

## Guide to Manufacturing Aerospace Components: Deep Drawn Stamping







## Creating Metal Components for Aerospace Applications

For aerospace applications where proper system operation is critical, it is essential to work with an experienced system component manufacturer who can follow through on technically demanding orders.

At Hudson Technologies, we are well-versed in designing, developing, and delivering standard and custom components for some of the most critical industrial applications. We employ deep drawn metal stamping processes to produce parts that have exacting specifications to tight tolerances with little to no additional tooling costs. These manufacturing capabilities, combined with our extensive knowledge of the aerospace industry and its unique challenges, makes us the ideal partner for all aerospace component needs.

Deep drawn metal stamping is a highly versatile forming process that employs a punch to turn a blank into a specific three-dimensional shape. Compared to other manufacturing methods, it accommodates a broader range of part designs and larger production quantities without sacrificing precision or cost-effectiveness. Typical parts produced through the process include cases, diaphragms, and enclosures.

## Manufacturing Considerations Unique to the Aerospace Industry

Within the aerospace industry, there is a push for better performance from system components. Industry professionals are increasingly seeking parts with greater strength, durability, and reliability as well as lower material weight to improve overall fuel efficiency. These demands add on to the already exacting specifications required for aerospace components, such as:

- Highly complex and intricate part designs
- Tight tolerance construction
- Resistance to temperature, pressure, and corrosion
- Accommodation of all applicable industry standards

Ultimately, these guidelines are in place to ensure the safety of aircraft crew and passengers. As aerospace operations generally occur tens of thousands of feet above the ground, it is essential for all systems to operate as intended. Any failure of a critical system can lead to catastrophic consequences.

For aerospace component manufacturers, satisfying the above requirements and restrictions necessitates a combination of broad manufacturing experience and a willingness to develop innovative solutions for unique challenges. At Hudson Technologies, our use of deep drawn manufacturing techniques enables us to meet and exceed these demands.

## Overview of Common Aerospace and Defense Components:

From actuators to sensors, all aerospace components must be manufactured to tight tolerances to ensure the proper operation of critical systems. As these parts make a significant difference in whether a flight ends successfully or catastrophically, it's important to understand their function within an aircraft.

### Oxygen Generating Systems:

Altogether, onboard oxygen generating parts and components produce and regulate the flow of oxygenated air throughout the aircraft. For aerospace and aviation applications, these systems are particularly critical as personnel and passengers can be exposed to low-oxygen environments.



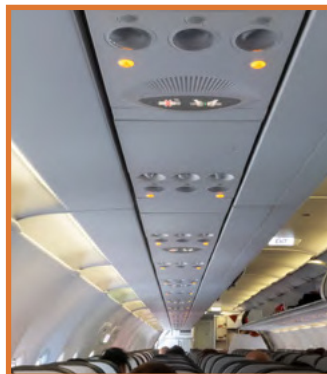
### Relays/Switches:

In aircraft, relays and switches play a critical role in electrical power supply and distribution systems as they control the input of electricity to various connected devices and systems, allowing them to turn on and off as needed. These components are available in a wide range of designs depending on the specific demands of the aircraft, including electromechanical, solid-state, high-voltage, and time delay.



## Lighting:

Aerospace lighting components find application in both the interior and exterior. Exterior lighting—such as anti-collision and navigation lights—facilitates better visibility (both for the aircraft in question and other aircraft) and is made from durable components designed to withstand harsh environmental conditions, including low and high temperatures, EMI, and extreme vibrations. Interior lighting enhances the comfort levels of passengers and aircraft personnel, allowing them to see within the cockpit and cabin.



## Instrumentation:

Aircraft instrument parts typically refer to the devices within the cockpit that facilitate safe and smooth operation. Common instrumentation found in aircraft includes flight instruments (such as altimeters, compasses, and gyroscopes), engine gauges (such as fuel pressure and level sensors), and cluster gauges.



## Engine Controls:

Aircraft engine controls and monitoring systems protect sensitive engine components from damage and ensure the engine is running at peak performance. These devices often use sensors to take in data about the engine, allowing pilots to adjust operations for better efficiency and facilitating maintenance and diagnostics procedures.





## Actuators:

In aircraft, actuators convert fluid pressure (hydraulic actuators) or electricity (electric actuators) into linear or rotary motion. This motion drives the operation of several essential aircraft components, such as the landing gear, wing flaps, or bay doors.



## Flight Control Systems:

Flight control systems are the primary means by which a pilot manages the direction of travel and altitude of an aircraft. The components of these systems are largely mechanical, with more heavy-duty parts employing hydraulic principles and advanced parts using electronics and fiber optics. Primary flight controls include elevators, stabilizers, and rudders, while secondary flight controls include flaps, slats, and spoilers.



## Fuel Systems:

Aircraft fuel systems store and distribute the fuel necessary for the flight. They generally consist of tanks, pipes, pumps, filters, valves, and gauges, all of which work together to deliver the fuel to the engine. Depending on the needs of the aircraft, the systems can feature either a gravity feed or pump feed design.



## Sensors:

Aircraft sensors find application in many aircraft systems. There are several types of sensors available that are suitable for use in varying applications, including pressure sensors, temperature sensors, position sensors, humidity sensors, and force sensors.



## Hydraulics:

Hydraulics play a critical role in aircraft ranging from light, single-person planes to large commercial airliners. Depending on the aircraft in question, hydraulic assemblies can be used in the operation of brake systems, steering systems, cargo and loading doors, and more.



## Pressurization Systems:

Aircraft pressurization systems maintain interior cabin pressures to facilitate comfortable breathing conditions for passengers and personnel at higher altitudes. Using outflow valves and compressors, they pump in fresh air and pump out spent air, while maintaining cabin pressures of between 11 to 12 psi.



## Antennas:

Aviation and aerospace antennas are essential components of modern aircraft communication, navigation, and detection systems. Using radio frequency, they serve as a reliable method of sending and receiving important data.



## Pressure Valves:

Aircraft valves most commonly find use in engines or pressurization systems. Due to their critical function, they must be designed and built to withstand harsh operating conditions, including low pressures, low and high temperatures, and corrosive elements.







## Materials Used in Aerospace Component Manufacturing Operations

When manufacturing aerospace components, the choice of construction material significantly affects performance. For this reason, manufacturers generally choose materials known to demonstrate advantageous physical and chemical characteristics that meet operating requirements, such as:

- Aluminum
- Brass
- Cold-rolled steel
- Copper
- Cupronickel
- HyMu 80 and similar shielding alloys
- Nickel
- Stainless steel
- Steel
- Titanium

### Non-Ferrous Metals

Non-ferrous metals—i.e., materials with no iron content—are well-suited for use in aerospace component manufacturing operations. Examples include aluminum, brass, copper, lead, tin, titanium, and zinc. The following material properties are some of the reasons why they are suitable for such operations:

- **High strength-to-weight ratio.** As indicated previously, industry professionals seek strong but lightweight components to meet harsh operating conditions while reducing fuel utilization.
- **Resistance to rust and corrosion.** Aerospace components must withstand extreme conditions, such as exposure to corrosive compounds and moisture buildup. Using materials that are inherently corrosion resistant helps to ensure the system components continue operating for the duration of their service lives.
- **Recyclability.** Throughout the industry, there is a growing demand for sustainability. By employing highly recyclable materials, aerospace industry professionals reduce their environmental footprint.

While non-ferrous metals offer several advantages when used in aerospace components, they are not ideal in all situations. Compared to ferrous metals, they generally have lower strength and durability, qualities that are critical for many of the components used in aerospace devices and systems.





## Ferrous Metals

Ferrous metals—i.e., materials with some iron content—also often find application in aerospace component manufacturing operations. Examples include stainless steel and carbon steel. Below we outline some of the reasons why they are suitable for use in such operations.

### Stainless Steel

Stainless steel is a steel alloy that contains at minimum 11% chromium, the presence of which gives the material its characteristic corrosion resistance. In addition to this property, stainless steel is known for its strength and formability (i.e., it can easily be formed into sheets, wires, and other forms). Alloying it with other elements—such as nickel or molybdenum—results in additional advantageous material properties.

### Carbon Steel

Carbon steel is one of the most commonly used varieties of steel. It is typically alloyed with a small amount of titanium, chromium, nickel, or cobalt to enhance certain properties depending on the application. While high carbon steel offers greater strength than medium and low carbon steel, all varieties exhibit high ductility, malleability, and formability. Compared to other materials, however, it is more susceptible to corrosion.

## Material Cost Considerations

While performance is the top priority for aerospace customers, cost remains a relevant consideration for any project. Of the discussed materials, carbon steel is the most affordable with aluminum, steel, and stainless steel generally coming with higher purchasing and production costs. In addition to being more expensive, these materials require more costly tooling in manufacturing operations. However, in some cases, the superior performance afforded by such materials justifies the higher cost.



## Partnering With Hudson Technologies for Aerospace Component Projects

As aerospace components play a role in critical operations with extreme environmental and operating conditions, they are bound by some of the most rigorous quality and safety standards across industry. At Hudson Technologies, aerospace customers know they can rely on us to meet their specifications and all applicable standards. By partnering with us for their aerospace component needs, they benefit from our:

- **Industry experience.** Throughout our years in business, we've collaborated with several nationally recognized aerospace companies. The experience garnered from these collabs has allowed us to develop an extensive understanding of what it takes to manufacture quality parts for the aerospace industry.
- **Commitment to quality.** We maintain numerous quality and industry certifications, including AS9100D.
- **Environmental consciousness.** We have implemented several environmentally focused initiatives to minimize our impact on the environment, such as using biodegradable lubricants and no-solvent cleaners.

Some of the components we regularly produce for the aerospace industry find application in the following:

- Aircraft instrumentation
- Military aircraft housings and enclosures
- Oxygen generating systems
- Relays, switches, lights, and electrical components

All of these components benefit from the solid, seamless construction generated by the deep drawn stamping process. We also offer additional services to enhance the functional and aesthetic qualities of the final product, such as:

- Anodizing
- Countersinking
- Deburring
- Machining
- Painting
- Passivation
- Plating
- Powder coating
- Silk screening
- Tapping

For additional information about our manufacturing capabilities and how we serve the aerospace industry, [contact us](#) today.