

Discover high technology
that lowers costs.

CHROMALLOY





- Replacement and Spare Parts
- Component Manufacturing
- Component Repair
- Rotor Repair and Overhaul
- Complete Refurbishment
- Field Maintenance
- Engineering Services
- Long Term Service Agreements
- Engineering Technology and Support
- Training Services
- Control System Retrofits
- Condition Monitoring and Diagnostics
- 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 T Ceramic Coatings
- Underplatform Coatings
- Airfoil Replacement
- Cobalt and Nickel Brazes
- Single Crystal Brazes
- Blade Tip Laser Powder Welding
- Extended Limit Repairs
- Upgrade Material Repairs
- Coating Upgrade Repairs
- Compressor
- Compressor Frames
- High Pressure Compressor
- High Pressure Turbine
- HPT Blades, Vanes, and Shrouds
- Inlet Case
- Low Pressure Compressor
- Low Pressure Turbine
- LPT Shrouds
- Shafts, Disks and Seals
- Turbine Frames

Today's power generation industry is more competitive than ever. As power producers around the world seek newer, better ways to maximize performance and minimize life cycle costs, Chromalloy is rising to the challenge.

Today, we offer high-tech coatings, repairs, exchange and replacement parts, as well as field services and monitoring that extend the life of critical parts and reduce operating expenses through our wholly-owned subsidiary Turbine Services Limited.

The evolution of Chromalloy.

Chromalloy pioneered the development and application of protective coatings for turbine airfoils in the 1950s—primarily in commercial aviation and military applications. As our expertise grew, we became one of the first independents in the world to repair gas turbine engine components. Later, we began re-engineering and casting parts and, in the last decade, tackled the challenges of both aeroderivative and heavy industrial gas turbine engines.

Today, Chromalloy is a \$1B+ company with locations in 17 countries around the world. We leverage our aerospace heritage, military insight and expertise in energy and power, to provide some of the most high-tech coatings, repairs and parts ever conceived for heavy industrial gas turbine engines.

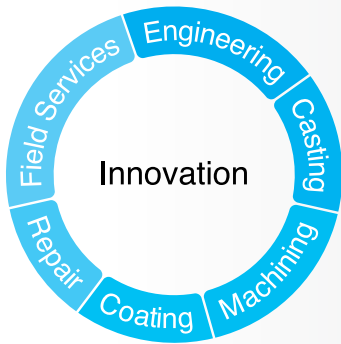
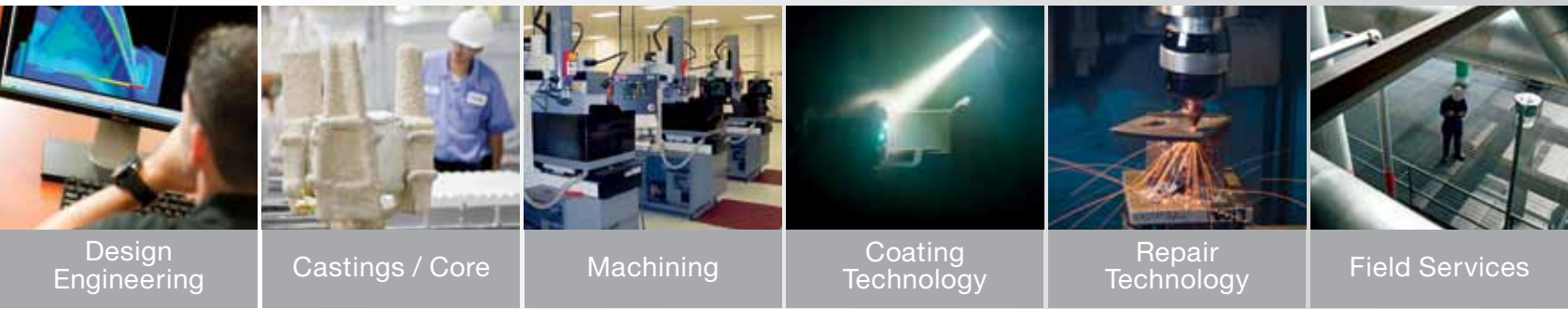
As an independent provider, we are uniquely focused on our customers and work together as partners. This approach enables us to provide the most reliable, technologically advanced solutions, and deliver those solutions in a flexible, cost effective manner.



Chromalloy supports a wide range of gas turbine engines.

GE Mature	GE Advanced	Siemens/MHI Westinghouse Mature	Siemens/MHI/AE Advanced	Alstom/ABB Mature	Alstom/ABB Advanced
Frame 3	Frame 6F	W251	SGT6-5000F (M501F/W501F)	9D	13E1
Frame 5	Frame 7F	TG20	M701F		13E2
Frame 6B	Frame 9F	501	SGT6-6000G (W501G)	11D	
Frame 7E		SGT6-3000E (501D5/A)	SGT6-4000F (V84.3A)	11E	
Frame 9E		701D	SGT5-4000F (V94.3A)	13D	
		SGT6-2000E (V84.2)	SGT6-8000H (NG60)		
		SGT5-3000E (V94.2)			
		AE94.2			
		SGT6-1000F (V64.3A)			

The Chromalloy Value Chain



Chromalloy combines our diverse expertise in aerospace, the military and power generation with a full scope of capabilities. This enables us to develop and deliver some of the world's most technologically advanced coatings, repairs and parts.

Innovation forms 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.

Chromalloy is the only non-OEM (Original Equipment Manufacturer) company in the world that provides gas turbine engine component coatings, repairs, castings, manufacturing and overhauls—all from a single source.





Through our wholly-owned subsidiary Turbine Services Limited, Chromalloy provides a wide range of services around the world. Turbine Services Limited is headquartered in Glasgow, UK.

- Gas Turbine Spares and Replacement Parts
- Component Repair Services
- Combustion Inspection Elimination Kit
- Gas Turbine Rotor Overhaul Services
- Field Support and Engineering Services
- Gas Turbine Refurbishment
- Long Term Service Agreements
- Sentinel C™ – Gas Turbine Control System
- TIGER® Condition Monitoring for Gas and Steam Turbines
- Training Courses for Gas Turbine Technologies

Life Cycle Cost Management – Chromalloy uses a two-step approach to deliver the most reliable and technologically advanced solutions in a flexible, cost-effective manner: (1) repair instead of replace and (2) replace non-repairable parts with OEM-equivalent components

Coating Technology



Chromalloy has been a leader in developing commercially viable aluminide coatings for decades. Today, we continue to provide these coatings and their derivatives to all the major OEMs, as well as owners and operators around the world. We are the world's largest provider of Low Pressure Plasma Spray Overlay and Electron Beam Physical Vapor Deposition (EBPVD) coatings. All Chromalloy coating technologies are designed to protect turbine components and increase their longevity.

Thermal Barrier Coating

- EBPVD 7YSZ
- EBPVD Low K Nd-YSZ
- Air Plasma Alumina
- Air Plasma 7YSZ
- Air Plasma Low K Nd-YSZ

Abradable Coating

- Plated CBN Tip
- Air Plasma Porous 7YSZ

Diffusion Coating

- Pack Aluminide
- Gas Phase Aluminide
- Pack/Gas Phase Chromide
- Pack/Gas Phase Platinum Aluminide
- Pack/Gas Phase Platinum Rhodium Aluminide
- Pack/Gas Phase Silicon Aluminide

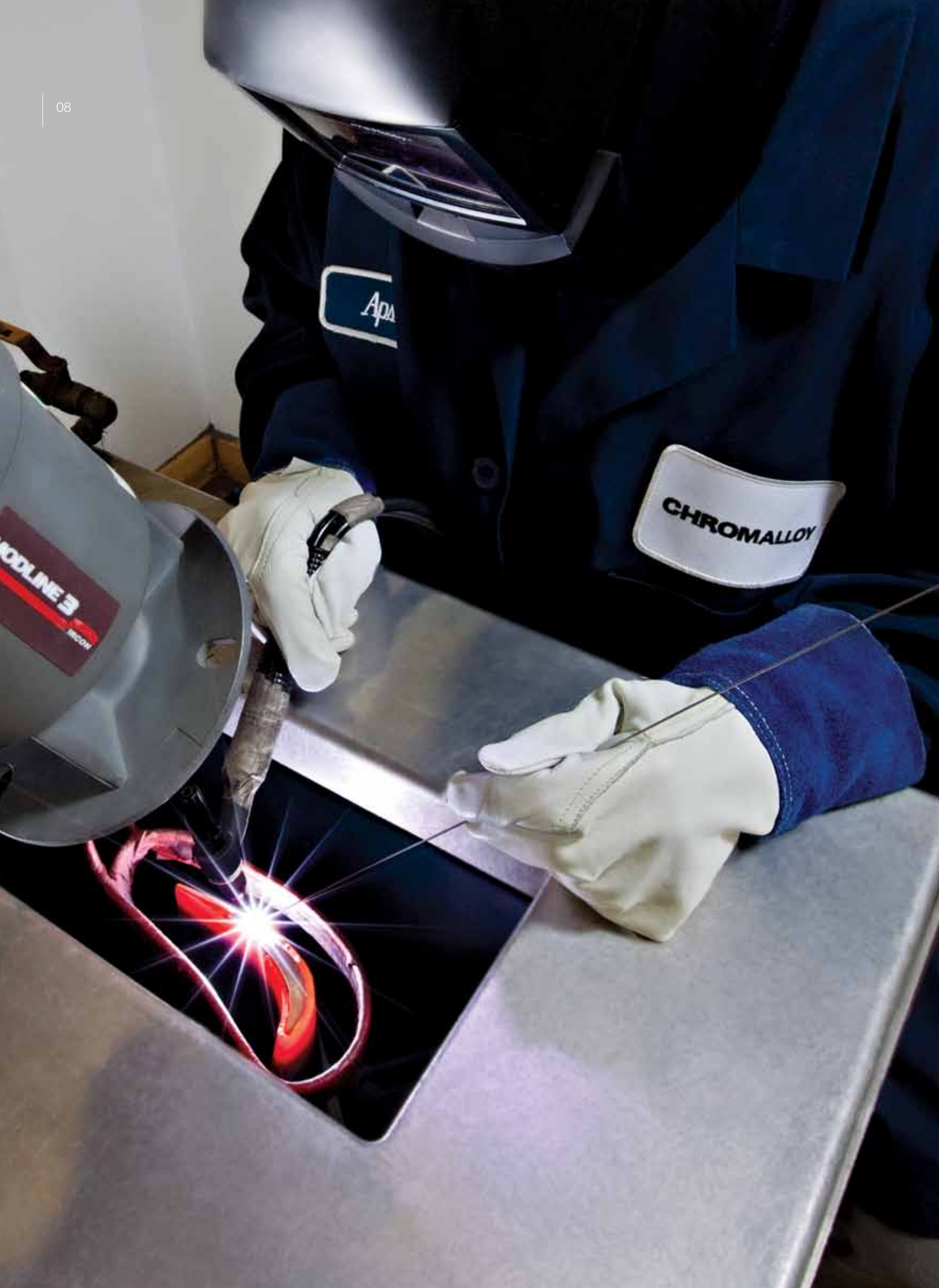
Overlay Coating

- EBPVD MCrAlY
- LPPS MCrAlY
- HVOF MCrAlY

Wear Coating

- Chromium Carbide
- Nickel Chromide







Chromalloy has analyzed thousands of engines and repaired over 1,000,000 heavy IGT components. We offer a full suite of repair capabilities for heavy industrial gas turbine engines from all the major manufacturers. Our dedication to research and technology has led to many proprietary processes for metallurgical and mechanical repairs that are simply unavailable from any other source.

Re-Engineering and Design Capabilities

- Coordinate Measuring Machine
- Video Measuring Machine
- ATOS scanning
- Full Engineering Analysis

Inspection Capabilities

- Eddy Current Inspection
- Fluorescent Penetrant Inspection
- Metallurgical Analysis
- Optical Contour Inspection
- Radiographic Inspection
- Ultrasonic Inspection
- Scanning Electron Microscope (SEM)
- X-ray Inspection
- Component Life Evaluations

Preparation Capabilities

- Chemical Stripping/Cleaning
- Degreasing
- Hydrogen Fluoride Ion Cleaning
- Water Jet Stripping and Cutting

Repair Capabilities

- Electron Beam Welding and Automatic TIG Welding
- 5-axis Laser Powder Welding with Vision System
- Induction Welding
- Gas Tungsten Arc Welding
- Coatings: Robotic HVOF, Plasma and Wire Arc
- Heat Treat and Thermal Processing
- Laser Cutting, Drilling and Shaping
- Honeycomb Sealing and Replacing
- Vacuum Furnace High Temperature Brazing
- Induction Brazing
- Automated Blending and Recontouring
- CBN Abrasive Tip Grinding
- Electro Chemical Grinding
- CNC Milling, Turning and Grinding
- Jig Boring and Grinding
- Shaped Hole Drilling
- Robotic Laser Drilling
- Vibro Super Polishing
- Chemical Plating
- Corrosion Resistant Painting
- Glass Bead Peening
- Steel Shot Peening
- Blade Moment Weigh Balancing

Capital Parts Development Technology



Chromalloy incorporates years of advanced coating and repair technology into the redesign, casting and manufacturing of our heavy industrial gas turbine parts. We utilize single crystal technology. And we use leading-edge manufacturing tools and processes to produce even the most sophisticated components with utmost precision. This generates high-quality components that not only cost less, but also perform equal to—and often better than—the OEM parts they replace.

Castings

The Chromalloy castings facility in Tampa, Florida is the most technologically advanced in the world. This, along with our other casting facility, allows us to provide a single source for replacement parts, and enables Chromalloy to meet the operational and financial needs of power producers 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 expedites turnaround times and reduces costs for customers around the world.

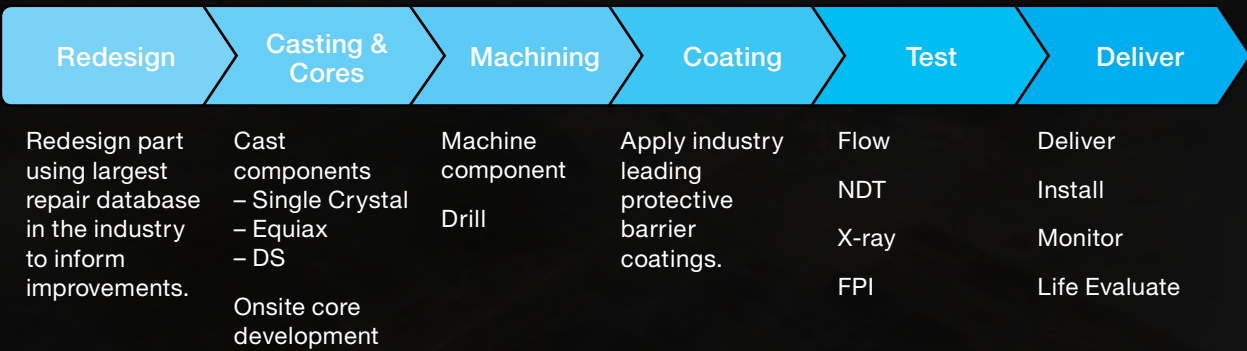
Technology

- Turbine Aerodynamic Design and Analysis
- Engine Performance Analysis
- Secondary Air System Design and Analysis
- Blade/Vane Cooling Design and Analysis
- CFD Analysis
- 3D Thermal Design and Analysis
- 3D Structural Design and Analysis
- Vibration/Modal Analysis
- Mechanical Design and Analysis
- Engine Instrumentation and Testing
- Engine Tuning and Optimization
- Hardware Characteristics



New Part Development Process

Chromalloy's capital parts development technology enables us to provide a fully-integrated supply chain.







Field Support, Engineering Services and Planned Maintenance Programs

Chromalloy staffs a wide range of experienced mechanical engineers, instrumentation and control engineers, field engineers, technical advisors and project managers. We promptly dispatch expert personnel to evaluate and perform both on-site and remote engineering services for planned and unplanned maintenance.

- Scheduled Outages
- Unscheduled Outages
- Comprehensive QHSE Programs
- Site Management
- Control Systems and Retrofits
- Electrical Engineering
- Fuel Conversions
- Technical Support
- Generator Overhauls
- Plant Commissioning
- Plant Upgrades
- Control Retrofits
- Plant Relocation
- Contractual Maintenance Agreements
- Auxiliary Plant Services
- Condition Monitoring and Diagnostics



Long Term Service Agreements

Chromalloy service agreements provide heavy IGT owners with predictable costs and reliable performance. Our agreements include complete management and maintenance services required for scheduled maintenance, unscheduled breakdown maintenance (with access to the Chromalloy strategic spare parts stockholding and rotor club), part repairs, plant modifications, condition monitoring, diagnostic trending, fault finding, plant improvements, inspection planning and more.

Controls and Remote Monitoring

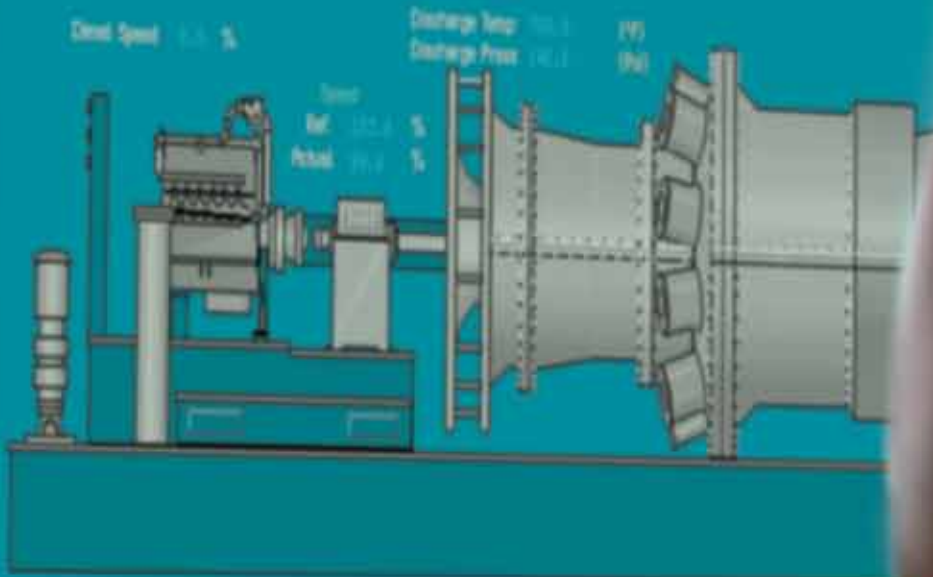
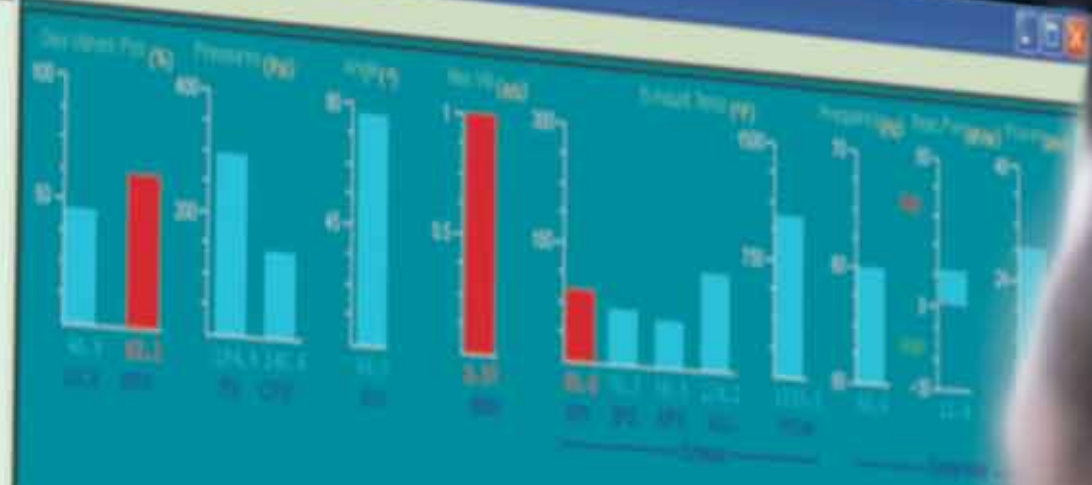
Control Systems

The Sentinel-C series of turbine control systems was designed specifically for the retrofit of heavy-duty gas turbine controls—particularly, the Speedtronic and LA families of turbine controllers. These systems follow the same turbine control philosophy as the original system and are easily adaptable to site-specific requirements. Once implemented, these systems can minimize downtime, increase availability and enhance reliability.

Condition Monitoring

TIGER® automates the knowledge of the best turbine engineers and continuously evaluates the condition of gas turbine engines. The software compiles a complete picture of the turbine in the last shift, day or week providing a simple-to-read diagnostic summary. TIGER® provides performance and maintenance calculations along with archiving and graphing capabilities which enable the analysis of trends and incidents in detail. The system allows colleagues to connect remotely to assist in turbine operations and alerts operators when problems occur.

- Alarm Server
- L1 Frame5
- K1 Frame5
- W1 Frame5
- W2 Frame5
- Z1 Frame5
- P1 Frame5
- Operating
- Performance
- Footprints
- Controller
- Thumbnail
- M1 Frame5
- C1 Frame5
- D1 Frame5
- O2 Frame5
- Z1 Frame5
- C1 UC500
- C2 UC500



STATUS	PLC	WINDMILL	PLC CONTROL	WINDMILL
<ul style="list-style-type: none"> ● Ready ■ Dis. in Prog ■ Comp. Dis. 	<ul style="list-style-type: none"> ● J0P01 ● J0P02 ● J0P03 ● J0P04 	<ul style="list-style-type: none"> ■ W1 ● W2 ● W3 ● W4 	<ul style="list-style-type: none"> ■ Start ■ Acceleration ■ Speed Drop ■ Speed Limit 	<ul style="list-style-type: none"> ■ Error Limit

DELL

Locations

Chromalloy's Worldwide Network



Our key industrial gas turbine facilities are located in New York, Florida, Scotland, the United Kingdom and Thailand.

Chromalloy Manufacture/Repair Facilities

Carson City, Nevada, 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
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
Melbourne, 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
 * Turbine Services is wholly owned by Chromalloy
turbineserviceslimited.com

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 — and everyday — to meet the needs of our customers, to extend the life of gas turbine engines and to reduce their operating expenses.

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