

# 3D PRINTING IN THE AUTOMOTIVE SECTOR

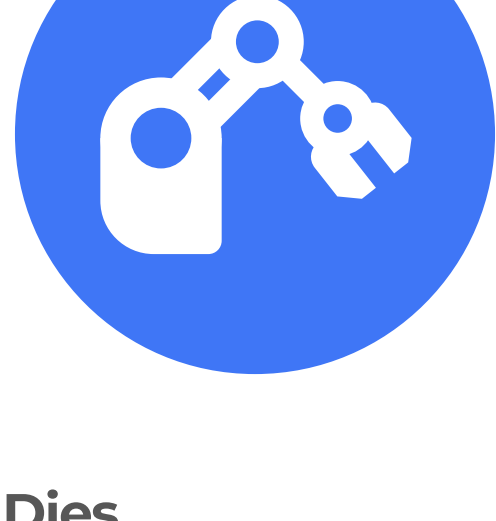
2022

## AUTOMOTIVE 3D PRINTING APPLICATIONS



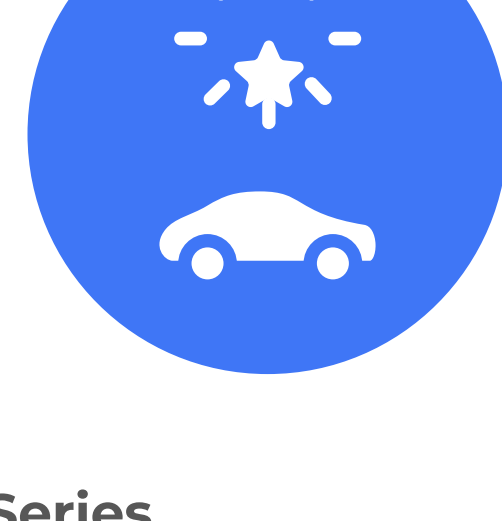
### Prototyping

Thanks to 3D printing, we can produce testable parts with an easily-changeable design.



### Tools & Dies

3D-printed tools and dies in the automotive industry - for example, holding devices to secure parts on the conveyor belt - bring significant cost and time savings.



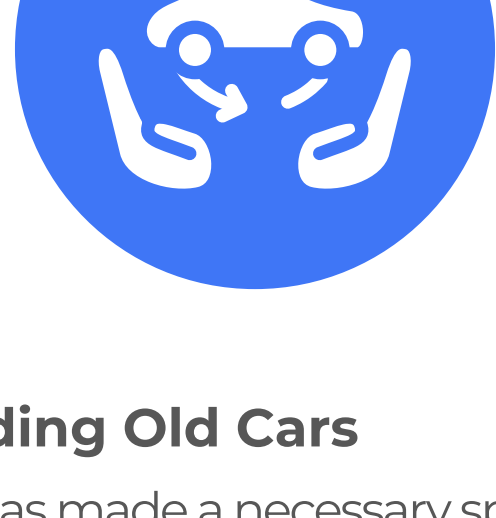
### Small Series

Especially for complex small series, 3D printing brings immense opportunities for manufacturers. It is suitable for brake calipers, for example.



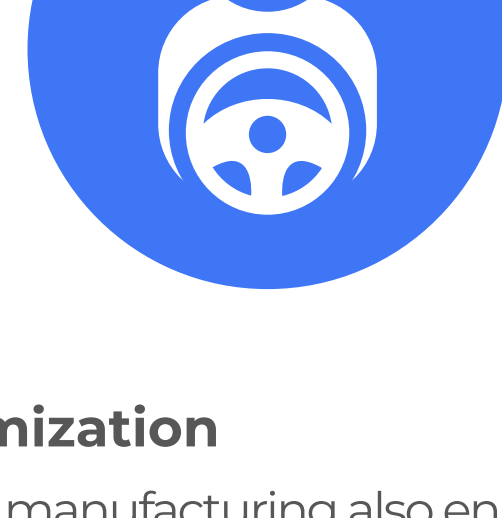
### Mass Production

U.S. car manufacturer Ford is already mass-producing key automotive components thanks to metal binder jetting.



### Rebuilding Old Cars

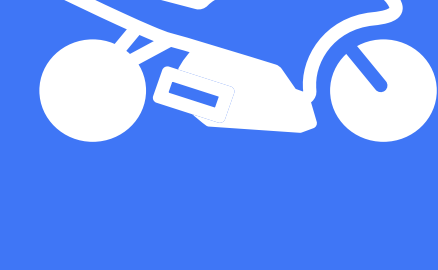
Sauber has made a necessary spare part for the Ferrari 340 America Barchetta using metal 3D printing.



### Customization

Additive manufacturing also enables greater customization at the design level, turning car models into memorable user experiences.

## WHERE IS ADDITIVE MANUFACTURING BEING USED IN THE AUTOMOTIVE SECTOR?



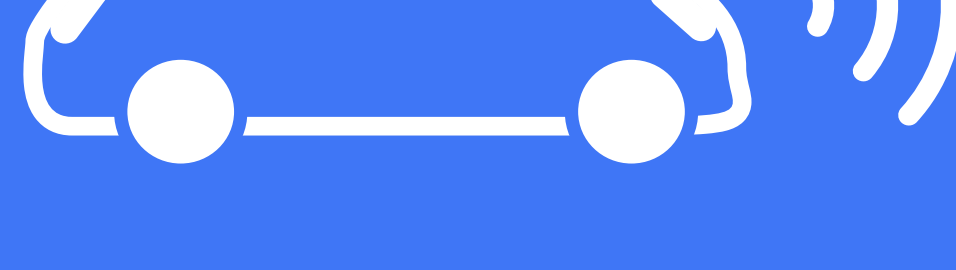
### MOTORCYCLES

ArcelorMittal worked with researchers at the University of Nebrija to use 3D printing to create a better frame for motorcycles that is much lighter than traditionally manufactured aluminum models, but has the same strength.



### PASSENGER CARS

AM already allows for the manufacture of entire chassis, such as in the case of McLaren, through the use of carbon fiber 3D printing.



### E-CARS/AUTONOMOUS VEHICLES

The world's first e-car made with the help of additive manufacturing is called Strati. The 3D printing of the car parts took only 44 hours, followed by 3 days of milling and assembling.



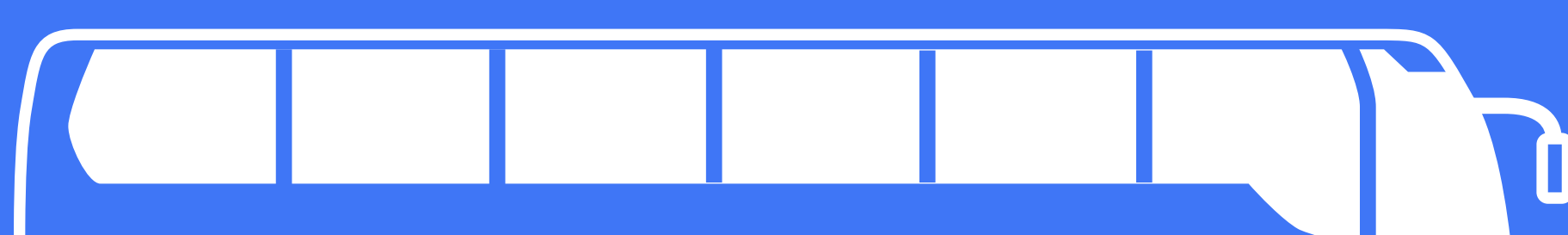
### FORMULA 1 RACECARS

McLaren entered into a collaboration with Stratasys that allows them to use additive manufacturing to create tens of thousands of parts using Stratasys' Neo800 3D printer. This has drastically reduced production times for some model parts.



### TRUCKS

For trucks, additive manufacturing is mainly used for the production of brake systems and pneumatic control systems. Power electronics can also be optimized.



### BUSES

Daimler offers its customers a comprehensive portfolio of services in the field of additive manufacturing, and supports them in the procurement and supply of parts. It also facilitates their entry into the digital transformation of their company.

## 3D PRINTED CAR PARTS

### PISTONS : 911 GT 2 RS PORSCHE

Using 3D printing, pistons can be produced with an optimized structure, providing more power and efficiency.

### HUBCAPS

Hubcaps can be made as prototypes using AM to optimize the design to ensure they can protect hubs and lug nuts with a reduced drag.

### MINI

Thanks to the MINI 'Yours Customized' project, MINI customers were able to, among other things, have their passenger-side cockpit sideband and side inserts personalized.

### TAIL LIGHT COVER : AUDI

Prototype tail light covers were able to be made with exact part geometries with no distortion and standard quality thanks to AM.

### ENGINE

In about 72 hours of printing, Toyota is able to bring together 80 individual 3D-printed parts to create its 4-cylinder 22R-E engine.

### STEERING WHEEL

Thanks to the use of polycarbonate 3D printing, Covestro's 3D-printed steering wheel can withstand heat all while still retaining its strength, toughness and shape.

### DOOR HANDLES

To make prototype door handles, Audi uses 3D printing in its pre-production center.

### CHASSIS : DIVERGENT BLADE

3D-printed aluminum alloys were used to create the chassis, making the vehicle 90% lighter and stronger.

### SPOILER CLOSEOUT SEAL : GM

General Motors used AM to produce 60,000 flexible spoiler closeout seals for the rear of their Tahoe SUV in just 5 weeks.

### CAR SEATS : OECHSLER

OECHSLER meets the strict quality standards for car seats while still ensuring functionality, seating comfort and customizability according to the type of vehicle.

## KEY FACTS & FIGURES ON 3D PRINTING IN THE AUTOMOTIVE INDUSTRY

**300,000 PARTS**

were produced by BMW in a year using additive processes.

(BMW GROUP)

**5 WEEKS**

were needed for General Motors to 3D print 60,000 parts.

(GENERAL MOTORS COMPANY)

**300**

industrial 3D printers are used by the VW Group.

(VW GROUP)

**94%**

of AM-using automakers plan to continue expanding its use.

(DABIL)

**\$12.4B**

will be the value of the automotive AM market by 2028.

(SMARTTECH PUBLISHING)

**40%**

weight reduction was achieved for the Bugatti Chiron Pur Sport thanks to the use of AM in the manufacturing of its brake calipers.

(BUGATTI)

**44 HOURS**

was the time needed to complete the first 3D-printed electric car.

(LOCAL MOTORS)

**80%**

of costs can be saved with the "design to cost" approach.

(FRAUNHOFER IAPT)

## TIMELINE

- 1980** S. Scott Crump develops the FDM process, which is instrumental in the automotive AM industry.
- 1991** BMW is the first car manufacturer to set up its additive manufacturing campus for the production of 3D prototypes and, from 2010, small series.
- 1998** The first Formula 1 team adopts an SLA 3D printer.
- 2010** The first 3D printed car chassis is presented at Chicago's International Manufacturing Technology.
- 2016** Creation of the first autonomous bus with 3D printed parts, Olli.
- 2019** The first 3D printed electric car, named YoYo and designed by Italian company XEV, is launched on the market.
- 2022** The 3,065-hp Ultracar achieves perfect performance using 3D printing.