

Providing assured
combat readiness at
a reduced cost.

CHROMALLOY





Pack Aluminides

Vapor Aluminides

Platinum Aluminides

LPPS Metallic and Ceramic Overlay Coatings

EBPVD Metallic and Ceramic Overlay Coatings

Ceramic Abradable Seals

Abrasive Tip Coatings

Low K Ceramic Coatings

Under Platform Coatings

FAA DER Repairs

Airfoil Replacements

Cobalt Brazes

Nickel Brazes

Single Crystal Brazes

Blade Tip Laser Powder Welding

Extended Limit Repairs

Upgrade Material Repairs

Coating Upgrade Repairs

CFM56-3

CFM56-5A

CF6-50

CF6-80A

CF6-80C2

JT8D

JT8D-217C/219

JT9D-7J

JT9D-7Q Series

JT9D-7R4D

PW2000

PW4000

V2500-A5/D5

FAA PMA parts

Turbine Blades

Turbine Vanes

Turbine Shroud Segments

Turbine Seals

Compressor Blades

Compressor Stators

HPC Seals

On your side.
Around the world.

01

Today's military relies on the gas turbine engine to reliably power its aircraft, vessels and tanks. Right now, original equipment manufacturers (OEMs) around the world are working on the next generation of gas turbine engines to power the *next* generation of vehicles—in the air, on land and at sea.

But what about existing legacy engine fleets? The thousands of engines currently supporting Warfighters deployed around the world? These engines are not new, but they *are* mission critical. And even though these engines are used by the military, they can still benefit from commercial best practices for improved performance and fuel efficiency.

Unfortunately, the OEM's answer to the Warfighter's need for legacy engine support is to promote the acquisition of new components and newly designed parts over the repair of existing components.

Enter Chromalloy.

For more than 50 years, Chromalloy has been trusted by gas turbine engine owners and operators to provide repairs, coatings and newly manufactured replacement parts that return gas turbine engines to like-new performance or better—at significant savings.

Today, Chromalloy is over 4,000 people strong, operating in 52 locations and 17 countries.

The people of Chromalloy are problem solvers—whether producing repairs that deliver cost-effective sustainment of legacy engines, developing a breakthrough coating in a high-tech lab, or streamlining a process on the shop floor. Chromalloy focuses on ingenuity, innovation and prompt solutions to customer needs.

Innovation creates longevity



Chromalloy has spent over five decades working side-by-side with our customers in the military, commercial aviation, aeroderivative marine and energy and power. During that time, Chromalloy has analyzed thousands of engines, developed unprecedented repairs, created groundbreaking coatings and reverse engineered hundreds of parts. Today, Chromalloy leverages this expertise to provide assured combat readiness with a reliable alternative to the OEM that reduces costs and extends the life of gas turbine engines.

Chromalloy utilizes a two-step approach to deliver the most technologically advanced solutions in a flexible, cost-effective manner: (1) repair instead of replace and (2) replace non-replaceable parts with approved alternative, newly manufactured parts.

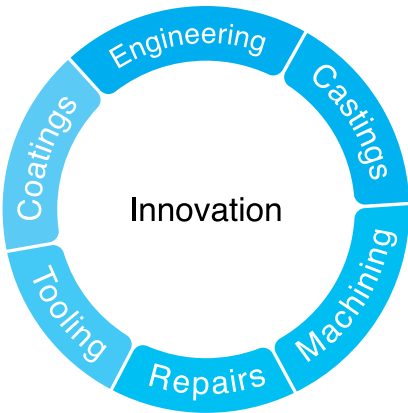
Trusted by Warfighters around the world

Chromalloy has worked jointly with Warfighters for years to provide the most technologically advanced solutions that reduce costs and sustain legacy engine fleets. In 2010 alone, Chromalloy has over \$1 billion in contracts in direct support of 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. Warfighters count on Chromalloy for sustained readiness, unrivaled flight safety and improved engine performance.

Carlyle Group

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.

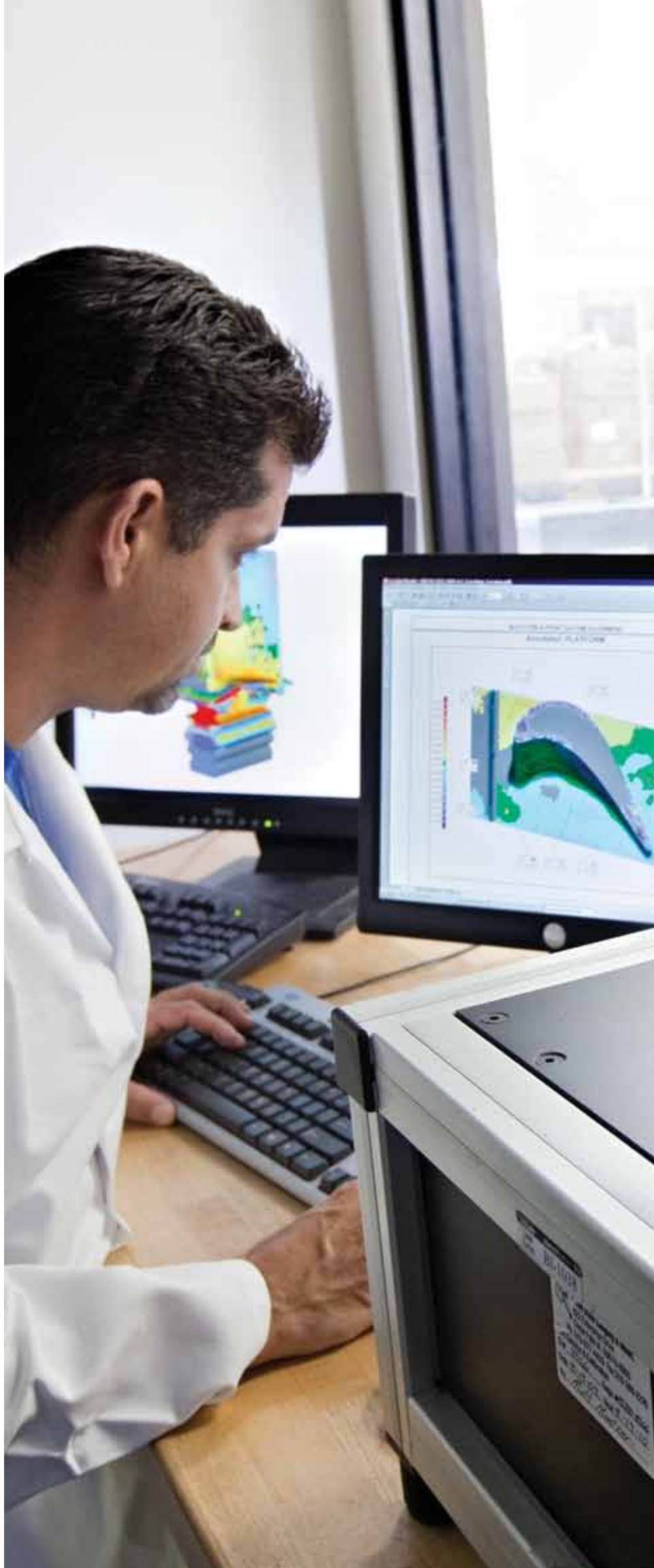




The Chromalloy Value Chain

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.

Heavy Aircraft

- TF33 SERIES
- F108
- TF39
- T56
- CF6-50
- F117
- PW2000
- CF6-80
- JT8D SERIES

Fighter Jets

- F100 SERIES
- F101 SERIES
- F110 SERIES
- TF34
- F404
- F414
- J85

Navy Ships / Industrial Power

- LM2500

Tanks

- AGT1500

Helicopters

- T700
- CT58
- T58
- PT6
- T64

CFM56-2/3 (F108) HPT
Stage 1 Vane

- + Airfoil Replacement (AFR) Repair developed in 1994
- + Since 2002: shipped over 30,000 vanes to U.S. Air Force and commercial airlines
- + Less than a 5% condemnation rate on U.S. Air Force vanes
- + Accrued over 14 million flawless hours of operation
- + Investment cast with intricate internal cooling patterns that reduce base material temperatures
- + Film cooling holes on the airfoils and platforms are EDM or laser drilled

103-H-301

Over 95,000 Airfoil
Replacement Repairs
Successfully In-Service.
No Airworthiness Directive
ever issued against a
Chromalloy part or repair in
over 50 years.

Proven repairs and performance.

Chromalloy repairs provide a reliable, cost-effective alternative to the acquisition of 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 the military. On average, Chromalloy repairs cost the military customer only 20% of a newly manufactured part. For one military 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 military customers, this generates significant savings, faster turnaround times and improved responsiveness to military needs.

Comprehensive capabilities.

Today, Chromalloy provides a full line of repair and maintenance capabilities for turbine engines used by the military. 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 military customers 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.

Overhaul and Repair



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 services numerous turbine engine components for both the military and commercial engine overhaul markets.

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

LM2500 HPT

Stage 1 Single Shank Blade

- + Advanced blade tip weld repairs using Chromalloy's patented laser powder welding techniques
- + Performing these repairs for the U.S. Navy since 1998
- + U.S. Navy reported \$81 million savings/avoided costs over the last 10 years as a result of Chromalloy HPT blade repairs
- + One of the (29) LM2500 components currently being repaired for the U.S.

In 2010, a 10-year evaluation program conducted by the U.S. Navy confirmed that LM2500 blade refurbishments reduced costs while maintaining performance. Since implementing the program with Chromalloy, the Navy has achieved cost savings and cost avoidance of \$81 million. Blade repairs per unit cost 86% less than the cost of a new OEM part. And the Navy reported a 208% gross return on investment over the life of the program. Regarding performance, the Navy reported that the blades provide virtually indistinguishable performance to OEM blades with no downside.



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

Approved replacement parts.

Chromalloy components are reverse engineered, newly manufactured and approved by the Federal Aviation Administration (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. All Chromalloy repairs and newly manufactured parts produced for the military are done so using the same exacting standards mandated by the FAA.

Commercial airlines use Chromalloy components on a regular basis. And right now, the U.S. Air Force and the U.S. Navy are approving non-OEM, newly manufactured parts on a case-by-case basis.

Competition drives down costs.

To date, the U.S. Air Force has approved unrestricted use of FAA-certified Chromalloy parts on its CF6-50 fleet for the KC-10 aircraft. This is facilitating a significant cost reduction. In addition, the U.S. Air Force now allows non-OEM high pressure turbine blades in its F108 CFM56-2 engines. Chromalloy brings competition to this important area.

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. These centers allow Chromalloy to provide a single source for replacement parts, and enable Chromalloy to meet the tactical and financial needs of the military in a way that no other company can. By managing the entire replacement part supply chain—from design, test and systems engineering, tooling, castings and core development, to repair technology, machining and coating—Chromalloy reduces Warfighter costs, deploys parts more quickly and provides uninterrupted Warfighter support around the world.



To enhance its new part capabilities, Chromalloy launched BELAC, a joint venture with United Airlines and Lufthansa Technik. BELAC produces FAA-approved High Pressure Turbine blades. To date, BELAC has delivered over 39,000 blades proven in 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.

Safety Record

Chromalloy has never been issued a single FAA Airworthiness Directive (AD) in our entire 50-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 the Warfighter.



Locations

**Chromalloy's
Worldwide Network**

4,000 people
52 locations
17 countries

Chromalloy is your ally around the world. With 52 locations in 17 countries, Chromalloy provides the parts, repairs and services the military demands—anytime, anywhere.



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
Lamukka, Thailand
Mexicali, Mexico
Midwest City, Oklahoma USA
Newnan, Georgia USA
Orangeburg, New York USA
Corporate Office
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
Dehli, India
Aero Regional Sales Office
Houston, Texas USA
IGT Regional Sales Office
Midwest City, Oklahoma USA
US Military Sales Office
Saint Ouen l'Aumone
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
Tulsa, Oklahoma USA
San Francisco, California USA
Vancouver, BC Canada

CHROMALLOY JOINT VENTURES

Advanced Coating Technology
Middletown, New York USA
Belac
Oldsmar, Florida USA
Masaood John Brown
Dubai, UAE
TRT
Somercotes, Derbyshire, UK
Turbine Airfoil Coating & Repair LLC
Berlin, Germany
Middletown, New York USA
Turbine Surface Technologies Ltd.
Annesley, Nottinghamshire

TURBINE SERVICES*

Corporate Office
Glasgow, UK
Sales & Field Service
Perth, Australia
Manufacturing & Repair
Lamukka, 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
Turbine Design Analytics Group
Stuart, Florida USA

We are Chromalloy.

We are innovators.

And we are working today to meet the needs of the military by extending the life of gas turbine engines, reducing your operating expenses and providing assured combat readiness.

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