

## **Topic Hub: Aerospace    Subsection : Operations**

While many of the parts used by aerospace manufacturers are made by other industry sectors and a large network of supply chains, many Original Equipment Manufacturers (OEMs), re-work facilities, military installations and commercial manufacturers have the same type of processes and work centers on site.

The following are the main processes that aerospace manufacturers and their subcontractors use to manufacture parts for aerospace vehicles.

### **Metal Fabrication and Machining Operations and Processes**

Please refer to Metal Fabrication and Machining topic hub for complete information about the [operations and processes used to manufacture metal parts](#).

### **Metal Finishing Operations and Processes**

Please refer to Metal Finishing topic hub for complete information about the [operations and processes used to finish metal parts](#).

### **Fiberglass Reinforced Plastics Operations and Processes**

Please refer to Fiberglass Fabrication topic hub for complete information about the [operations and processes used to manufacture fiberglass reinforced plastic parts](#).

### **Assembly**

Aircraft assembly requires the coordination of thousands of parts coming together to form one large final product. When the parts are all coordinated the following processes that may generate hazardous wastes, air emissions, and wastewater discharges are used:

#### **Welding/Riveting**

##### **Fusion Welding**

Fusion welding is performed with a metal arc in the presence of an inert gas which prevents the oxidation of the metals to be welded. An alternating or direct current, depending on the type and thickness of the metal, is typically applied through an electrode.

##### **Resistance Welding**

Resistance welding requires: a primary electrical circuit from a transformer; a secondary circuit and electrodes to conduct the current to the desired spot; a mechanical system to hold the components and apply force; and control equipment to measure duration and magnitude of the electrical current. This process is used to create seam welds, which are leak-proof and pressure-tight.

##### **Electron Beam Welding**

Electron beam welding is achieved by concentrating a beam of high velocity electrons onto the surfaces to be joined.

##### **Riveting**

Riveted joints are usually used in sheet metal parts where the rivets take a shearing load.

#### **Sealing**

Sealants are applied throughout the aerospace vehicle primarily to seal out moisture and contaminants. This helps prevent corrosion, particularly on faying (i.e., closely or tightly fitting) surfaces, inside holes and slots, and around installed fasteners. Sealants are also used to seal fuel tanks and pressurized components. They are applied using tubes, spatulas, brushes, rollers, or spray guns. Sealants are often stored frozen and thawed before use, and many are two-component mixtures that cure after mixing.

#### **Adhesive Bonding**

Adhesive bonding involves joining together two or more metal or nonmetal components. This process



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is typically performed when the joints being formed are essential to the structural integrity of the aerospace vehicle or component. Bonding surfaces are typically roughened mechanically or etched chemically to provide increased surface area for bonding and then treated chemically to provide a stable corrosion-resistant oxide layer.

Nonstructural adhesives are used to bond materials that are not critical to the structural integrity of the aerospace vehicle or component, such as gaskets around windows and carpeting or to non-structurally joined components. These adhesives are applied using tubes, brushes, and spray guns.

### **Testing**

A wide variety of tests are performed by the aerospace industry to verify that parts meet manufacturing specifications. Many different kinds of penetrants, fluids, dyes, and etchants can be applied to the surface of metal parts to aid in the detection of defects.

### **Repair/Rework**

Repair operations generally include all conversions, overhauls, maintenance programs, major damage repairs, and minor equipment repairs. Typical maintenance and repair operations include:

- Depainting of aircraft surface with chemicals or mechanical force
- Cleaning and repainting the aircraft's surfaces, superstructure and interior areas
- Major rebuilding and installation of equipment such as turbines, generators, etc.
- Systems overhaul, maintenance, and installation
- System replacement and new installation of systems such as navigational systems, combat systems, communication systems, etc.
- Propeller and rudder repairs, modification, and alignment

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