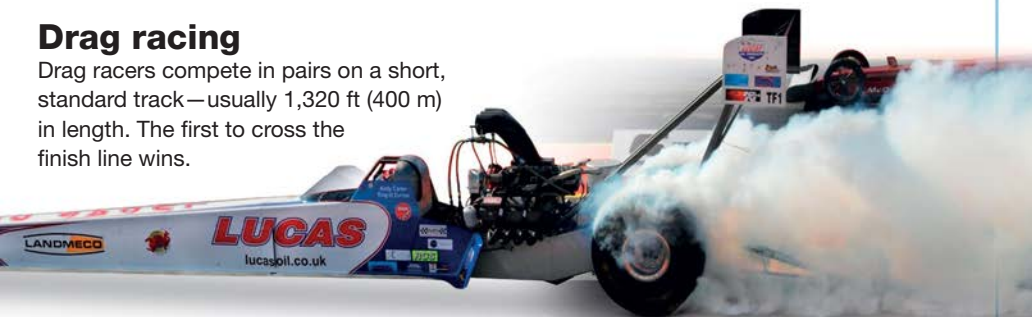
## Rallying

In rally races, cars run between two controlled stops (special stages) on public or private roads, instead of a track. Pairs of drivers aim to arrive first or match a stipulated time.



## Drag racing

Drag racers compete in pairs on a short, standard track—usually 1,320 ft (400 m) in length. The first to cross the finish line wins.



## Formula racing

Formula racing gets its name from early motor racing championships, held in Europe. These had set rules, or a “formula,” that every participant had to follow. Today, formula racing includes Formula One, Two, and Three series.



# Speedsters

Both racing and sports cars are built for speed, but only sports cars appear in showrooms for sale to the public. Race cars may be closed-wheel (with wings covering the wheel) or open-wheel (without wings). They are modified for competing in various championships.

## Race cars

High-performance race cars are designed specifically to take part in various types of motor racing. Modifications include adding more engines, lowering the car's height, and removing the wings.



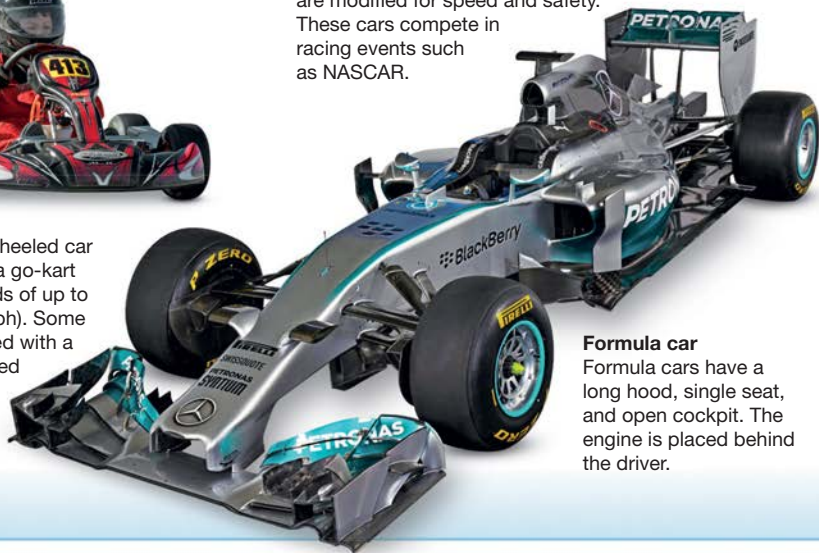
### Go-kart

A small, open-wheeled car built for racing, a go-kart can reach speeds of up to 155 mph (250 kph). Some go-karts are fitted with a specially designed engine.



### Stock car

Stock cars resemble ordinary street models but their chassis, tires, and accessories are modified for speed and safety. These cars compete in racing events such as NASCAR.



### Formula car

Formula cars have a long hood, single seat, and open cockpit. The engine is placed behind the driver.



## Air flow

Aerodynamics is the study of the flow of air around a moving object, such as a car. Cars are designed with features that fight drag (air resistance) to improve speed and reduce lift, which could flip a car.

**Rounded front wing** channels airflow over the car \_\_\_\_\_

**Rear spoiler**, or wing, stabilizes car at high speeds by reducing drag \_\_\_\_\_

**Front spoiler**, or air dam, decreases amount of air passing underneath the car \_\_\_\_\_

**Front air inlet** can be closed to lessen drag \_\_\_\_\_

**Low, flat underbody** allows smoother airflow beneath the car \_\_\_\_\_



## Sports cars

Equipped with strong engines and designed to be sleek and lightweight, sports cars are usually production vehicles (made for sale) that provide the thrill of driving at high speeds.



**Roadster**  
Agile, two-seater roadsters, such as this BMW Z4, are usually open-top cars. They may come with a soft top or a retractable hard top.



**Supercar**  
Costly supercars are exceptional, superfast sports cars, featuring state-of-the-art racing technology.



## FOCUS ON... F1 FLAGS

In an F1 race, different flags are used to indicate the condition of the track or to relay important messages to the drivers.



▲ A red flag signals that the race has been stopped for safety reasons and that all drivers must pull in.



▲ A striped flag warns drivers of substances on the track, including water, oil, and debris.



▲ The checkered flag is shown to declare the winner and to signal that the race is officially over.

# Racing cars

Built for speed and agility, racing cars are usually one- or two-seater vehicles designed to be driven in racing competitions. Cars for different types of race, such as Formula or drag racing, have specifically modified engines and body shapes.

## Ferrari F138

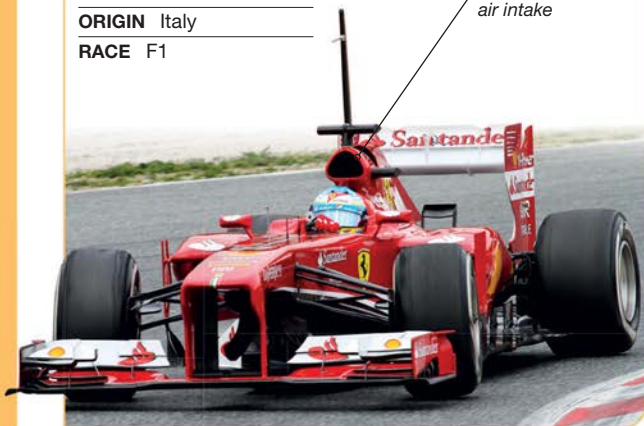
Designed for the 2013 Formula One (F1) Season, the lightweight F138 was driven by the two-time World Champion Fernando Alonso. The name—F138—is a combination of the race year and the number of engine cylinders. The car has a high nose, while the rear is narrow, which makes it more aerodynamic.

**YEAR** 2013

**ORIGIN** Italy

**RACE** F1

Vent for  
air intake



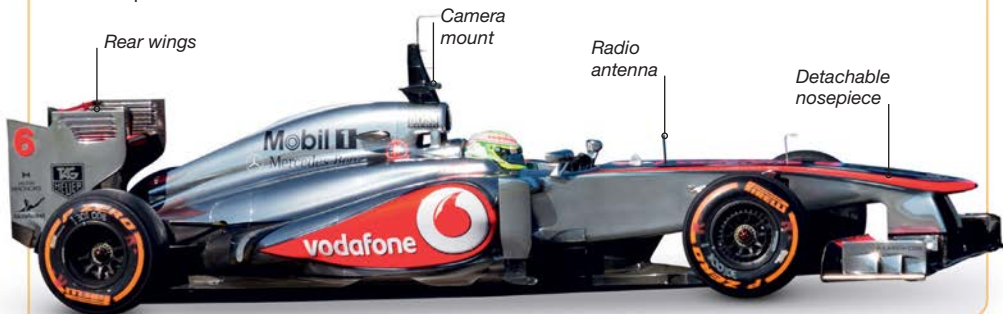
## McLaren Mercedes MP4-28

Launched on January 31, 2013, as part of McLaren's 50th anniversary celebration, the MP4-28 has a completely new design—with a new chassis and a higher nose. However, it failed to perform well in the races.

**YEAR** 2013

**ORIGIN** UK

**RACE** F1



## Red Bull Racing RB9

The RB9 was driven by Sebastian Vettel, the three-time winner of the World Driver's Championship, which is awarded to the F1 driver of the season. This car faced the disadvantage of being equipped with tires that wore out more quickly during a race than other cars' tires.

**YEAR** 2013

**ORIGIN** UK

**RACE** F1



## Mercedes AMG Petronas F1W05

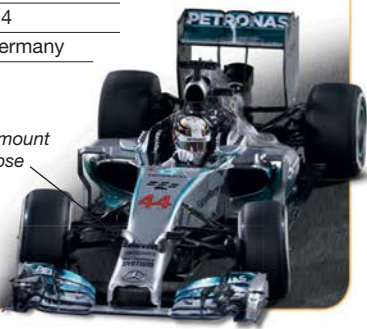
The F1W05 has a smooth, wide nose, unlike the typical raised nose of a Formula car. The downturned nose makes the car more aerodynamic.

**YEAR** 2014

**ORIGIN** Germany

**RACE** F1

*Camera mount  
on the nose*




## Habermann Top Methanol Dragster

This dragster (car used in drag racing) was driven by Dennis Habermann, who was third in the 2012 FIA European Drag Racing Championship. Although similar in design to Top Fuel dragsters, Top Methanols are less powerful. They are powered by fuel that is 100 percent methanol, while Top Fuel dragsters use a fuel mixture that is only 10 percent methanol.

**YEAR** 2012

**ORIGIN** Germany

**RACE** Top Methanol



Top Methanol Dragsters can cover a quarter mile (0.4 km) in less than 6 seconds, reaching speeds of up to 248 mph (400 kph).



## Castrol GTX High Mileage Ford Mustang

The High Mileage Ford Mustang was driven by 16-time Funny Car race champion John Force. Funny Car dragsters look similar to production cars but have custom-built chassis. Ford Mustangs have been used in drag racing since 1964.

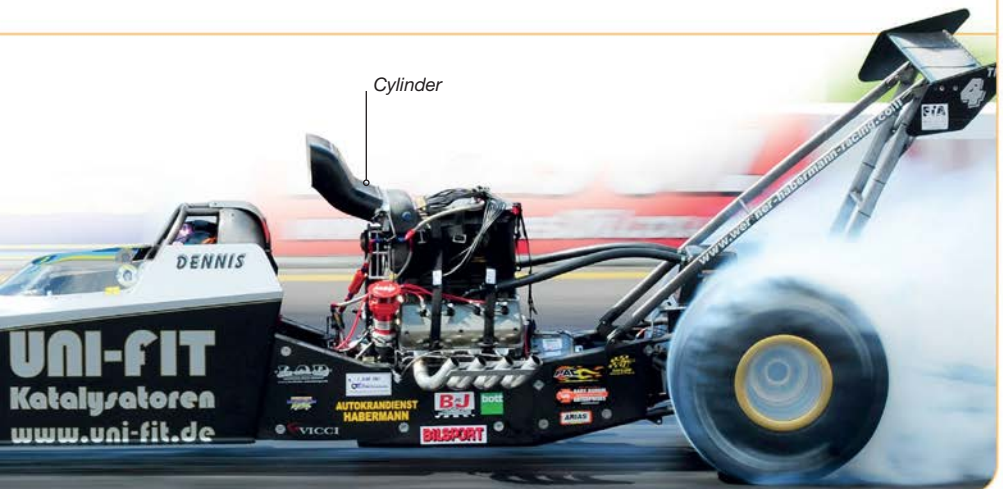
**YEAR** 2009

**ORIGIN** USA

**RACE** Funny Car



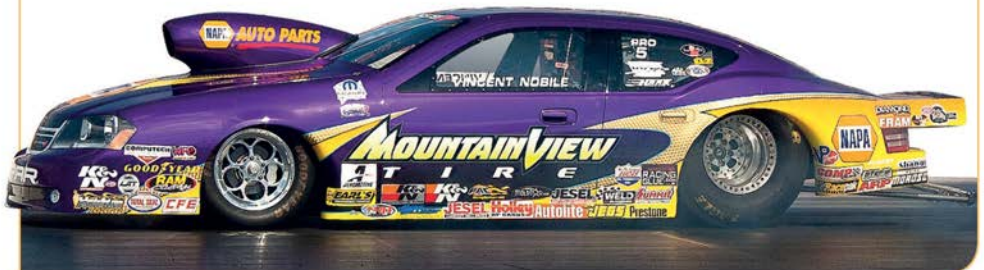




## Mountain View Tire Dodge Avenger

Driven by the youngest winner of the National Hot Rod Association (NHRA) Pro Stock class, Vincent Nobile, the Dodge Avenger has been modified as per NHRA's strict regulations. Nobile reached a top speed of 211.03 mph (339.61 kph) with the Dodge Avenger.

**YEAR** 2012  
**ORIGIN** USA  
**RACE** Pro Stock



## SEAT León

The León was first introduced to the World Touring Car Championship in 2005. SEAT won the manufacturer's title in 2008 and 2009 with this car. A limited edition road-going model, the Cupra World Champion Edition, was built in 2010 to celebrate the successful race season.

**YEAR** 2009

**ORIGIN** Spain

**RACE** World Touring Car Championship



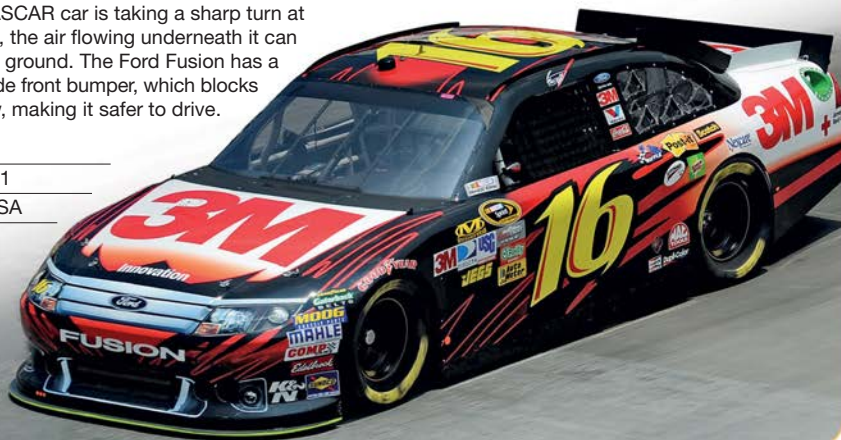
## Ford Fusion

When a NASCAR car is taking a sharp turn at high speed, the air flowing underneath it can lift it off the ground. The Ford Fusion has a low and wide front bumper, which blocks this air flow, making it safer to drive.

**YEAR** 2011

**ORIGIN** USA

**RACE**  
NASCAR



## Chevrolet Impala



Richard Childress Racing Team's Chevrolet Impala was driven by Kevin Harvick up until the 2013 season. Harvick won the race at the 2012 Phoenix International Raceway and finished third overall in the 2013 Sprint Cup Series.

---

**YEAR** 2012

---

**ORIGIN** USA

---

**RACE** NASCAR

## Honda Civic

Pirtek Racing team's Honda Civic participates in the British Touring Car Championship, a race event for sedans. It is equipped with a low-cost, turbocharged engine, which matches the specifications required for all touring race cars.

---

**YEAR** 2013

---

**ORIGIN** UK

---

**RACE** British Touring Car Championship



### Superkart 250 cc

The fastest go-kart in the world, a Superkart 250 cc can complete laps faster than more technologically advanced race cars. It can reach a top speed of 160 mph (257 kph), and is primarily used in the British Superkart Championship.

**YEAR** Unknown

**ORIGIN** Unknown

**RACE** British Superkart Championship



### Subaru Impreza WRC

Introduced in 1993, the Impreza WRC has performed well in rally races over the years. The 2004 model had improved aerodynamics, a turbocharged engine, and four-wheel drive (where the engine's power goes to the front and rear wheels).

**YEAR** 2004

**ORIGIN** Japan

**RACE** World Rally Racing





## Swamp Thing

The Swamp Thing is a monster truck, which is a modified pickup truck with giant wheels. This vehicle weighs a hefty 11,000 lb (5,000 kg). In addition to competing in monster truck races, it also participates in entertainment events, such as crushing smaller cars and performing stunts.

**YEAR** 2004

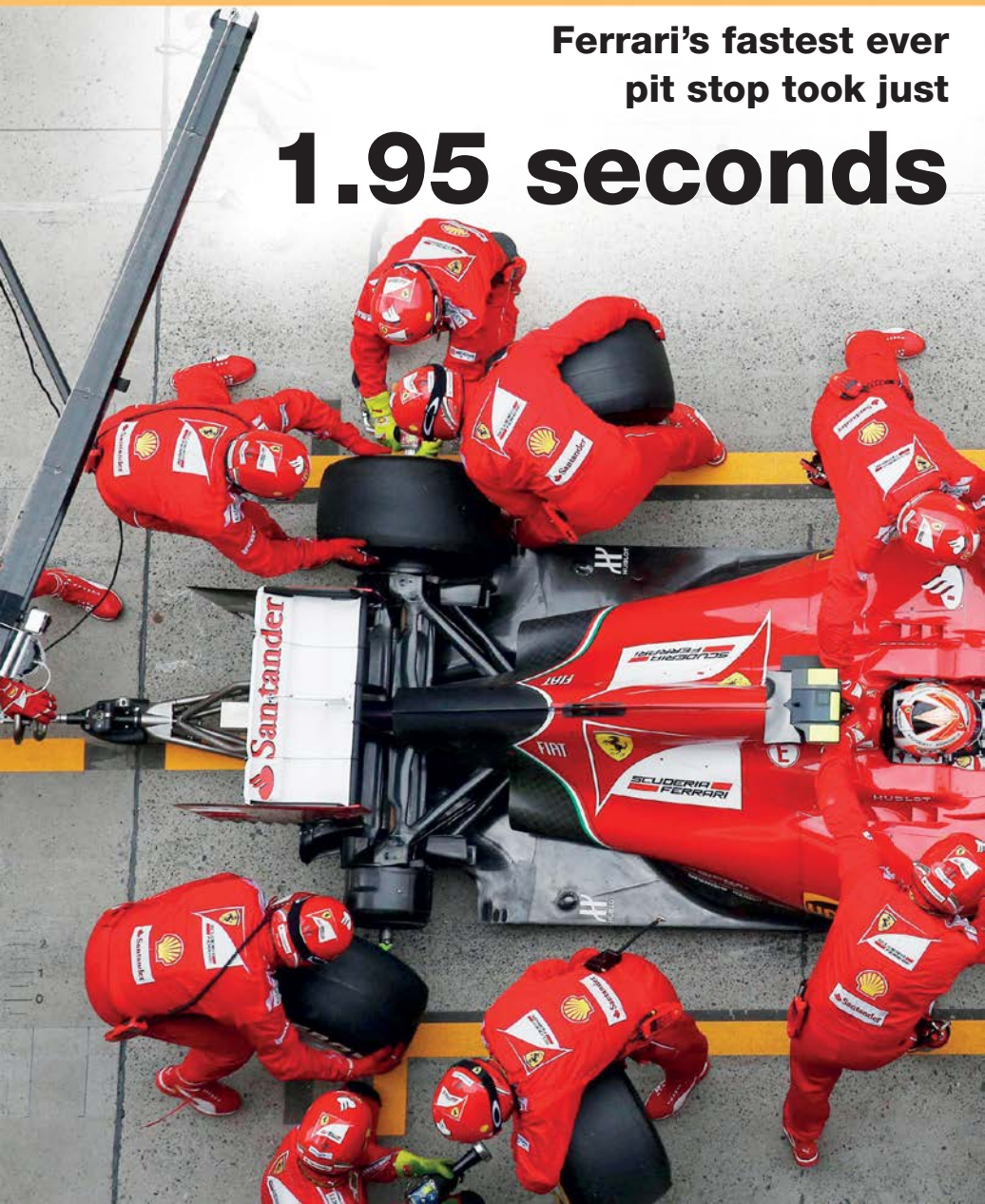
**ORIGIN** UK

**RACE** Monster truck racing



Ferrari's fastest ever  
pit stop took just

# 1.95 seconds







### PIT STOP

A race car makes a pit stop to get new tires and have minor repairs between laps.

Pit stops are in a lane that runs parallel to the race track. The team's pit crew must complete all the tasks as fast as possible for the car to get back in the race. An average F1 pit stop lasts about 2.5 seconds.

# Roadsters

Traditionally, a roadster was defined as a car with no windows and, sometimes, no doors. Today, however, a roadster is any two-seater convertible, open-top car (without a fixed roof). This sporty car has a lightweight structure, and can have a soft top or a hard top.

## BMW Z1

The Z1 was BMW's first open two-seater since the late 1950s. A unique feature of this car is that its doors can be retracted vertically down into the car's body. The body itself is high enough to offer protection even when the doors are down.

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**YEAR** 1989

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**ORIGIN** Germany

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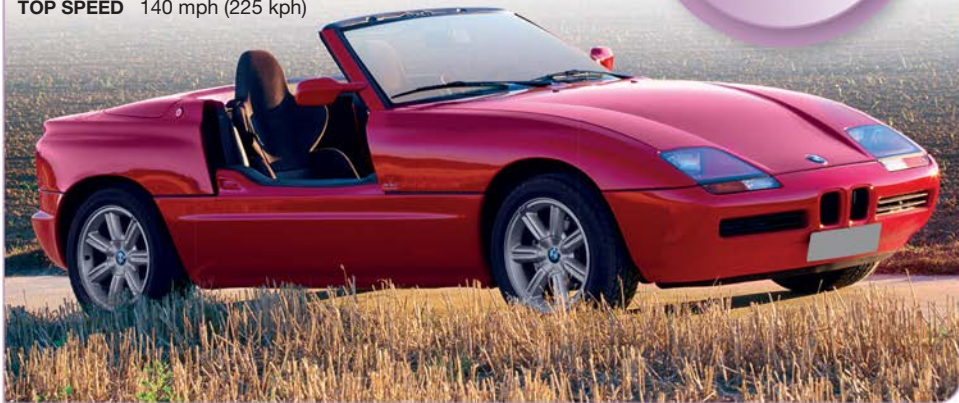
**ENGINE** 2,494 cc, six-cylinder

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**TOP SPEED** 140 mph (225 kph)



All BMW Z1s were left-hand drive, except the final one, which was also the only Z1 to be hand-built.





### Marcos Mantula Spyder



The Spyder is the convertible version of the 1984 Marcos Mantula coupe. Technologically, the two cars are similar, except that the Spyder has a stiffer chassis to make up for the open roof. It also has a rounded nose and a padded soft top.

**YEAR** 1986

**ORIGIN** UK

**ENGINE** 3,532 cc, V8

**TOP SPEED** 139 mph (224 kph)

### Alfa Romeo Spider

The Alfa Romeo Spider has a typical Italian design, with a low body that is broad and flattened. It is fitted with the trademark Alfa Romeo grille, round headlights, and has a steeply sloping windshield. Although it has a high rear, the hood space is small.

**YEAR** 1995

**ORIGIN** Italy

**ENGINE** 2,959 cc, V6

**TOP SPEED** 140 mph (225 kph)



## Renault Sport Spider

Built to promote Renault as a sporting brand, the Sport Spider is a lightweight car with an aluminum chassis and a plastic body. It has neither a roof nor a top and only Sport Spiders sold in the UK have a windshield.

---

**YEAR** 1996

---

**ORIGIN** France

---

**ENGINE** 1,998 cc, straight-four

---

**TOP SPEED** 131 mph (211 kph)



## Honda S2000 AP1

First shown as a concept car in 1995, the S2000 AP1 was launched in 1999. This stylish car is equipped with a vinyl soft top. An aluminum hard top is available as an optional extra.

---

**YEAR** 1999

---

**ORIGIN** Japan

---

**ENGINE** 1,997 cc, straight-four

---

**TOP SPEED** 150 mph (241 kph)



## Lamborghini Murcièlago Roadster

Fighter aircraft, Spanish architecture, and mega-yachts were among the things that inspired the styling of this impressive, soft-top Lamborghini. The Murcièlago has a low-tech, manually operated roof.





**YEAR** 2004

**ORIGIN** Italy

**ENGINE** 6,496 cc, V12

**TOP SPEED** 200 mph (322 kph)



### Audi TT RS Roadster

The TT RS is equipped with an engine designed exclusively for it, and no other Audi car used it until the RS3 in 2011. This powerful engine, combined with the lightweight aluminum chassis and body, provides a smooth ride.

**YEAR** 2009

**ORIGIN** Germany

**ENGINE** 2,479 cc, straight-five

**TOP SPEED** 155 mph (250 kph)



# Supercars

Supercars are very expensive sports cars. They are usually produced in limited numbers, which makes them exclusive and highly prized. Equipped with the latest technology, these powerful performers are capable of reaching extremely high speeds.

## Ferrari 288 GTO

Originally built for racing, the 288 GTO did not end up on the track, as the race category it was designed for was discontinued. This limited edition car was released only in Ferrari's iconic red color.

**YEAR** 1984

**ORIGIN** Italy

**ENGINE** 2,855 cc, V8

**TOP SPEED** 190 mph (306 kph)



## Aston Martin V8 Zagato

Recognized for its unique angular design, the V8 Zagato is one of the rarest supercars. Aston Martin decided to make only 52 cars of this model, and all of them were bought before its production, solely on the basis of drawings and a scale model.

**YEAR** 1986

**ORIGIN** UK

**ENGINE** 5,340 cc, V8

**TOP SPEED** 186 mph (300 kph)





## McLaren F1

In its time, the McLaren F1 succeeded in breaking multiple speed records. It can reach such high speeds that its engine compartment has to be lined with gold foil, to shield against the heat produced.

**YEAR** 1992

**ORIGIN** UK

**ENGINE**  
6,064 cc, V12

**TOP SPEED**  
243 mph  
(391 kph)



## Lamborghini Diablo VT Roadster

With this car, Lamborghini continued its tradition of naming its models after fighting bulls. The Diablo VT Roadster was a convertible version of the coupe. It earned its supercar status as it was one of the fastest cars of its time.

**YEAR** 1995

**ORIGIN** Italy

**ENGINE** 5,707 cc,  
V12

**TOP SPEED**  
201 mph (323 kph)



### Alfa Romeo 8C Competizione



This car's design was inspired by the Alfa Romeo models of the 1950s and 1960s. Its name is a tribute to Alfa Romeo's racing tradition: "8C" is a reference to the eight-cylinder engine used by most Alfa Romeo race cars in the 1930s, and "Competizione" is Italian for "competition."

<b>YEAR</b>	2007
<b>ORIGIN</b>	Italy
<b>ENGINE</b>	4,591 cc, V8
<b>TOP SPEED</b>	181 mph (292 kph)

### Lamborghini Aventador LP 700-4

Parts of this sleek two-seater's body, including the roof and doors, are made of carbon fiber. While this makes the car body extremely strong, the use of aluminum in other parts makes the Aventador light as well.

<b>YEAR</b>	2011
<b>ORIGIN</b>	Italy
<b>ENGINE</b>	6,498 cc, V12
<b>TOP SPEED</b>	217 mph (350 kph)



### Bugatti Veyron 16.4 Grand Sport

One of the fastest and most expensive convertibles in the world, this supercar has two removable roofs. One of them is a manually removable hard top, made of transparent polycarbonate. The other is a soft top that unfolds over the cabin, much like a flat umbrella.

---

**YEAR** 2009

---

**ORIGIN** France

---

**ENGINE** 7,993 cc,  
W16

---

**TOP SPEED** 253 mph  
(407 kph)





**The Bugatti Veyron**

**Super Sport was the world's**

**fastest road car**

**for three years, with a**

**top speed of 267.8 mph (431 kph)**



**MADE FOR SPEED**

Bugatti's supercar, recognized by its iconic horseshoe-shaped front grille, was named after the French race car driver Pierre Veyron. This car takes only 2.5 seconds to reach a speed of 60 mph (97 kph). Its record was broken by the Hennessey Venom GT in February 2014.





# Amazing cars

Some cars are set apart by their unusual designs or extremely powerful engines, while others look to change the concept of what a car is or how it can be run. Record breakers, usually jet-propelled, show how fast a car can go, while amphibious cars make it possible to drive cars through water. Several cars are built purely as concepts to show off advanced technologies and designs.



## **ELECTRIC CARS**

Some cars—such as this Venturi Fétish, the world's first two-seater electric sports car—run only on electricity, using energy stored in batteries.

# Out of the ordinary

In the history of car design and technology, a few special vehicles mark significant breakthroughs. These cars led the way with innovations in speed, fuel efficiency, safety, styling, or mechanics. Some vehicles are even designed for use in outer space!

## Eco cars

Environmentally friendly cars are built from sustainable materials where possible and produce low or zero emissions. This all-electric BMW i3 is powered by a rechargeable battery.



## Speed demons

Supersonic cars, such as the Bloodhound SSC, are designed to travel faster than the speed of sound. Powered by both a jet and a rocket engine, this car is in development to shatter the world land speed record by achieving a speed just over 1,000 mph (1,600 kph).







## On land and water

Versatile and fun, amphibious vehicles, such as the WaterCar Panther, can cruise highways, climb sand dunes, or jet along a river faster than a motor cruiser.

## Concept cars

Prototype cars showcase new strategies in design and technology. Previewed in 2011, this state-of-the-art hybrid Ford Evos featured many new design concepts, such as front and rear gull-wing doors.



LED strip headlights

## CARS IN SPACE

Space cars, or rovers, are built for space exploration. NASA's *Curiosity*, shown here, is controlled from Earth and conducts scientific experiments on Mars, collecting rock samples and photographing the terrain.



# Hybrid cars

Cars that use more than one power source—usually a combination of a gas engine and an electric motor—are called hybrid cars. These vehicles are more fuel efficient and emit (give out) lower levels of air pollutants.



## FOCUS ON... REFUELING

In addition to gas or diesel, hybrid cars are powered by an electric motor or an alternative fuel, such as hydrogen.

### Honda Insight

The Honda Insight is equipped with an electric motor that boosts the performance of its gas engine. In addition to the hybrid drive system, its lightweight body and streamlined design also help to improve the car's fuel efficiency.

---

**YEAR** 2000

---

**ORIGIN** Japan

---

**ENGINE** 995 cc, straight-three

---

**TOP SPEED** 106 mph (170 kph)

*Most of the body is made up of aluminum and plastic*



### Saturn Vue Green Line



The first hybrid SUV created by General Motors, the Saturn Vue Green Line is a mild hybrid. This means that the electric motor is used to assist the main engine but cannot be used independently. This model uses up to 20 percent less fuel than a regular Saturn Vue.

---

**YEAR** 2007

---

**ORIGIN** USA

---

**ENGINE** 2,376 cc, straight-four

---

**TOP SPEED** 100 mph (160 kph)



◀ Charging points can be used to recharge the batteries of an electric hybrid car.



◀ Although not as common as charging points, hydrogen filling stations have been opened in many countries.

## Toyota Prius

The 1997 Toyota Prius was the first hybrid car to be mass-produced. The 2004 Prius is a full hybrid, which means that power from the gas engine and the electric motor can be shared to run the car.

**YEAR** 2004

**ORIGIN** Japan

**ENGINE** 1,497 cc, four-cylinder

**TOP SPEED** 106 mph (170 kph)



## Toyota Highlander

The midsize SUV Highlander is a full hybrid, known for its smooth ride and spacious interior. However, it is more expensive than other SUV hybrids, and not particularly fuel efficient in comparison to other cars of the same type.

**YEAR** 2007

**ORIGIN** Japan

**ENGINE** 3,310 cc, straight-six

**TOP SPEED** 112 mph (180 kph)



## Chevrolet Volt

Introduced as a concept vehicle in 2007, the Volt is a full hybrid, plug-in electric car. The electric battery is powerful enough for city driving. The Volt also has a gas-powered engine, which can be used for longer distances.

**YEAR** 2011

**ORIGIN** USA

**ENGINE** 1,398 cc, straight-four

**TOP SPEED** 100 mph (161 kph)



## LaFerrari

The LaFerrari's design is inspired by the brand's race cars. Only 499 units of this sports car are planned. Unlike most hybrid vehicles, the internal combustion engine and the electric motor of the LaFerrari can run at the same time.





## Nissan Cima

The luxury saloon Cima combines powerful engine performance with elegant design and a spacious interior. Its efficient hybrid technology significantly reduces the harmful emissions produced.

**YEAR** 2012

**ORIGIN** Japan

**ENGINE** 3,498 cc, V6

**TOP SPEED** 93 mph (150 kph)

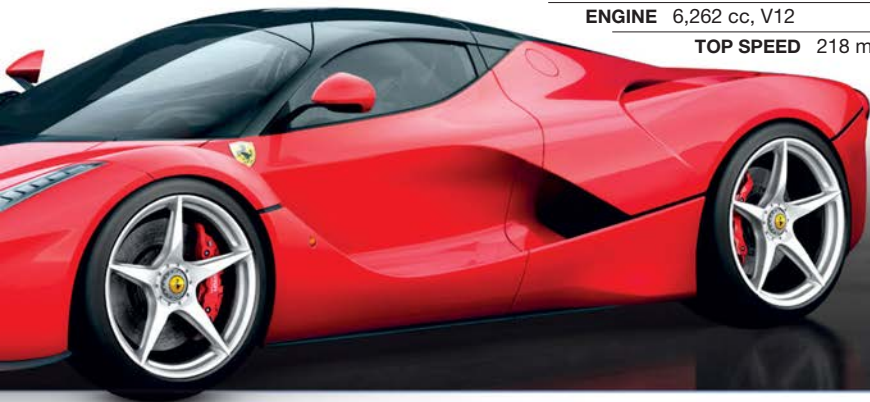


**YEAR** 2013

**ORIGIN** Italy

**ENGINE** 6,262 cc, V12

**TOP SPEED** 218 mph (350 kph)



# Record breakers

The first land speed record—the highest speed by a vehicle on land—was set in 1898 by Count Gaston de Chasseloup-Laubat, who drove 0.6 miles (1 km) in 57 seconds, in an electric motor-powered vehicle. Modern-day record breakers use rocket or jet engines.

## Blue Flame



Driven by American race car driver Gary Gabelich, the rocket-powered Blue Flame achieved a world land speed record on the Bonneville Salt Flats in Utah on October 23, 1970. This record remained unbroken until October 1983.

**YEAR** 1970

**ORIGIN** USA

**SPEED** 630.4 mph (1,015 kph)

**LENGTH** 37 ft 5 in (11.4 m)

## Thrust2

After Thrust1 crashed in 1977, its driver Richard Noble improved the design and went on to build, and pilot, Thrust2. On October 4, 1983, Thrust2 broke Blue Flame's world land speed record. It was powered by a single Rolls-Royce Avon turbojet engine.

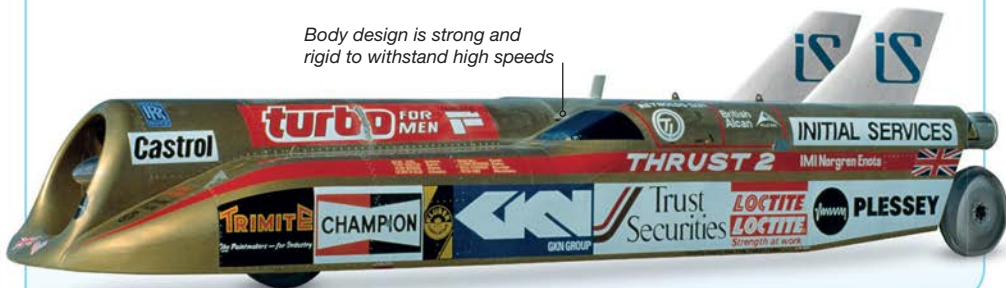
**YEAR** 1983

**ORIGIN** UK

**SPEED** 633.5 mph (1,019.4 kph)

**LENGTH** 27 ft 3 in (8.3 m)

*Body design is strong and rigid to withstand high speeds*



## ThrustSSC

ThrustSSC was the first supersonic car—one designed to be faster than the speed of sound. On October 15, 1997, it became the first car officially to break the sound barrier, and currently holds the world land speed record.

---

**YEAR** 1997

---

**ORIGIN** UK

---

**SPEED** 763.04 mph (1,227.98 kph)

---

**LENGTH** 54 ft (16.5 m)



ThrustSSC's two engines burn nearly 5 gallons (18 liters) of fuel per second.



## Bloodhound SSC

Bloodhound SSC is a supersonic car currently being developed with the goal of beating the current land speed record. This pencil-shaped car is powered by a jet engine and a rocket.

---

**YEAR** 2014

---

**ORIGIN** UK

---

**SPEED** About 1,000 mph  
(1,600 kph)

---

**LENGTH** 44 ft (13.5 m)





## FOCUS ON... DIVERSITY

Various types of vehicle are specifically built to be amphibious, while some are modified for such use.



▲ Amphibious buses are used for city sightseeing trips, carrying tourists on both roads and rivers.



▲ Amphibious boats can be used for tourism in places where there is a need to cross both land and water.



▲ Armored amphibious military tanks are used for defense and patrol work.

# Amphibious cars

Amphibious cars can travel both on land and on or even under water. Most land vehicles can be adapted for driving on water by fitting them with a waterproof body. Some use propellers to move forward, while others use high-powered water jets.

## Amphicar Model 770

The Amphicar was the first amphibious car to be mass produced. A pair of propellers were mounted under the rear bumper to push it through water. This car steered with its front wheels not just on land, but even in water.

**YEAR** 1961

**ORIGIN** Germany

**ENGINE** 1,147 cc, straight-four

**TOP SPEED** Land: 70 mph  
(110 kph); Water: 7 mph (11 kph)



In 1965, four Englishmen crossed the English Channel in two Amphicars in just seven hours.





## Gibbs Aquada

Once the Gibbs Aquada enters the water, its wheels retract, its road lights change to water lights, and a powerful jet is started to push it through the water. The entire process takes only four seconds. This three-seater car has no doors, which helps to prevent leaks.

**YEAR** 2003

**ORIGIN** New Zealand

**ENGINE** 2,500 cc, V6

**TOP SPEED** Land: 100 mph (161 kph);  
Water: 35 mph (56 kph)



## WaterCar Python

In 2010, the WaterCar Python became the fastest amphibious vehicle in the world. However, it never went into production. Watercar has now built the Panther, an amphibious SUV with specifications similar to that of the Python.

**YEAR** 2009

**ORIGIN** USA

**ENGINE** 2,997 cc, V6

**TOP SPEED** Land: 125 mph (201 kph);  
Water: 60 mph (97 kph)



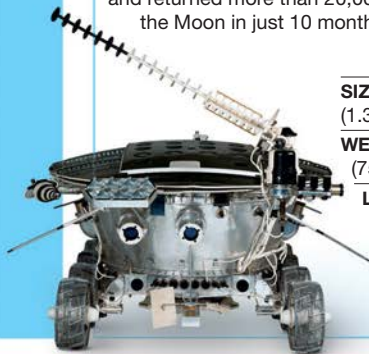
# Cars in space

Scientists have developed special machines that have been driven on the surface of the Moon and Mars. Most of these vehicles, called rovers, are operated remotely from Earth and send back scientific data for scientists to study.

## Lunokhod 1



This was one of two rovers built and sent to the Moon by the Soviet Union (a group of states that included modern-day Russia). It was controlled by radio signals from Earth and returned more than 20,000 images from the Moon in just 10 months.



**SIZE** 4 ft 6 in  
(1.35 m) tall

**WEIGHT** 1,665 lb  
(756 kg)

**LAUNCH DATE**  
November  
10, 1970

## Lunar Roving Vehicle



The first rover to be driven on the Moon (rather than being controlled remotely) was a battery-powered vehicle that could carry two astronauts and their equipment. It traveled at a top speed of 11.5 mph (18.5 kph). Three such rovers were built, one for each of the last three missions to the Moon.

**SIZE** 10 ft (3 m) long

**WEIGHT** 465 lb (210 kg)

**LAUNCH DATE**

First launched with  
*Apollo 15* on July 26, 1971

## Sojourner

The first rover to be operated on another planet, *Sojourner* was powered by solar panels arranged on its top and could travel at the speed of  $\frac{1}{2}$  in (1 cm) per second. It sent back information about the chemical makeup of the rocks on Mars, and the wind and weather conditions there.

**SIZE** 25½ in (65 cm) long

**WEIGHT** 23 lb (10.6 kg)

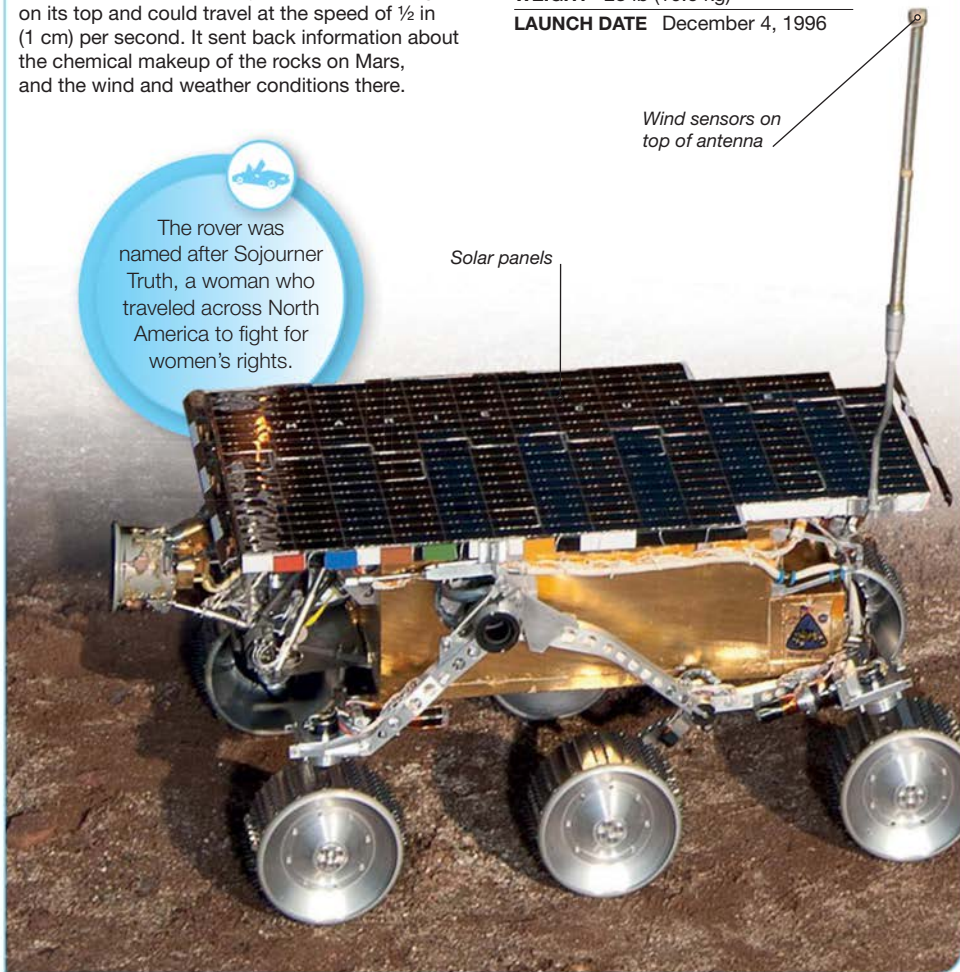
**LAUNCH DATE** December 4, 1996



The rover was named after Sojourner Truth, a woman who traveled across North America to fight for women's rights.

Solar panels

Wind sensors on top of antenna



## Opportunity



In 2003, NASA sent two identical rovers—*Opportunity* and *Spirit*—to Mars with the goal of collecting and studying the Martian soil for signs of life. Both rovers could travel at a maximum speed of 2 in (50 mm) per second. Communication from *Spirit* ended in 2010, but *Opportunity* continues to send back data.

**SIZE** 5 ft 4 in (1.6 m) long

**WEIGHT** 385 lb (174 kg)

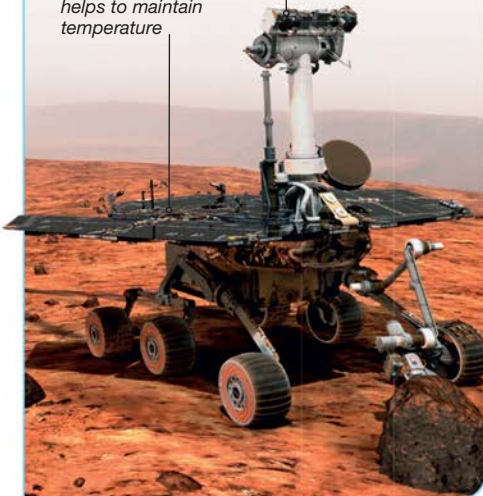
**LAUNCH DATE** July 7, 2003



The spacecraft that carried *Curiosity* to Mars took 253 days to cover the 352 million miles (566 million km) between Earth and Mars.

Gold-painted body helps to maintain temperature

Camera on top of mast can rotate 360 degrees





## Curiosity



This six-wheeled rover is about the same size as a small SUV. It carries equipment that can collect and analyze rock and soil samples. *Curiosity* is designed to drive over obstacles up to 25 in (65 cm) high and can travel about 660 ft (200 m) every day. It has a top speed of 1½ in (4 cm) per second.

---

**SIZE** 10 ft (3 m) long

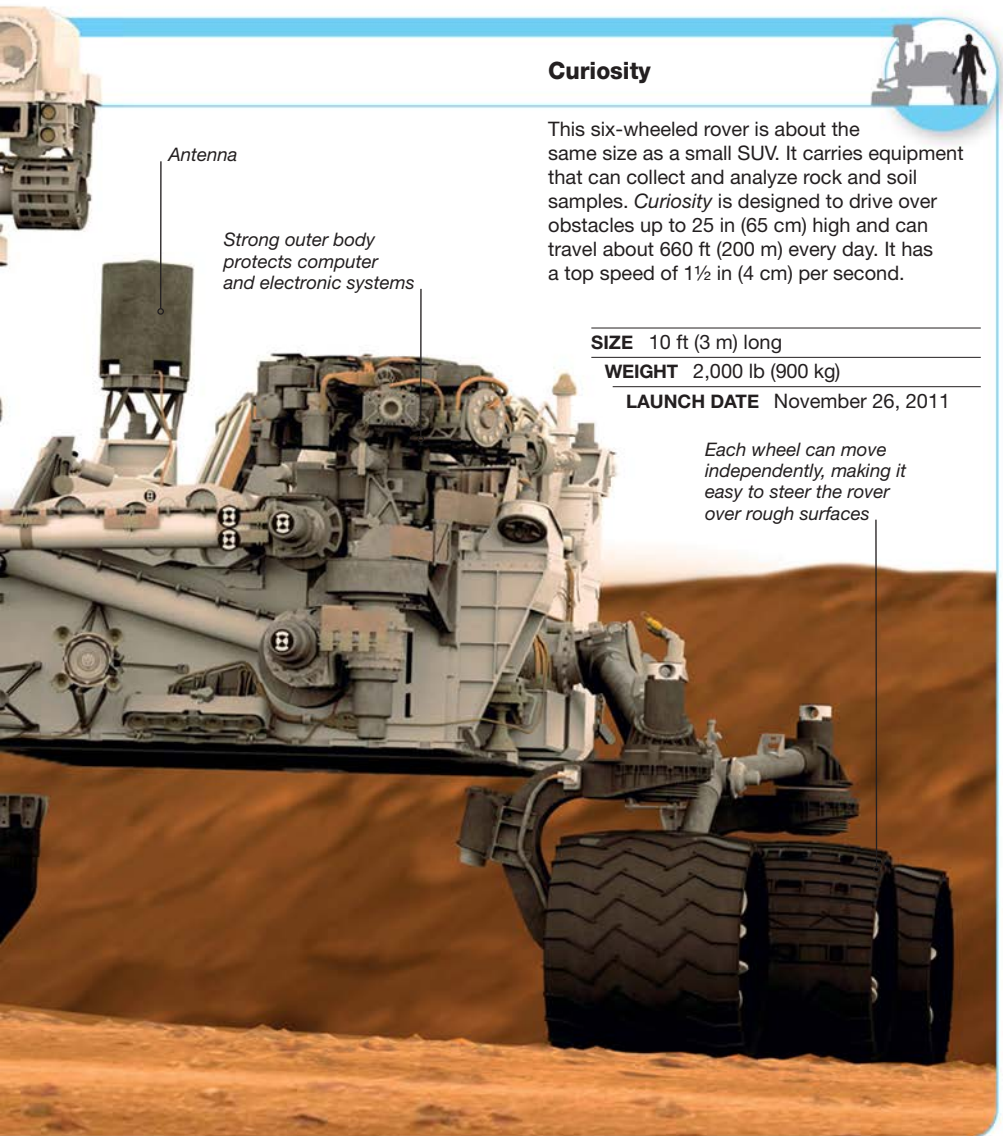
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**WEIGHT** 2,000 lb (900 kg)

---

**LAUNCH DATE** November 26, 2011

*Each wheel can move independently, making it easy to steer the rover over rough surfaces.*



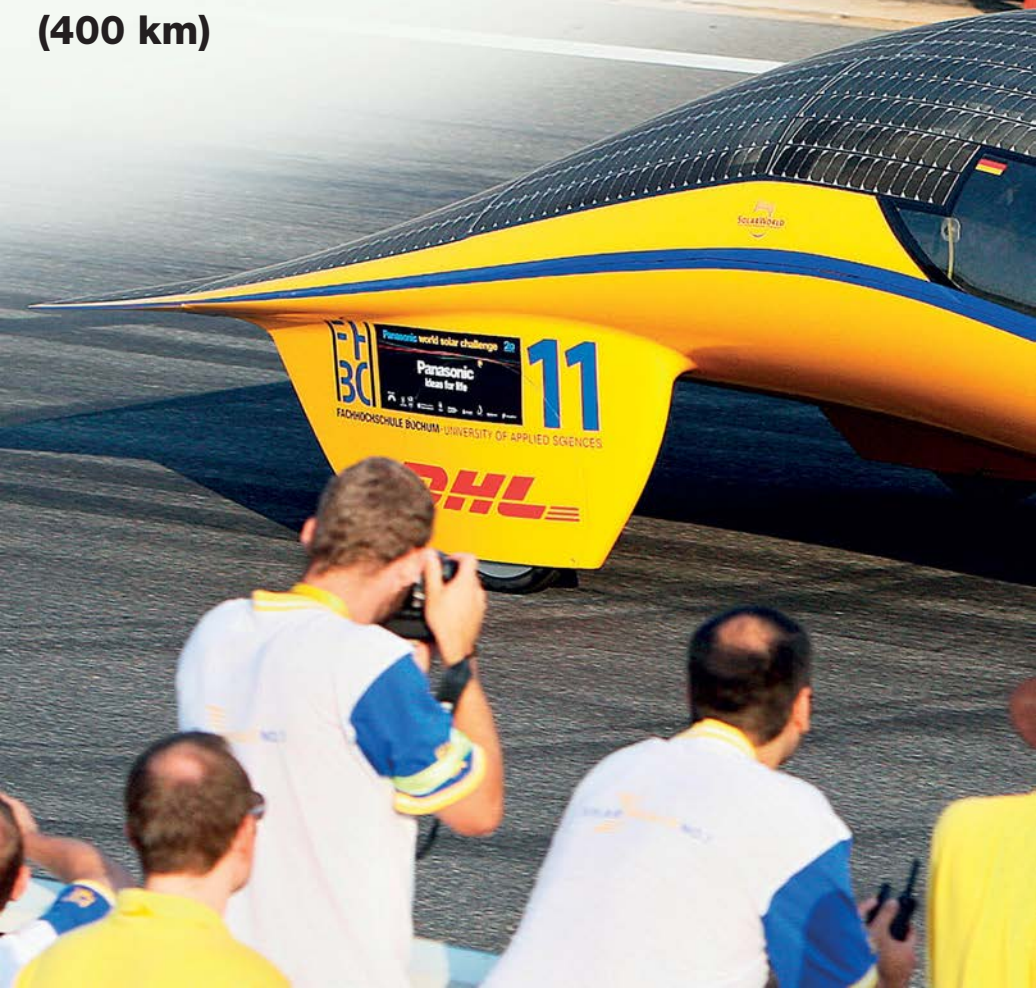
Antenna

Strong outer body  
protects computer  
and electronic systems

A fully charged battery can  
power a solar car for up to

# 250 miles

(400 km)



**SOLAR-POWERED CARS**

Some modern cars are powered by solar energy (energy from the Sun). These cars are covered in solar panels, which absorb and convert the Sun's energy into electricity. Some solar cars, such as the Solarworld No. 1 (shown here), are built to take part in races.





# Concept cars

A car created to feature an unusual new design or exciting technology is called a concept car. Concept cars are usually shown at major car shows to test new ideas and attract attention. They are one-of-a-kind models that may or may not be built for sale.



**Volvo YCC**

*Special paint does not allow dirt to cling on easily*

*Gull-wing door*

The YCC (Your Concept Car) is the first concept car to be designed by an all-female team. The front is lower and the rear slants back more than a typical Volvo, allowing the driver to see all four corners of the car. Other features include run-flat tires that last for a safe distance even after a puncture.

---

**YEAR** 2004

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**ORIGIN** Sweden

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**TOP SPEED** Not stated



## Mercedes-Benz F700

This large sedan is powered by a new DiesOtto engine, which combines the fuel efficiency of a diesel engine with the low emissions of a gas engine. The vehicle has two laser scanners to detect uneven surfaces, allowing the car to adjust for a smoother ride.

**YEAR** 2008

**ORIGIN**  
Germany

**TOP SPEED**  
125 mph  
(200 kph)



## Mercedes-Benz F-Cell Roadster

Inspired by the 1886 Mercedes-Benz Motorwagen, this concept car's design resembles that of a horseless carriage. This hydrogen-electric hybrid produces no harmful emissions. Other features include a joystick instead of a steering wheel, and big spoked wheels with thin, solid rubber rims.

**YEAR** 2009

**ORIGIN** Germany

**TOP SPEED**  
15 mph (25 kph)



## Cadillac Urban Luxury Concept



The Urban Luxury can seat four people despite its compact size—it is just 151 in (384 cm) long and 57 in (145 cm) tall.

Instead of the usual gauges, this gas-electric hybrid has touchpad screens, which can also be controlled using a voice recognition system.

---

**YEAR** 2010

---

**ORIGIN** USA

---

**TOP SPEED** Not stated

## Volvo Air Motion Concept

Designed to weigh less than 1,000 lb (454 kg), this car has a simple design with fewer and lighter body parts than other cars. Instead of an internal combustion engine, it is powered by compressed air motors, which further reduces the weight.

---

**YEAR** 2010

---

**ORIGIN** Sweden

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**TOP SPEED** Not stated



## Mercedes-Benz Biome

With the help of special hybrid technology, the Biome releases oxygen instead of carbon dioxide. The car's body is made of a material called BioFibre, which is grown in a laboratory.

---

**YEAR** 2010

---

**ORIGIN** Germany

---

**TOP SPEED** Not stated



## Jaguar C-X75

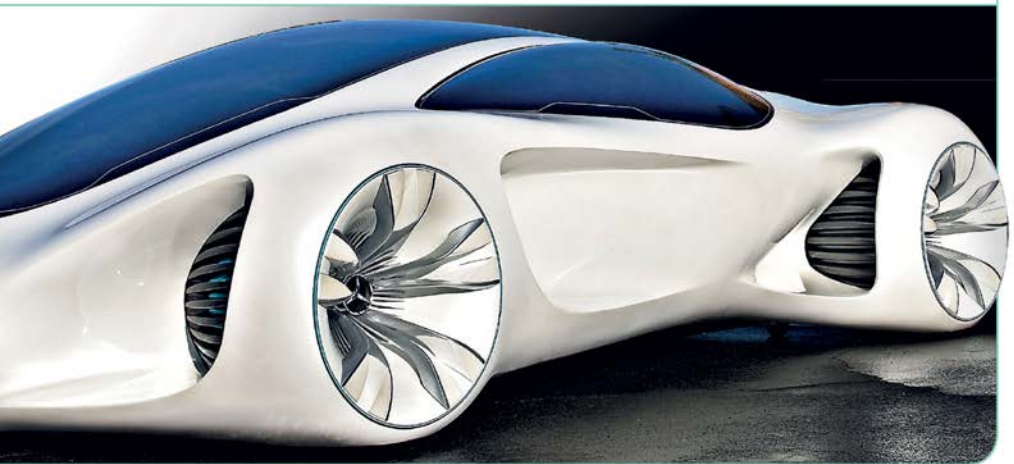
This two-seater supercar has four electric motors, each turning one wheel. The electric motors are powered by a gas turbine instead of a conventional piston engine. In 2011, Jaguar announced production of the C-X75 in collaboration with the Williams F1 racing team. However, production was canceled in 2012.

**YEAR** 2010

**ORIGIN** UK

**TOP SPEED** 205 mph (330 kph)

*Aluminum body, with  
a carbon-fiber chassis*



## BMW i8 Concept

The futuristic BMW i8 is powered by a gas engine and an electric motor. The interior of this eco-friendly car is made up mainly of recycled material. Instead of LED headlights, it uses new laser technology that is a thousand times more powerful.

---

**YEAR** 2011

---

**ORIGIN** Germany

---

**TOP SPEED**

155 mph (250 kph)

*Butterfly doors  
open up and out*



## Jaguar C-X16

This is the smallest Jaguar since 1954. Its gas engine and electric motor can be used independently or together. A button on the steering wheel allows the driver to boost the engine's performance with the electric motor.

---

**YEAR** 2011

---

**ORIGIN** UK

---

**TOP SPEED** 186 mph (300 kph)





## Audi Urban Concept

This ultralight two-seater concept car has a carbon fiber body, weighing just under 1,100 lb (500 kg). The driver can adjust the steering wheel and pedals to his own body measurements in this narrow car. Despite the size, the Urban Concept also has a small, drawerlike luggage compartment.

**YEAR** 2011

**ORIGIN** Germany

**TOP SPEED** 62 mph (100 kph)

*Protective mudguards on wheels, which stand away from chassis*

*Driver's seat is placed 12 in (30 cm) ahead of the passenger's seat to give more elbow and shoulder room*



## Toyota Fun-Vii Concept

This car's exterior and interior color and design can be changed to suit the driver's mood. The Fun-Vii also has a pop-up avatar projected from the dashboard to help the driver understand the car's futuristic features. The car seats three people.

*LED-screen exterior can be used as a display, with changing wallpapers.*

**YEAR** 2011

**ORIGIN**  
Japan

**TOP SPEED**  
Not stated



## Lexus LF-LC

The Lexus Future-Luxury Coupé features an enormous front grille and day-running headlights—each shaped like an “L.” The car is also equipped with a race car-inspired steering wheel and touchscreens for controlling the windows and adjusting the seats.

**YEAR** 2012

**ORIGIN** Japan

**TOP SPEED** Not stated



## Audi Sport Quattro Concept

Designed to celebrate the 30th anniversary of the first Audi Sport Quattro model, this sporty concept car's body is mostly made up of carbon fiber, while the doors are aluminum.

**YEAR** 2013

**ORIGIN** Germany

**TOP SPEED** 190 mph (305 kph)



## Toyota i-Road

The three-wheeled, electric-powered i-Road can seat two people, one behind the other. It has a meter that calculates how much the driver is leaning when taking a turn, and limits the angle of the turn. This ensures the car never tips over. The steering wheel vibrates to let the driver know when the car is tilting at its maximum angle.

**YEAR** 2013

**ORIGIN** Japan

**TOP SPEED** 37 mph  
(60 kph)



# Fun cars

Some cars are truly unique, with very unusual designs. While many of these cars are modified for fun, or specially built by companies for promoting their goods, a few are based on the designer's own ideas about what a car is and what it could do.



## Dusty Dave the Dolphin

Dusty Dave is an adapted 1972 Volkswagen Beetle. Its exterior was modified by sculptor Tom Kennedy so that it looked like a dolphin. Its mouth is hinged to open.

---

**YEAR** 1996

---

**ORIGIN** USA

---

**DESIGNED BY**

Penny Smith and  
Harry Leverette

## Ford 1932 Hot Rod



This Ford 1932 Model B has been redesigned more recently as a hot rod car, with its hood removed to show off the engine. A hot rod is fitted with a modified, powerful engine and is often painted in bright colors that add to its appeal.

---

**YEAR** 1932

---

**ORIGIN** USA

---

**DESIGNED BY**

Unknown



## Wienermobile



Shaped like a hot dog on a bun, the Wienermobile is used by the Oscar Mayer Company to advertise its products. The first Wienermobile was built in 1936, and six tour the US today. This 2004 model has gull-wing doors, a hot dog-shaped dashboard, and mustard- and ketchup-colored seats. The drivers of these cars are called "hotdoggers."

---

**YEAR** 2004

---

**ORIGIN** USA

---

**DESIGNED BY**  
Prototype Source

## Wenzhou shoe car

Built by a shoe company to promote its brand, this shoe-shaped electric car is made of the same leather the company uses for its footwear. It took six months to construct this car, which is 10 ft (3 m) long and 3 ft (1 m) high.

---

**YEAR** 2011

---

**ORIGIN** China

---

**DESIGNED BY** Kang Shoe Company



## Wind-powered car

This wind-powered car runs on two sets of generators and batteries that are connected to a fan in the front. As the car moves, the fan spins, producing electricity for the vehicle. Solar panels at the back also help generate electricity.

---

**YEAR** 2012

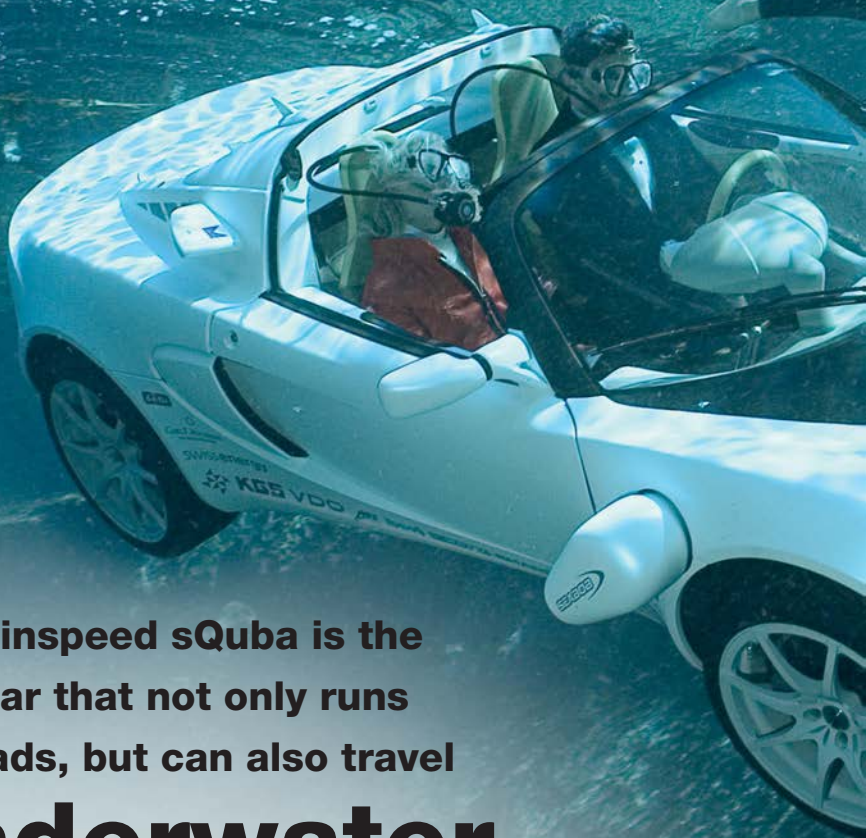
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**ORIGIN** China

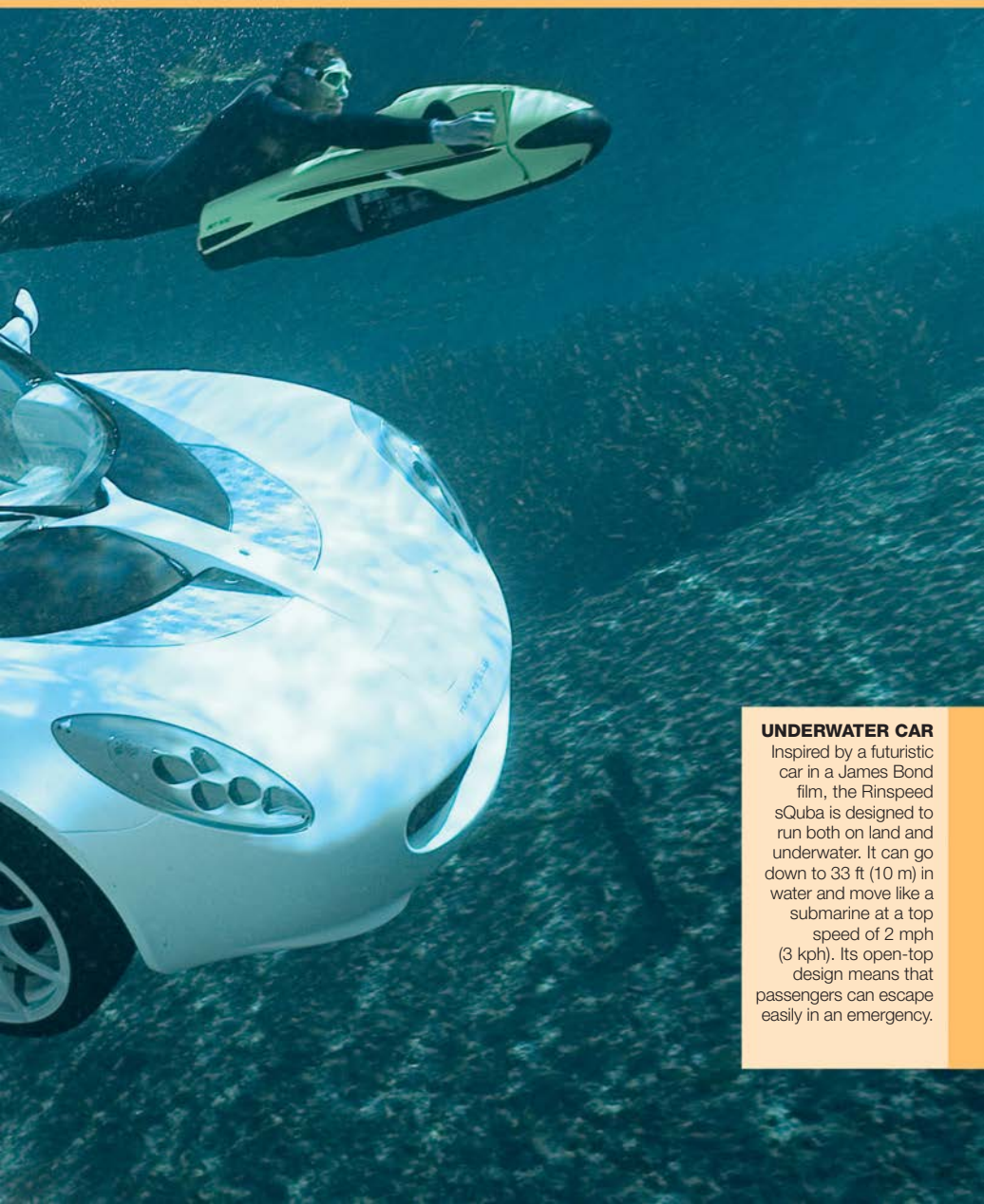
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**DESIGNED BY** Tang Zhenping





The Rinspeed sQuba is the first car that not only runs on roads, but can also travel **underwater**

**UNDERWATER CAR**

Inspired by a futuristic car in a James Bond film, the Rinspeed sQuba is designed to run both on land and underwater. It can go down to 33 ft (10 m) in water and move like a submarine at a top speed of 2 mph (3 kph). Its open-top design means that passengers can escape easily in an emergency.

# All about cars

## ONCE UPON A TIME

- The first cars had **no steering wheels**: they were steered with a lever called a tiller.
- The first **accident** in a gas-powered car occurred in 1891, when the car swerved and crashed into a post. No one was hurt.
- The first **specially built car racetrack** was Brooklands in the UK, built in 1907.
- The first **car tires** were white.

- The 1904 Thomas Flyer, which had a removable hard top, is considered to be the first **convertible car**.
- The first **recorded speeding ticket** was issued in 1904 to Harry Myers, actor and director, for driving at 12 mph (19 kph).
- The first **electric traffic light**, with red and green signals, was invented in 1912 by American police officer Lester Wire. They were first installed on the streets of Cleveland, Ohio, in 1914.

## ACCESSORIES

- ★ The **gas gauge** first appeared as a standard feature in 1922.
- ★ **License plates** were first issued in France in 1893 by the police.
- ★ **Airbags** were invented by John Hetrick, an industrial engineering technician, in 1951.
- ★ **Air conditioning** was introduced in 1939 by Nash Motors. This ventilation system was called the “Weather Eye.”
- ★ A **rearview mirror** was first used in 1911 by Ray Harroun, a race car driver.

- ★ The first **car radio** was invented by the Galvin brothers, Paul and Joseph, in 1929.
- ★ **Electric windows** were first used in cars by the British car manufacturer Daimler in 1948.
- ★ The **windshield wiper** was invented by Mary Anderson in 1903.
- ★ The **three-point seatbelt**, which goes around the lap and over the shoulder, was first introduced in 1959 by Volvo.
- ★ A third **rear brake light**, mounted on the rear windshield, was invented in 1974 by US psychologist John Voevodsky.



## KNOW YOUR CAR

◆ The **dashboard** was originally a piece of wood attached to the front of a horse-drawn carriage. It prevented mud from splattering the driver.

◆ **Flat, asphalt roads** were originally requested by cyclists, not drivers.

◆ The most **recycled product** in the world today is the car: about 95 percent of retired cars are recycled every year.

◆ **When idle**, a car uses 1.6 fl oz (0.05 liters) of gas in one minute.

◆ Toyota has said that an **average car is made up of** 30,000 parts and 3,000 ft (915 m) of electrical wire.

◆ Car manufacturers now place a small arrow next to the **fuel level icon** on the dashboard to show drivers which side of the car the fuel tank is on.

◆ An **out-of-range car remote** can be pressed 256 times before it stops working.

◆ If a car could be driven straight upward at 60 mph (100 kph), it would take about six months to **reach the Moon**.

◆ **One in four cars** are now manufactured in China.

◆ An **airbag inflates** within 40 milliseconds of a crash.

◆ Many cars can be driven for up to 60 miles (100 km) after the fuel tank is empty—this is called the **buffer zone**.

◆ Around **60 million cars** are produced each year—that's about 165,000 cars a day.



Currently, more than 1 billion cars are in use around the world.

◆ Leonardo da Vinci made **drawings for a self-propelled vehicle** in the 1400s—at least 400 years before the car was invented.

◆ On average, it takes **25 hours to build** a car, 10 of which are spent painting it.

◆ The **onboard computer** system in a standard modern car is more powerful than the ones that were used to send astronauts to the Moon in the 1960s and 1970s.

◆ If a car is **struck by lightning**, the passengers inside will usually be safe: the electricity is deflected around the car's metal frame.

## RECORD BREAKERS

- ▶ The world's **heaviest limousine** is the *Midnight Rider*. It weighs more than 50,000 lb (22,680 kg) and has space for up to 40 people across a number of “rooms.”
- ▶ The **least amount of time** taken to remove a car engine and replace it with a new one is 42 seconds. The car used was a Ford Escort.
- ▶ The world's **lowest street-legal car**—the *Flatmobile* built by Perry Watkins—is just 19 in (48 cm) high.
- ▶ **The longest limousine** is the 100-ft- (30.5-m-) long *American Dream*. It has 26 wheels and is hinged in the middle for turning corners.
- ▶ **The smallest roadworthy car** is the *Wind Up*, which measures 41 in (104 cm) high, 26 in (66 cm) wide, and 52 in (132 cm) long. It was built by Perry Watkins.
- ▶ The **longest jump by a monster truck** off a ramp is 237 ft 8 in (72.4 m). It was achieved by the American Joe Sylvester in his *Bad Habit* monster truck in 2013.

## WONDERFUL CARS

- ★ The Volkswagen Beetle is the **best-selling car** of all time. A total of 21.5 million Beetles were sold from 1938 to 2003.
- ★ In 1916, **55 percent** of the world's cars were Ford Model Ts—a record that has never been beaten.
- ★ The **first car built** in the US was the Duryea, of which only one still exists today.
- ★ **More than 1 million** Chevrolet Impalas were sold in 1965, a record for a single year.
- ★ The world's **oldest running car**, a steam-powered model built in 1884 for Count De Dion in France, sold for \$4.6 million in 2011.
- ★ The **Ford GT** is so strong that during its “roof crush” test it broke the machine.
- ★ The *Car-puccino* **runs on coffee**, converting used coffee grounds to flammable gas.
- ★ Volkswagen has **named several cars after winds**—“Passat,” a German word for the trade winds; “Polo,” after the polar winds; and “Bora,” from the Bora winds.



## FORMULA 1

- While standard car engines can last for more than 10 years, F1 **car engines** last for only about two hours of racing.

- An F1 car **can accelerate** from 0–160 mph (0–258 kph) and decelerate back to zero within just four seconds.

- F1 **drivers** lose up to 9 lb (4 kg) of their body weight in just two hours of racing.

- The force an F1 driver feels when they **brake** their car is comparable to how it would feel to drive through a brick wall at a speed of 186 mph (300 kph).

- An F1 car is made up of **80,000 parts**.

- **Racing tires** last for only 56–75 miles (90–120 km), while standard car tires can last for 37,300–62,140 miles (60,000–100,000 km).

- The **tires** of most F1 cars are filled with nitrogen, as it has a more consistent pressure than normal air.

- An F1 driver **changes gears** 2,500–4,000 times during a race.

- **Pit stop crews** in F1 races take an average of three seconds to refuel and change tires.

## AROUND THE WORLD

- ▶ One **Hong Kong** businessman recently placed an order for 30 Rolls-Royce cars, the single largest order for this car ever made.

- ▶ In **Japan**, drivers above 75 years of age have to mark the rear of their cars with the “Koreisha” symbol (elderly car mark).

- ▶ In **China**, you can pay to have someone drive your car through a traffic jam, while you are whisked away on a motorcycle.

- ▶ In **Albania**, 80 percent of registered cars are Mercedes-Benz.

- ▶ One of the longest recorded traffic jams, in **France** in 1980, stretched 110 miles (177 km).

- ▶ In the **US**, a driver spends an average of 38 hours a year waiting at red lights.

- ▶ The Kea, a bird native to **New Zealand**, is notorious for eating the strips of rubber from around car windows.

- ▶ In **Cyprus**, it is illegal to eat or drink anything while driving.

- ▶ In 1898, police in **New York City** used bicycles to pursue speeding drivers.

# Glossary

**Accelerate** To speed up and go faster.

**Aerodynamics** The science of designing something to have a lower air resistance so it can move smoothly through the air. This makes it more efficient because it uses less energy and saves fuel.

**Airbag** A safety device usually packed in the center of the steering wheel and in the dashboard in front of the passenger seat. An airbag quickly inflates with air during a crash, cushioning a car's occupants from the impact.

**Amphibious car** A car that can operate on land and on water.

**Axle** The shaft (or rod) that car wheels turn on. The axle transmits power to the wheels and makes them turn.

**Battery** A store of chemicals that produce electricity when connected to a circuit.

**Bumper** A bar of metal, plastic, or rubber that is attached to the back and front of a car to protect it in the event of a collision.

**cc (cubic centimeters)** This is a measurement of the capacity, or space, inside all the cylinders of an engine. A larger cc usually means a more powerful engine.

**Chassis** The basic frame of a vehicle, upon which the engine and main body are mounted.

**Clutch** A device operated by a pedal that allows the driver to change gears. The clutch is operated by the driver's left foot.

**Concept car** A vehicle that is built to show new designs or technologies.

**Convertible** A car with a roof that can be folded back or removed.

**Coupe** A two-door car with a fixed roof that slopes down to the rear.

**Crankshaft** In an engine, the crankshaft is a rod that is turned by the power of the pistons pumping up and down. The crankshaft changes this up-and-down motion into a rotating motion that turns the car's wheels.

**Crash test dummy** A full-scale model of a person, used to test the safety of road vehicles in simulated collisions.

**Crumple zone** The area on a vehicle that absorbs force during a collision, helping to protect the occupants from injury.

**Dashboard** A panel inside the vehicle, below the windshield, that contains indicator dials (i.e., a speedometer), storage compartments, and controls.

**Diesel** A type of liquid fuel, made from oil. Diesel is used to power many trucks and some cars.

**Disk brake** A brake that reduces the speed of a car by using friction to slow down the wheels.

**Drag racing** A type of car race where two or more cars accelerate from a standing start and race for a fixed distance in a straight line.

**Electric car** A car with an engine powered solely by electricity.

**Force** A push or a pull action that can make things change direction, speed up, slow down, and even change shape.

**Formula 1 (F1)** A worldwide racing championship that uses extremely fast, single-seat racing cars built to strict rules (the "formula"). Races take place on tracks over many laps.

**Four-stroke cycle** The most common type of engine. Each piston in the engine works in four stages, or strokes: intake (taking in a mixture of air and gas), compression (squeezing the mixture), explosion (a spark ignites the mixture, which explodes and pushes the piston down), and exhaust (the spent mixture leaves the piston).

**Four-wheel drive** A system in which power from a vehicle's engine is sent to all four wheels.

**Front-wheel drive** A system in which power from a vehicle's engine is sent to the front wheels only.

**Gasoline** A liquid fuel used to power most of the cars on our roads. Gasoline is made from crude oil or gaseum, which is found deep under the Earth.

**Gearbox** The part of a vehicle that contains the gears.

**Gears** Toothed wheels that lock together. Gears are used to change the speed or force with which a car's wheels turn.

**Gear stick** A rod located by the driver's seat that is used in conjunction with the clutch to change gears.



**Go-kart** A small, low-slung motor vehicle with an exposed frame, often used for racing.

**Grand tourer (GT)** A high-performance, luxury car, able to make long journeys at high speeds in style and comfort.

**Hatchback** A car with a rear door that opens upward, revealing the trunk area.

**Horsepower (hp)** A unit of power. It is used to measure the power of a vehicle's engine. The term was invented more than 200 years ago to compare the amount of work a steam engine could do compared to a horse.

**Hybrid** A vehicle that uses two or more different power sources, such as gas and electricity.

**Internal combustion engine** An engine that burns fuel inside one or more cylinders, rather than in an exterior furnace. Most vehicles are powered by internal combustion engines.

**Jet propelled car** A car that is powered by a jet engine.

**LED (light emitting diode)** An LED is a small but bright light that is very energy efficient.

**Limousine** A long, luxury car, often with a partition that separates the driver from the passenger compartment.

**Microcar** The smallest type of car. A microcar has little internal space, a weak engine, and sometimes only three wheels.

**Moose test** A test that measures how well a car is able to avoid a sudden obstacle.

**Minivan** An minivan is a large vehicle able to carry up to eight passengers. They are also known as multipurpose vehicles.

**Pickup truck** A small truck with one bank of seats and a large, flat cargo area at the back.

**Pit stop** When a car leaves the track for repairs and refueling during a car race.

**Production car** A car that is mass-produced and sold to the general public.

**Rallying** A type of motorsport in which adapted production cars are driven over public roads or across rough terrain against a set time.

**Roadster** A sporty, open-topped car.

**Running board** A narrow platform attached to the sides of a vehicle that is used to climb in or out. Running boards were common on early cars, but are no longer used.

**Sedan** A four-door car for four or more people that has an enclosed trunk.

**Solar car** A car powered by the Sun's energy.

**Speedometer** A dial on the dashboard that shows the driver how fast the vehicle is moving.

**Spoiler** A small wing mounted on the back of a car to reduce lift at high speeds, which helps the car to grip the road better.

**Standing start** Some motorsports have a standing start, where cars are stationary at the beginning of the race.

**Station wagon** A car with an extended roofline. It has a floor to roof trunk space.

**Steering wheel** A wheel that the driver turns to change the direction of the front wheels. It is mounted on the dashboard.

**Stock car racing** A type of motorsport in which production cars are driven around an oval racetrack for a set number of laps.

**Sunroof** A panel in a car's roof that can be opened.

**Supercar** An expensive, high-performance car. Supercars have powerful engines.

**Suspension** A system of springs and shock absorbers that help a vehicle travel more smoothly over bumps in a road's surface.

**SUV (sport utility vehicle)** A rugged vehicle designed for off-road use, but often used on normal roads in urban areas.

**Trunk** A small, self-contained space, usually at the rear of a car, used for carrying goods such as luggage.

**Turbocharged** A turbocharged car is equipped with a turbocharger, which increases the engine's power.

**VIN (vehicle identification number)** A VIN is a unique code used to identify every individual vehicle.

**Wind tunnel** A large, tubelike passage with a huge fan at one end that is used to test the aerodynamics of cars and other objects.

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# Acknowledgments

Dorling Kindersley would like to thank: Annabel Blackledge for proofreading; Helen Peters for indexing; and Fleur Star for editorial assistance.

The publishers would also like to thank the following for their kind permission to reproduce their photographs:

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