



Superior Solutions

Barnes Group Inc

Barnes Aerospace is a primary business of Barnes Group Inc, a diversified international manufacturer of precision metal parts and distributor of industrial supplies, serving a wide range of markets and customers. Founded in 1857, Barnes Group Inc has achieved prominence as a highly respected global company by working closely with its customers to enhance their competitiveness and time to market.



Overview

Capabilities

Working to ISO 9002 standards, Barnes Aerospace divisions provide critical manufacturing services for aircraft engine and airframe manufacturers, airlines and the military. Our Divisions serve industry manufacturers in 5 primary areas:

- Precision Machining
- Advanced Fabrications
- Kits & Assemblies
- Overhaul & Repair
- Gear Machining

We serve some of the best and most demanding customers in our industry including Airbus, Boeing, General Electric, Goodrich, Pratt & Whitney and Rolls-Royce. These and other organizations look to Barnes Aerospace to support their most critical engineering challenges.

Global Company

Barnes Aerospace has earned an international reputation in the aviation industry for serving the original equipment manufacturer as well as overhaul and repair markets. We are continually expanding our international operations. In addition to our eight domestic locations, our Singapore overhaul and repair facility is renowned for its support of our Pacific Rim customers while our United Kingdom sales office was established to better serve Barnes Aerospace's European customer base. In addition, we are experienced in manufacturing in Mexico and are seeking additional sites to further develop opportunities in the region.

Partnership and Commitment

At Barnes Aerospace we work in close partnership with our customers. Through our state-of-the-art facilities, we provide custom engineering services in manufacturing research, testing and evaluation. Many customers consider us an adjunct facility to their own operation, where we work in a spirit of partnership and collaboration toward a common goal and solution. As a result of our partnering relationships, we add value to the processes of manufacturing and maintenance. Such relationships allow us to address multiple needs, share new technologies and anticipate future requirements.

Barnes Aerospace also promotes internal partnership. Our various divisions work together to provide solutions for our customers within the Barnes Aerospace family. For example, an engine component may require both precision machining as well as fabrication processes to produce a finished part. Barnes Aerospace satisfies machining and fabrication engineering and manufacturing requirements, providing a complete integrated assembly as a single vendor. The result is a simplified supply chain for our customers.



Quality, Engineering and Continuous Improvement

We set the standard in our industry – offering a comprehensive range of in-house support and capabilities that are difficult for our competitors to emulate.

At Barnes Aerospace we take particular pride in the range of engineering expertise we provide our customers. We provide concurrent engineering services during product development, as well as re-engineering support. High quality and reduced costs are benefits our customers experience as a result of the level of involvement and commitment from our engineering staff. Whether a design issue or technical problem, we provide specialized support for our customers throughout a product life cycle.

Barnes Aerospace has developed a culture where continuous improvement and lean thinking are practiced daily across all divisions and throughout all levels of the organization. Widespread implementation of kaizen processes, total productive maintenance (TPM) and cellular manufacturing are examples of our continuous improvement efforts.

Our quality program emphasizes superior customer service, zero defects, reduction in turn-times and affordable prices.





Precision Machining

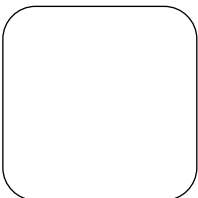
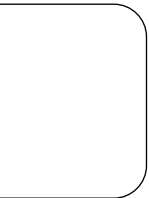
Prime engine manufacturers such as General Electric, Pratt & Whitney and Rolls-Royce look to Barnes Aerospace for complex machining of critical turbine engine components. For decades, Barnes Aerospace Windsor Division, located in Windsor, Connecticut, has met the changing requirements of the major global jet engine manufacturers keeping pace with industry change since the dawn of the turbine age. Today, taking on larger sections of engines, we've become a leading supplier for high thrust, lightweight aircraft engine components. Aircraft engine manufacturers turn to our machining abilities for complex components, kits and assemblies.

We are advancing engine manufacturing technologies through our leadership and Expertise in the following areas:

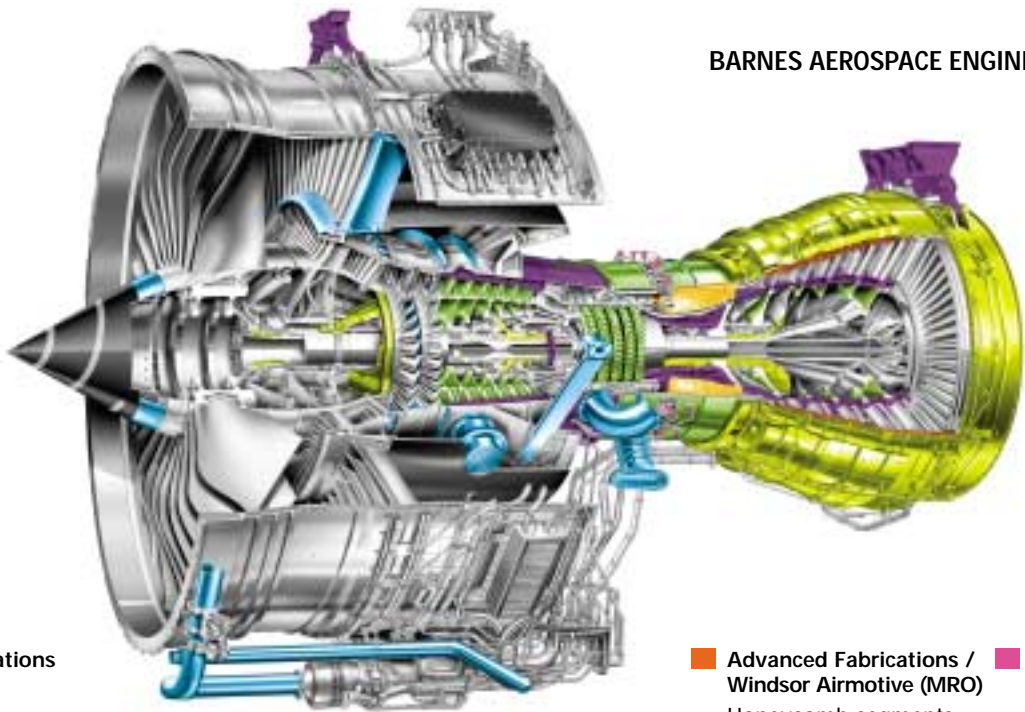
- Extensive grinding capability including continuous dress, rise and fall creep grinding and 4-axis rotary grinding
- Non-conventional machining including electrical discharge and laser cutting
- 4 and 5-axis state-of-the-art milling centers
- Multiple 4-axis lathes and vertical turret lathes featuring live spindle and capability in excess of 100 inches
- On-site metallurgical lab

Barnes Aerospace has produced engine components for virtually every major engine program and can be found in most airlines and air forces throughout the world. Our components are located in the compressor, combustor and turbine sections of the engine and include:

- Tail bearing housings
- Engine cases
- Bearing housings
- Rotating air seals
- Shroud and hanger segments
- Swirlers
- Combustor liners
- Spanner nuts
- Turbine center frame panels and fairings



BARNES AEROSPACE ENGINE COMPONENTS



■ **Advanced Fabrications**

Struts
Manifolds
Retainer rings
Nose cone fairing
Tube & duct assemblies
Bleed valve ducts
A-frame
Blade retainers
Augmentor/exhaust duct liner
Lever arms
Exhaust nozzle flaps
C-sump
Liners
Stiffeners
Rotating air ducts

■ **Windsor Division
(Precision Machining)**

Engine mounts
Compressor cases
Vane actuator rings
Shaft nuts/bearings
Segments
Vane rings
Nozzles
Swirlers
Bearing housings

■ **Windsor Airmotive (MRO)**

Drum rotors
Engine tubing
Diffuser cases
High pressure compressor cases

■ **Advanced Fabrications /
Windsor Division
(Precision Machining)**

Combustor cases

■ **Advanced Fabrications /
Windsor Airmotive (MRO)**

Honeycomb segments
Honeycomb shrouds

■ **Windsor Division
(Precision Machining)/Windsor
Airmotive (MRO)**

Tail bearing housings
Low pressure turbine cases
High pressure turbine cases
Stub shafts
Rotating knife edge seals
Turbine exhaust cases

■ **Apex Manufacturing**

Fuel shrouds
Valve bodies
Starter hub assemblies
Fuel control components
Rotor seals





Advanced Fabrications

Barnes Aerospace is a prime source for fabricated airframe and engine components and assemblies for global aircraft manufacturers. Our Advanced Fabrications Division with locations in West Chester Ohio, Lansing Michigan, and Ogden Utah, continually upgrade process capabilities providing customers with superior solutions involving complex components made of high-temperature metals including titanium, hastelloy, inconel and stainless steels.

We are industry leaders in superplastic forming – recognized as a major technology in the widespread use of titanium sheet metal fabrication in the aerospace industry. This technology has distinct advantages over conventional fabrication. No fasteners are required and the number of parts within a product is reduced. Design freedom is dramatically increased and the technology can be applied to a variety of components allowing the incorporation of numerous design concepts. Our customers have recognized our leadership in this area with a wide range of quality awards.

Barnes Aerospace has an enviable leadership position in the forming and fabrication of titanium and other advanced metals. Our internally-developed back-to-back forming process is another specific area of expertise allowing bends of superalloy materials at 180 degrees on a radius without cracking. With this process, products such as engine shroud segments can be manufactured from one sheet metal piece.

Proficiency in technologies like superplastic and back-to-back forming result in increased design freedom, the elimination of costly multi-piece welded assemblies, reduced part count and material and tooling savings. The benefits and savings are passed on to our customers.

As top providers of advanced metal fabrications to the aerospace industry, Barnes Aerospace Advanced Fabrications Division specializes in:

- Hot and superplastic forming
- Cold forming
- Welding and brazing
- Honeycomb brazing and grinding
- Multi-axis machining
- Laser and water jet cutting technologies
- Diffusion bonding



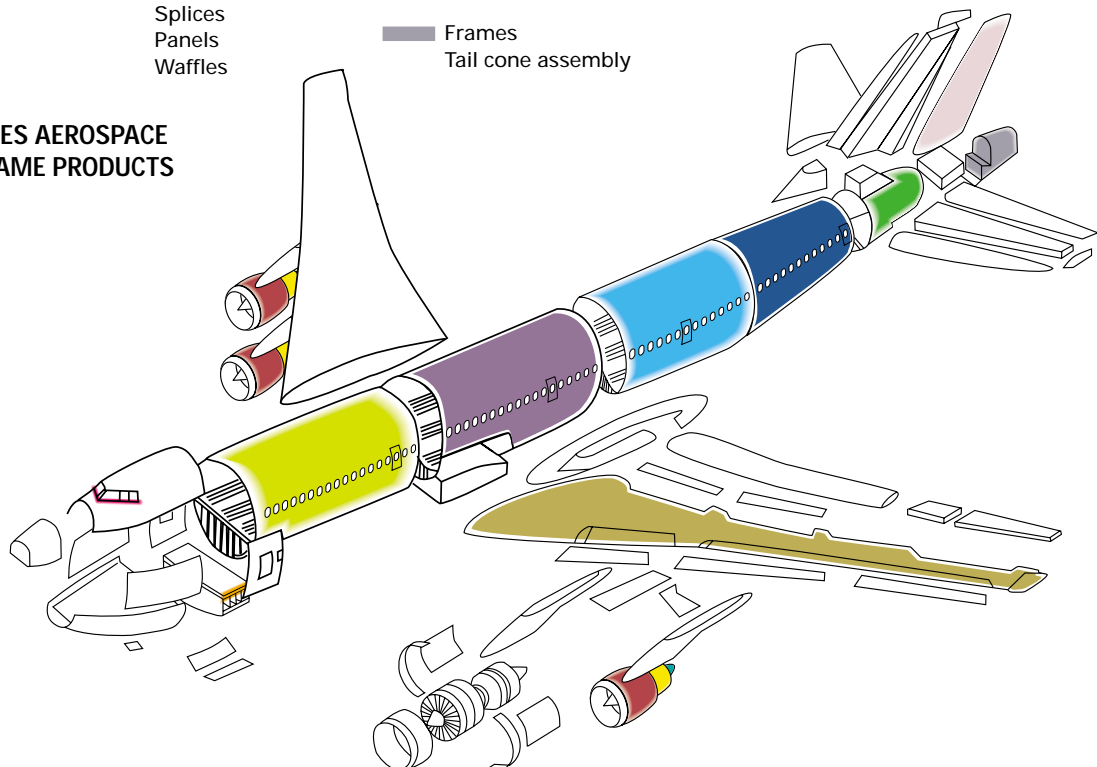


Components manufactured by Barnes Aerospace Advanced Fabrications Division are found throughout the airframe, nacelle and engine and include:

- Skins
- Exhaust nozzles/ducts
- Liners
- Tube and duct
- Structural support members
- Ribs and torque boxes
- Beams, stiffeners and channels
- Shroud segments
- Retainer rings
- Abrasion strips
- Firewalls
- Bird strike doublers

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|---------------|----------------------|-----------------------------------|-------------------------------|
| Doors | Ducts | Aft cowls | Vent screens |
| Skins | Webs | Hub & shaft assemblies (APU) | APU access doors |
| Covers | Scoops | Thresholds | APU ducts |
| Fairings | Mounts | Closeout tip ribs | Ram air heat exhaust exchange |
| Housing units | Heat shields | Exhaust nozzles | Telescoping ducts |
| Panels | Inlet duct assembly | Hub & shaft assemblies (starters) | Plenum assembly |
| Waffles | Bird strike doublers | Heat shields | Telescopic ducts |
| Brackets | Firewalls | Frames | Flap skew assemblies |
| Clips | Bulkheads | Tail cone assembly | Flap drive motors (shafts) |
| Angles | Splices | | |
| Access doors | Panels | | |
| Beams | Waffles | | |

BARNES AEROSPACE AIRFRAME PRODUCTS



Gear Machining



Barnes Aerospace Apex Manufacturing Division in Phoenix Arizona is renowned for tight tolerance (to AGMA 11) gear machining. Capable of hobbing and shaping a wide variety of internal and external gear features such as splines, ratchets, spurs, helicals and crowns, our gears are used in high precision applications including aircraft starters, actuating systems, fuel controls, hydraulic and fuel pumps and environmental control units.

The Apex Manufacturing Division also specializes in complex assemblies, offering customers complete assembly, balancing and test services.

Apex Manufacturing has developed extensive capabilities in manufacturing detail parts and complete assemblies to customer specifications. In-house processes include:

- CNC turning
- 5-axis machining
- I.D., O.D., centerless and surface grinding
- Honing and lapping
- Gear hobbing and shaping

Components manufactured by Barnes Aerospace Apex Manufacturing Division include:

- Gears
- Shafts
- Fuel shroud nozzles
- Complex assemblies

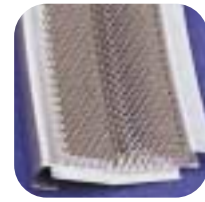
Kits and Assemblies



Barnes Aerospace offers customers the opportunity to simplify their supply chain by providing complex kitting and assembly services. Kits, modules and assemblies account for a large portion of our work. We maintain an infrastructure assuring accurate kit configuration, inventory control and just-in-time delivery. Customers can order finished, tested assemblies from Barnes Aerospace rather than procuring multiple detail parts and carrying extra inventory. Equipped to meet OEM and Government specifications and requirements, Barnes Aerospace uses the following technologies to produce kits and assemblies for our customers:

- Automatic and manual drilling, countersinking, riveting
- Welding and brazing
- Diffusion bonding
- Hot and superplastic forming
- Specialized packaging
- Precision balance
- Functional test

Overhaul & Repair



Barnes Aerospace Windsor Airmotive Division supports your aircraft assets with quick competent engine component overhaul and repair services. Our FAA/JAA certified repair stations in East Granby Connecticut, West Chester Ohio, and Singapore have pioneered the most extensive and economical repair techniques available to the industry. Our reputation for quality can be measured by the approval of every major engine manufacturer, the world's leading airlines, the FAA and JAA and certification to ISO 9002 standards.

- East Granby, CT FAA/JAA Certified Repair Station #KC1R265K
- West Chester, OH FAA/JAA Certified Repair Station #KKWR148K
- Singapore FAA/JAA Certified Repair Station #ZWDY470L

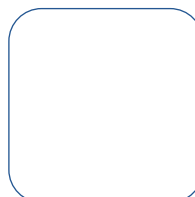
Serving more than 90 percent of the world's major airlines, Windsor Airmotive is an industry leader in turbine engine component overhaul and repair. Our capabilities meet the most critical industry specifications. As one of the world's leading repair sources, we are committed to providing our customers with superior delivery, quality and performance commitments. Primary overhaul and repair capabilities at our Windsor Airmotive facilities include:

- Overhaul of engine cases, such as diffuser, turbine and exhaust cases
- Restoration of turbine engine knife-edge seals
- Complete overhaul capabilities for turbine engine bearing housings, turbine supports and gas generator cases
- Honeycomb replacement for turbine engine sealing components
- Drum rotor and disk repairs



Our integrated technologies meet all industry specifications and feature the largest electron beam welder on the East Coast. We are recognized leaders in:

- Electron beam, manual & CNC tungsten and plasma arc welding
- Surface metalizing including plasma and wire arc coating
- Heat treat and thermal processing, vacuum and inert atmosphere
- CMM Inspection
- Non-destructive testing including X-ray, FPI, MPI and UT
- High pressure water jet coating removal
- CNC milling and turning
- Vacuum brazing



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