

# 3D PRINTING IN THE DEFENSE SECTOR

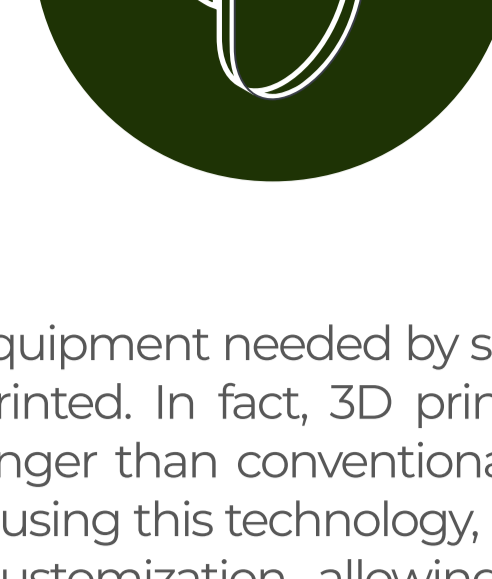
2024

## APPLICATIONS FOR 3D PRINTING IN DEFENSE



### Weapons

3D printing can be used to develop new weapons as well as to make existing weapon production cheaper and faster. Thanks to these technologies, the production cost is much lower and single units can be produced instead of mass production. In addition, production times are reduced, making it possible to create firearms in record time. 3D printing also covers fields such as the design and manufacture of other types of weapons like missiles.



### Equipment

Most of the equipment needed by soldiers on the battlefield can be 3D printed. In fact, 3D printed equipment can be better or stronger than conventional equipment. The main advantage of using this technology, in addition to speed and low cost, is customization, allowing soldiers to personalize their own equipment as they wish.



### Medical

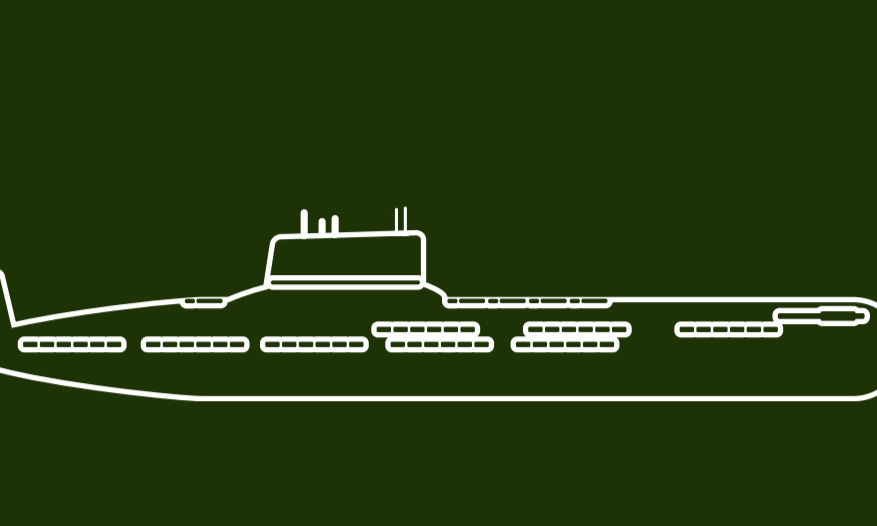
The number of applications of 3D printing in the medical sector in warfare is impressive. Currently, thanks to this type of technology, it is possible to manufacture custom-made tourniquets or prostheses for wounded soldiers. If these prostheses were created by traditional methods, they would take months to manufacture, whereas thanks to 3D printing they can be made in a matter of hours. In fact, it is even possible to print them on the battlefield itself.



### Vehicles

The applications of 3D printing in military vehicles cover a wide range of possibilities, from being able to create cheaper parts in less time, to creating obsolete parts for vehicles or developing new technologies. In fact, the applications cover a wide range of vehicles, from airplanes to cars to submarines.

## THE DIFFERENT 3D PRINTED VEHICLES IN THE DEFENSE SECTOR



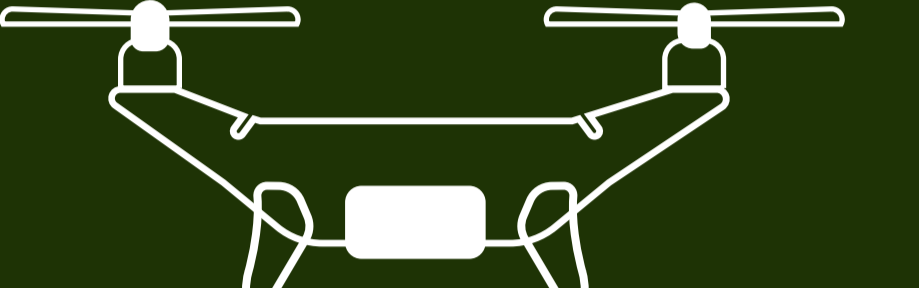
### ARMORED VEHICLES

3D printing is increasingly used to improve the performance of military vehicles. This technology reduces costs, production lead times and vehicle panels. Spare parts are already successfully being manufactured in the United States using this technology.



### SUBMARINES

Military forces at sea are embracing additive manufacturing, as evidenced by a collaborative project between Oak National Laboratory (ORNL) and the U.S. Navy's Disruptive Technology Laboratory. They have succeeded in manufacturing the first 3D printed submarine hull using FDM and carbon fiber-reinforced materials.



### SHIPS

The Naval Group uses 3D printing for warships. They have applied this technology by designing a fully 3D printed propeller for a minehunter ship. Using WAAM, they were able to overlap metal wires welded by an electric arc and a robotic arm, reducing manufacturing time and minimizing the amount of materials used.



### DRONES

3D printing improves drones, increasing their performance and flight time. In Ukraine, the military uses modified, 3D printed civilian drones to carry and drop small bombs. These drones have been adapted to carry Soviet VOG-17 fragmentation grenades.



### HELICOPTERS

The Spanish military uses 3D printing to create tools and final parts that can withstand demanding conditions. In Madrid, the air force's helicopter workshop systematically opts for additive manufacturing to meet the demand for parts.



### MILITARY AIRCRAFT

3D printing improves military air operations. At the 204th air base in Mérignac, in the Nouvelle-Aquitaine region of France, Atelier 13D uses the SmartFarm solution for smart manufacturing. It speeds up prototyping, creates spare parts to combat obsolescence and rapidly produces parts in small series.

## HOW IS 3D PRINTING USED ON THE BATTLEFIELD?

### HELMET

Helmets are an essential part of any soldier's equipment. Thanks to 3D printing technologies, in addition to the possibility of customizing them to each person, they can be made lighter so that the soldier carries less weight.

### LENSES/BINOCULARS

The creation of this type of equipment through 3D printing favors the creation and testing of prototypes for later use.

### BUTTSTOCK

The buttstock, or butt, of certain types of gun is essential for accuracy. That is why, thanks to 3D printing, this accessory can be customized, improving comfort and precision.

### SILENCER

The silencer is an accessory frequently used by soldiers. However it is expensive and slow to manufacture, but, these issues can be solved by creating them using 3D printing according to Silencer Central magazine.

### BODY ARMOR

The creation of bulletproof vests by 3D printing allows soldiers to create their own customized vests in record time. New designs are also being researched, such as one from ARL, which incorporates 3D printed materials such as ceramics.

### TRIPOD

The tripod of army firearms can be 3D printed. This way the manufacturing takes less time and the monetary expense is much less.

### BULLETS

For years it has been possible to manufacture bullets using AM. The designs are getting better and better and cover more and more types of ammunition as reported by Advanced Research Projects in 2016 after conducting the first tests with these printed projectiles.

## KEY FIGURES FOR 3D PRINTING IN DEFENSE

**\$1.7B**

The projected value of 3D printing in the defense sector by 2027.

(BASSETI)

**8 HOURS**

The time it takes Boeing to 3D print an aluminum joint for the main rotor of an Apache helicopter, compared to the approximately 1 year it would take using traditional technology.

(BOEING)

**\$300M**

The amount the U.S. Department of Defense planned to spend on additive manufacturing in 2023.

(ADDITIVE MANUFACTURING RESEARCH)

**5.8 KM/S**

A 3D printed bulletproof cube can withstand the impact of a bullet of this velocity without suffering any damage.

(RICE UNIVERSITY)

**36 HOURS**

How long it took U.S. Marines to 3D print a rocket launcher shelter.

(3DUNIVERSE)

**353 SQUARE METERS**

The size of the 3D printed barracks at the Camp Swift training center in Bastrop, Texas. It can hold up to 72 soldiers.

(U.S. DEPARTMENT OF DEFENSE)

## TIMELINE

- 2013** ● The US association "Defense Distributed" presents "Liberator", the first fully 3D printed gun. The gun's schematics were downloaded more than 100,000 times before being banned by the US authorities.
- 2014** ● UK-based BAE Systems successfully flies a Royal Air Force Tornado fighter-bomber using 3D printed components, including a protective cover for the cockpit radio and elements of the air intake system and landing gear.
- 2016** ● The Russian defense industry began using 3D printing to produce prototypes of components for its new T-14 tanks.
- 2017** ● The U.S. Army's Construction Engineering Research Laboratory (CERL) 3D printed its first concrete barracks in collaboration with NASA.
- 2019** ● The F-22 Raptor, the U.S. Air Force's most expensive fighter jet, makes a flight using 3D printed components.
- 2020** ● The French Army integrates 50 Ultimaker S5 FDM printers to reinforce its autonomy and equip the Bourges Military Schools.
- 2022** ● The U.S. Navy adopts 3D metal printing for selected warships (USS Bataan) to improve the self-sufficiency of deployed aircraft carriers and their crews.
- 2023** ● U.S. Marines demonstrate in-flight 3D printing by scanning a Marine's arm to create a medical cast. The cast was printed during filming, takeoff and in-flight maneuvers.