

Discover high technology  
that lowers costs.

**CHROMALLOY**





Pack Aluminides

FAA DER Repairs

CFM56-3

Vapor Aluminides

Airfoil Replacements

CFM56-5A

Platinum Aluminides

Cobalt Brazes

CF6-50

LPPS Metallic and Ceramic Overlay Coatings

Nickel Brazes

CF6-80A

EBPVD Metallic and Ceramic Overlay Coatings

Single Crystal Brazes

CF6-80C2

Ceramic Abradable Seals

Blade Tip Laser Powder Welding

JT8D

Abrasive Tip Coatings

Extended Limit Repairs

JT8D-217C/219

Low K Ceramic Coatings

Coating Upgrade Repairs

JT9D-7Q Series

FAA PMA parts

Turbine Blades

JT9D-7R4D

Compressor Blades

JT9D-7R4G

PW2000

PW4000

Compressor Stators

Turbine Seals

JT9D-7R4E

V2500-A5/D5

Turbine Vanes

Compressor Blades

Compressor Stators

HPC Seals

Pack Aluminides

CFM56-3

## **Chromalloy is trusted worldwide**

to provide repairs, coatings and FAA-approved, newly manufactured replacement parts that return gas turbine engines to like-new performance or better—at significant savings.

Chromalloy is driven by innovation. It's in our roots as pioneers in the 1950s of protective coatings for turbine airfoils. It's in our evolution as one of the first independents to repair gas turbine engine components. And it's in our future as we continually develop new solutions that extend the life and reduce the operating expense of gas turbine engines.

**Today, we are over 4,000 people strong, operating in 52 locations and 17 countries** to meet the needs of our customers around the globe. We are one of the world's largest non-OEM providers of advanced coatings, repairs and replacement parts for gas turbine engines. And we are the only non-OEM company in the world that provides coatings, repairs, castings, manufacturing and overhauls—all from a single source.

## The world's leading independent alternative.

As an independent provider, Chromalloy is uniquely focused on our customers and their needs. We work side-by-side with commercial airlines, the military, aeroderivative marine engine owners and power companies.

Through more than five decades of collaboration, we have analyzed thousands of engines, developed unprecedented repairs and coatings, and reverse engineered hundreds of parts. Today, we leverage this expertise to provide a reliable alternative to the OEM that reduces your costs and extends the life of gas turbine engines.

### **Trusted by airlines around the world**

Chromalloy works with all major airlines worldwide and the United States Department of Defense. These contracts incorporate all aspects of the gas turbine engine—from component/module repair and newly manufactured replacement parts, to engine fleet management services, maintenance and overhauls.

### **Innovative thinkers**

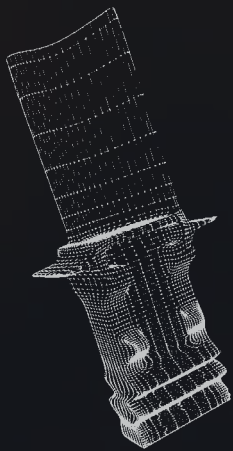
At Chromalloy, we are problem solvers—whether developing a breakthrough coating in a high-tech lab, or inventing a repair technique that extends engine life. We focus on ingenuity and innovation at every level.

### **Financial stability**

Chromalloy is part of the Carlyle Group, one of the world's largest private equity firms. The firm has specific expertise in the defense and aerospace sector as well as in energy and power. Carlyle combines global vision with local insight to maximize the strength and value of its companies.

### **Safety Record**

Chromalloy has never been issued a single FAA Airworthiness Directive (AD) in our entire 60-year history, spanning more than 300,000 PMAs and AFRs. Chromalloy is proud of this record because it speaks to the precision and durability of its work, but even more so because of the confidence and peace of mind it brings to our customers.



### Lifecycle cost management

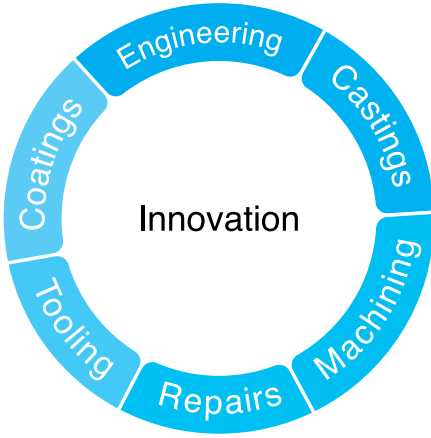
For 60 years now, Chromalloy has worked shoulder-to-shoulder with our customers to support their efforts to establish best practice in engine lifecycle cost management. We understand that operators—whether commercial or military—first seek to repair worn or damaged parts. If parts cannot be repaired, operators make every effort to replace them with new, FAA-approved alternative parts. Finally, if the FAA has not approved an alternative for the part, operators turn to new OEM replacement parts. This philosophy is driven by the operators' requirement to manage their engine fleets as efficiently as possible while maintaining stringent performance and safety standards.

Worn Part

Repairs  
\$

PMA  
\$\$

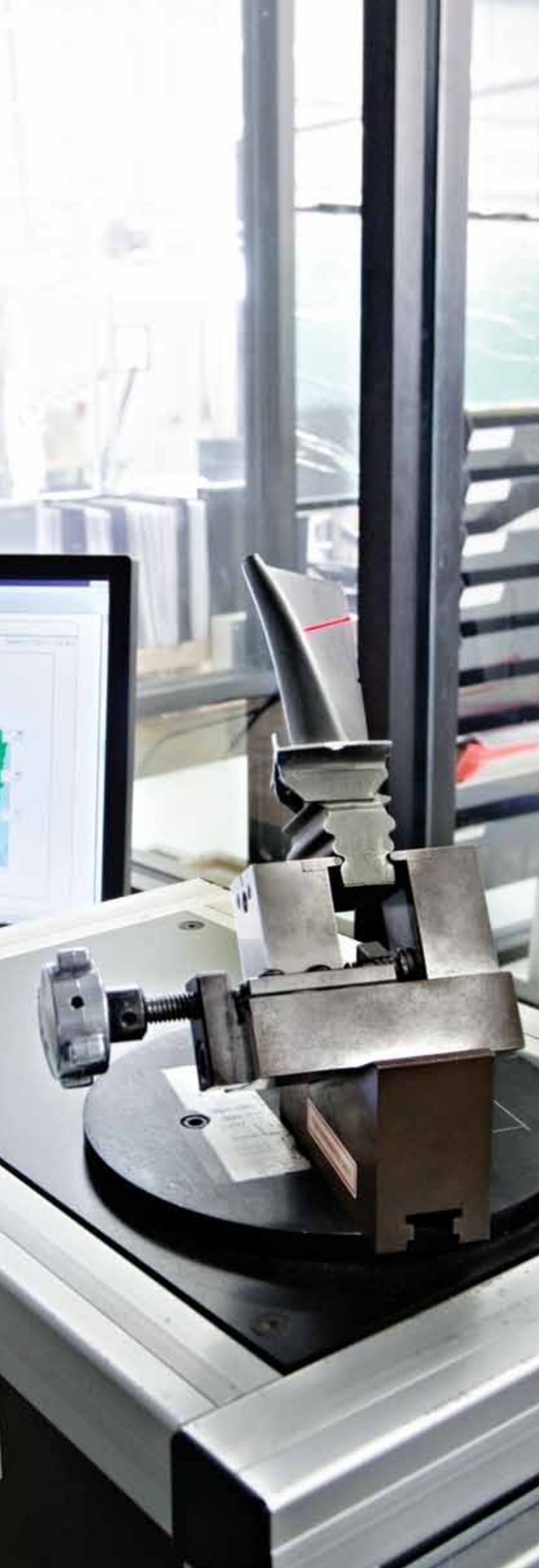
New OEM  
\$\$\$



### The Chromalloy Value Chain

Innovation is at the core of the Chromalloy value chain, and influences each of our capabilities. From design, test and systems engineering, castings and core development, to machining, repair technology, tooling and coatings—every discipline benefits from our global knowledge base. Today, Chromalloy is the only non-OEM company in the world that provides gas turbine engine component coatings, repairs, castings, manufacturing and overhauls—all from a single source.





**Chromalloy supports a wide range of gas turbine engines.**

**CFM**

- CFM56-2
- CFM56-3
- CFM56-5A
- CFM56-5B
- CFM56-5C
- CFM56-7

**GE**

- CF34-3
- CF6-50
- CF6-6
- CF6-80A
- CF6-80C2
- CF6-80E
- CF700/CJ610
- CT58

**Honeywell**

- AL5512
- ALF502/LF507
- GTCP131
- GTCP331-200
- GTCP331-350/400
- GTCP331-500
- GTCP36-100
- GTCP36-280
- GTCP660
- GTCP85
- LTS101
- TFE731
- TPE331
- TSCP700

**International Aero Engines**

- 2500A1
- V2500A5/D5

**Pratt & Whitney**

- JT12A
- JT15D
- JT8D-200
- JT9D-3/-20J
- JT9D-59A
- JT9D-7Q
- JT9D-7R4D/E/H
- JT9D-7R4G2
- PT6
- PW100
- PW200
- PW2000
- PW4000-100
- PW4000-112
- PW4000-94
- PW901

**Rolls-Royce**

- 501D
- A250
- Dart
- RB211-22B
- RB211-524
- RB211-524B/C/D
- RB211-524G/H
- RB211-535C
- RB211-535E4
- Tay
- TRENT 500
- TRENT 700
- TRENT 80



Over 95,000 Airfoil  
Replacement Repairs  
successfully in-service.  
No Airworthiness Directive  
ever issued against a  
Chromalloy part or repair in  
over 60 years.

## **Proven repairs and performance**

Chromalloy repairs provide a reliable, cost-effective alternative to new parts and costly OEM repairs. Over the last several decades, Chromalloy has invested millions of dollars in the research and development of innovative repair processes that return components to their original form, fit and function. As a result, Chromalloy repaired parts are proven to perform equal to, or better than, the OEM components they replace.

## **Significant cost reduction**

Chromalloy repairs can dramatically reduce costs for an airline. On average, Chromalloy repairs cost an airline only 20% of a newly manufactured part. For one customer with 17 Chromalloy repair contracts, this has reduced costs by nearly \$900 million. In addition, it has forced OEMs to compete on cost, schedule and performance. For airlines, this generates significant savings, faster turnaround times and improved responsiveness to your needs.

## **Comprehensive capabilities**

Today, Chromalloy provides a full line of repair and maintenance capabilities for turbine engines. These include standard repairs, source-demonstrated repairs and advanced source-demonstrated repairs such as airfoil replacement repairs. In addition, our research has generated multiple proprietary repair processes from metallurgical and mechanical repairs to the design, casting and manufacturing of precision turbine components. These advanced capabilities set Chromalloy apart from any other provider.

## **MRO – Maintenance, Repair and Overhaul**

In certain circumstances, Chromalloy provides airlines with MRO services. By incorporating the latest technology in coatings, repairs and manufacturing into our MRO services, Chromalloy adds value to components, extends the time between overhauls and expedites turnaround.

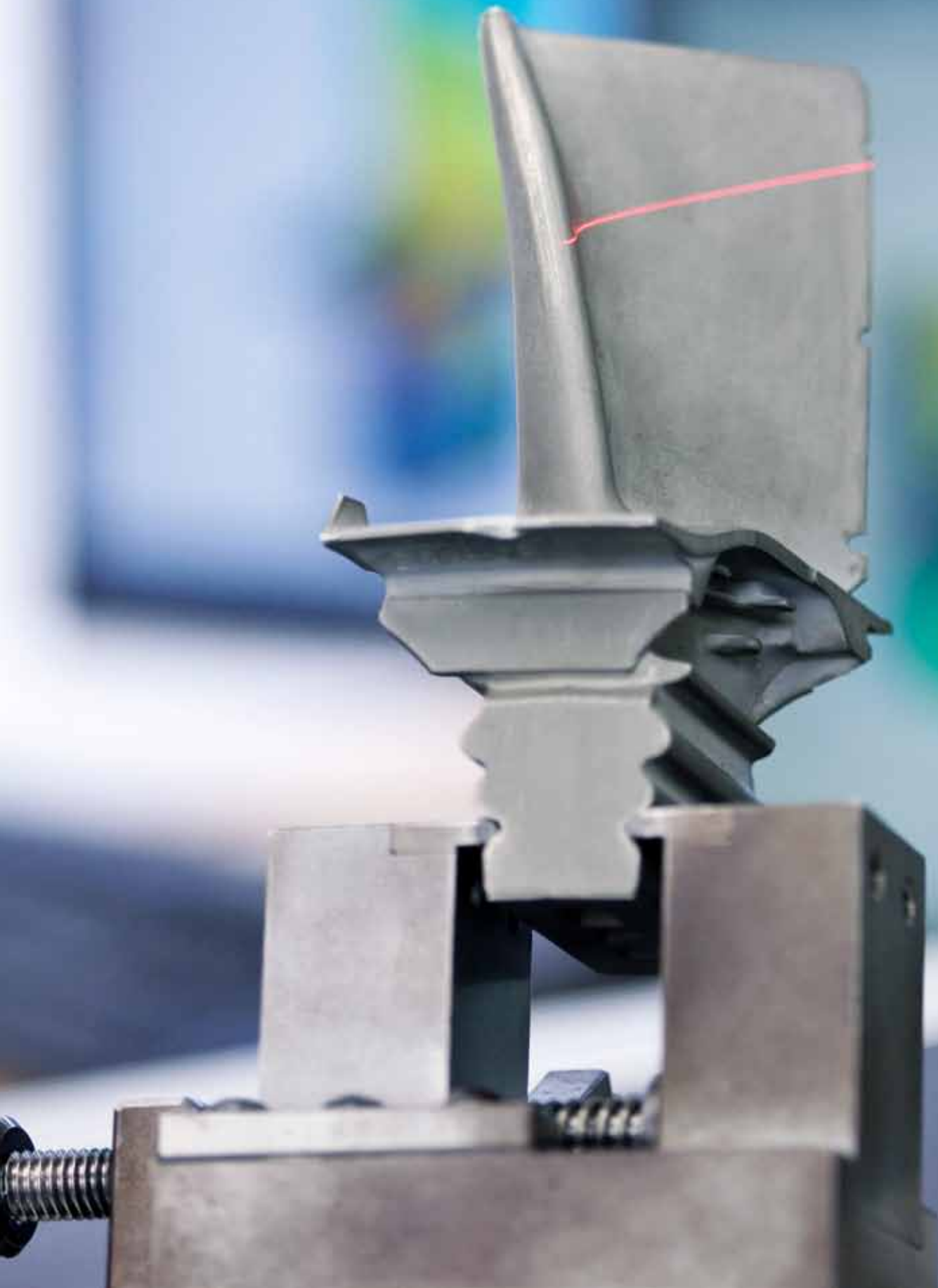
## Gas Turbine Engine Repairs



### **Chromalloy is a world leader in turbine engine component repair.**

Our in-house capabilities include:

- Electron beam welding and automatic TIG welding
- High pressure water jet stripping
- CNC milling, turning and grinding
- Jig boring and grinding
- Robotic HVOF, plasma and wire arc coating
- Heat treat and thermal processing
- Vacuum brazing
- X-ray, robotic eddy current, submerged ultrasonic and other non-destructive testing
- Shot peening
- Balancing
- Corrosion resistant painting
- Advanced HF cleaning process
- 5-axis laser machining/welding
- Advanced technology coatings







Our engine components are found in most major aircraft worldwide, and are located in the heart of the engine: the fan, compressor, combustor and turbine.

## **Chromalloy overhauls numerous turbine engine components for commercial airline customers.**

### **Modules**

- Compressor
- Combustor
- HPT
- LPT

### **Blades**

- LPC/HPC
- HPT
- LPT

### **Vanes & Nozzles**

- HPC
- HPT
- LPT

### **Rotating Components**

- Seals
- Disks
- Shafts
- Drum rotors and spools

### **Gearbox**

- Accessory gearbox
- Inlet/Transfer gearbox
- Gearshafts

### **Cases/Frames/Supports**

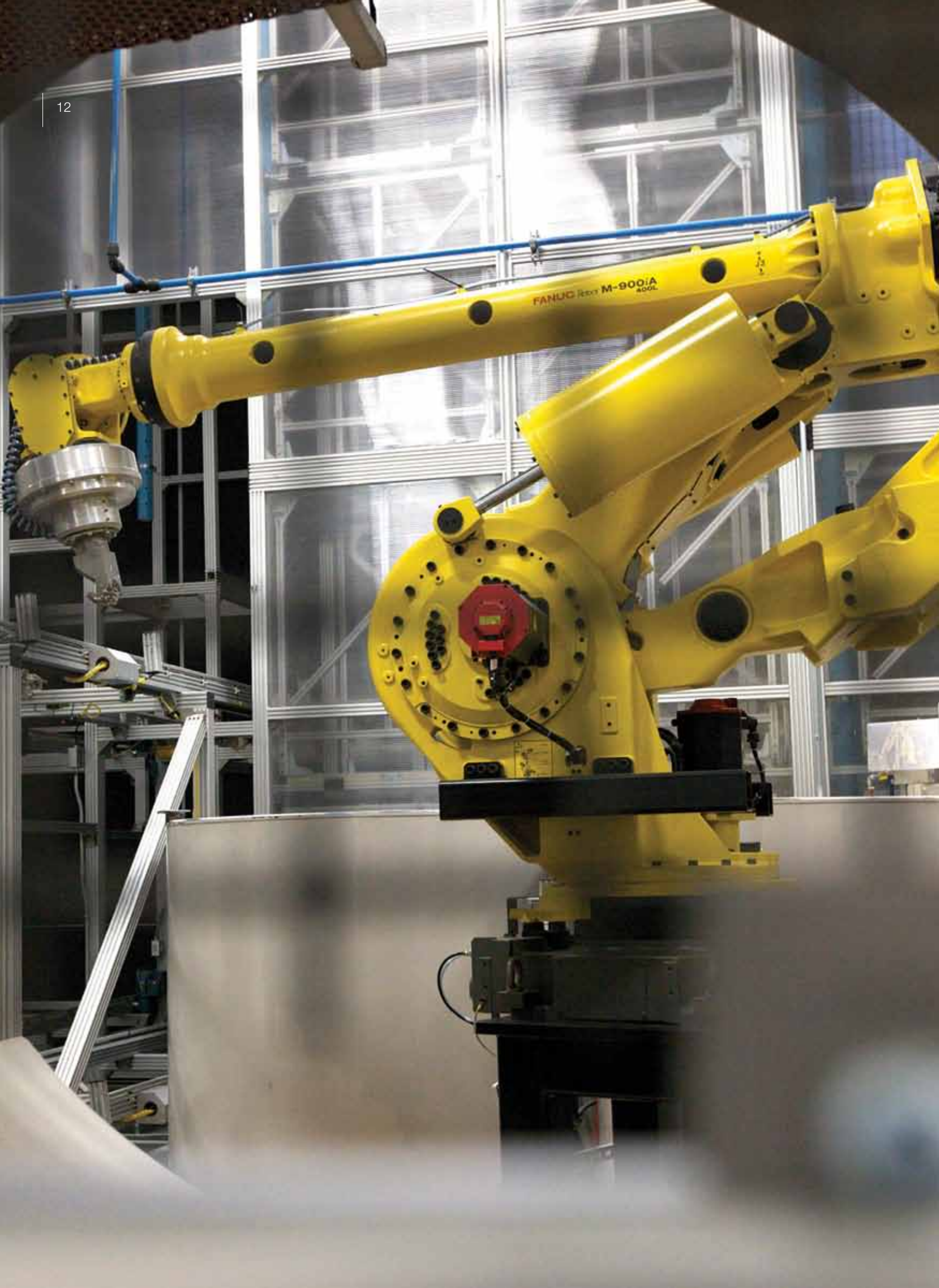
- Fan and booster cases
- Compressor cases
- Intermediate cases
- Compressor rear frame/Diffuser case
- HPT case
- Combustion case/liners
- Turbine mid-frame
- LPT case
- Turbines exhaust case

### **Stationary Seals**

- LPC honeycomb segments
- HPC honeycomb segments
- HPC retainer seals
- HPT shroud segments
- HPT honeycomb segments
- HPT duct supports
- LPT honeycomb segments

### **Small Gas Turbine Engine / APU**

- Complete engine overhaul and testing
- AGT 1500
- TSCP 700
- GTCP331-200
- GTCP36-280



# Gas Turbine Engine Replacement Parts

Over 324,000 Chromalloy-engineered blades and vanes are currently operating in commercial and military engines around the world.

Chromalloy components are engineered to meet or exceed the performance, reliability and durability specifications of OEM parts—while being offered at a lower cost.

## **Approved replacement parts**

Chromalloy components are reverse engineered, newly manufactured and approved by the FAA. To earn and maintain this approval, all Chromalloy parts must meet or exceed the exact same performance, reliability and durability specifications as the original FAA type-certified parts. At the same time, Chromalloy parts cost 35-45% less.

## **Castings**

Chromalloy operates several state-of-the-art castings centers including a facility in Tampa, Florida that is the most technologically advanced in the world. This facility features the most cutting-edge technology—from shell lines that fine-tune process control to furnaces that enable the production of the entire range of complex aero, aeroderivative, industrial gas turbine and heavy industrial components.

The Tampa facility was designed from the ground up to optimize workflow, which means faster turn times and greater capacity. Specifically, Chromalloy has doubled its previous capacity to produce complex equiaxed components and tripled its previous capacity to produce directionally solidified and single-crystal components. In addition, Chromalloy can now cast 1,000,000 pounds of nickel and cobalt-based super-alloys every year.

This technology, expertise and capacity allow Chromalloy to meet the needs of our customers in a way that no other company can. By managing the entire replacement part supply chain—from design and development to casting and coating—we deliver parts more quickly and reduce costs for our customers. These unique capabilities have earned us the trust of airlines, the military and power companies around the world.

## **BELAC LLC**

To further our new part capabilities and to better serve the market, Chromalloy launched BELAC, a joint venture with Lufthansa Technik and United Airlines. BELAC produces High Pressure Turbine blades approved by the FAA and, through bilateral aviation safety agreements, every major regulatory agency in the world. To date, BELAC has delivered over 42,000 High Pressure Turbine blades to 34 airlines worldwide. These blades have accumulated over 300 million hours of service.



## Component Coatings



### **Coating Technologies**

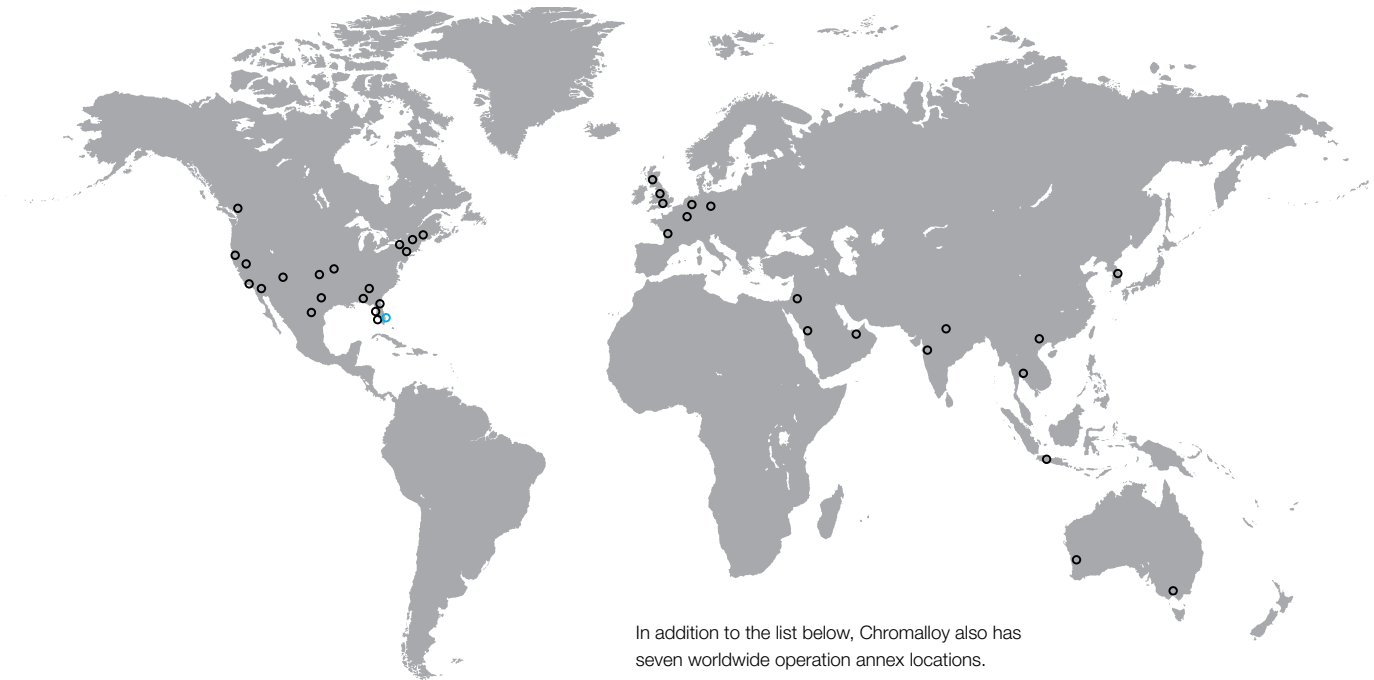
Chromalloy was the first company to develop commercially viable aluminide coatings, and Chromalloy continues to provide these coatings and their derivatives to all the major OEMs. Chromalloy is the world's largest provider of Low Pressure Plasma Spray Overlay and Electron Beam Physical Vapor Deposition (EBPVD) coatings. Chromalloy also offers ceramic (thermal barrier) coatings, diffused precious metal/aluminide coatings, vacuum plasma coatings and other innovative processes that protect turbine components and increase their efficiency and reliability.



## Locations

**Chromalloy's  
Worldwide Network**

4,000 people  
52 locations  
17 countries



In addition to the list below, Chromalloy also has seven worldwide operation annex locations.

### Chromalloy Manufacture/Repair Facilities

**Carson City, Nevada, USA**  
**Dallas, Texas, USA**  
**Eastwood, Nottingham, UK**  
**Lamlukka, Thailand**  
**Mexicali, Mexico**  
**Middletown, New York, USA**  
**Midwest City, Oklahoma, USA**  
**Newnan, Georgia, USA**  
**Orangeburg, New York, USA**  
**Phoenix, Arizona, USA**  
**Qiryat-Gat, Israel**  
**Rochefort, France**  
**San Antonio, Texas, USA**  
**San Diego, California, USA**  
**Saint Ouen l'Aumone, France**  
**Tampa, Florida, USA**  
*Chromalloy Castings*  
**Tilburg, The Netherlands**  
**Windsor, Connecticut, USA**

### Chromalloy Regional Sales Offices

**Beijing, China**  
*Aero & IGT Regional Sales Office*  
**Delhi, India**  
*Aero Regional Sales Office*  
**Midwest City, Oklahoma, USA**  
*U.S. Military Sales Office*  
**Saint Ouen l'Aumone, France**  
*Aero Regional Sales Office*  
**San Diego, California, USA**  
*Aero Regional Sales Office*  
**Seoul, Korea**  
*Aero Regional Sales Office*  
**Tilburg, The Netherlands**  
*Worldwide Aero Sales Office*

### Chromalloy Service/Customer Support Centers

**Bangkok, Thailand**  
**Jakarta, Indonesia**  
**Jeddah, Saudi Arabia**  
**Melborne, Australia**

### Mumbai, India

**San Francisco, California, USA**  
**Tulsa, Oklahoma, USA**  
**Vancouver, BC, Canada**

### Chromalloy Joint Ventures

**Advanced Coating Technology**  
Middletown, New York, USA  
**BELAC LLC**  
Oldsmar, Florida, USA  
**Masaood John Brown**  
Dubai, UAE  
**TRT**  
Somercotes, Derbyshire, UK  
**Turbine Surface Technologies Ltd.**  
Annesley, Nottinghamshire, UK

### Turbine Services\*

**Corporate Office**  
Glasgow, UK  
**Sales & Field Service**  
Perth, Australia  
**Manufacturing & Repair**  
Lamlukka, Thailand

\* Turbine Services is wholly owned by Chromalloy

### Other Chromalloy Facilities

**Airworthiness Office**  
Burlington, Massachusetts, USA  
**Engineering Technical Services Center**  
Fort Walton Beach, Florida, USA  
◦ **Engineering Center of Excellence & Corporate Office**  
Palm Beach Gardens, Florida, USA  
**Turbine Design Analytics Group**  
Stuart, Florida, USA

**We are Chromalloy.**  
We are innovators.

And we are working today to meet the needs of our customers by extending the life of gas turbine engines and reducing their operating expenses.

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**CHROMALLOY**