Turbomachinery Modifications and Rerates

As process plants and rotating equipment mature, efficiency and reliability can decline. Elliott Engineered Solutions improves the performance of turbomachinery from any manufacturer while maintaining the equipment's overall fit, form, and function. Elliott can:

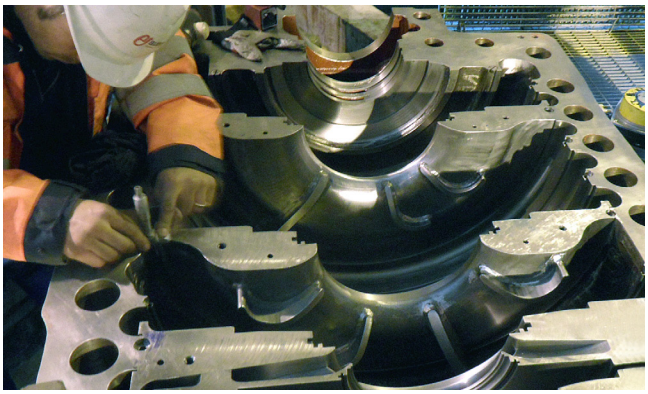
- Debottleneck your process through compressor and turbine rerates
- Extend the operational life of turbomachinery
- Integrate new components into existing installations with minimal disruption to plant operations or an outage schedule
- Reduce your environmental footprint through efficiency improvements and reduction of fugitive gas emissions via seal modifications
- Help solve the operational and reliability problems and increase the mean time between overhaul
- Improve the operation and monitoring of turbomachinery through controls and instrumentation upgrades
- Apply Elliott's technology to any rotating equipment regardless of the original equipment manufacturer (OEM)

Elliott begins modification and rerate projects with an inspection of spare rotors and parts. We review instruction manuals, overhaul history, and service reports to obtain a full understanding of the machine's history of operation and maintenance. We determine which existing components should be re-engineered and those that can remain unchanged. . We accurately reverse engineer components for which original drawings are unavailable. We apply the same high standards of quality and engineering to every piece of equipment, whether it was first built by Elliott or another manufacturer. We can provide critical spare components for your equipment prior to a shutdown to more quickly restore plant operations.

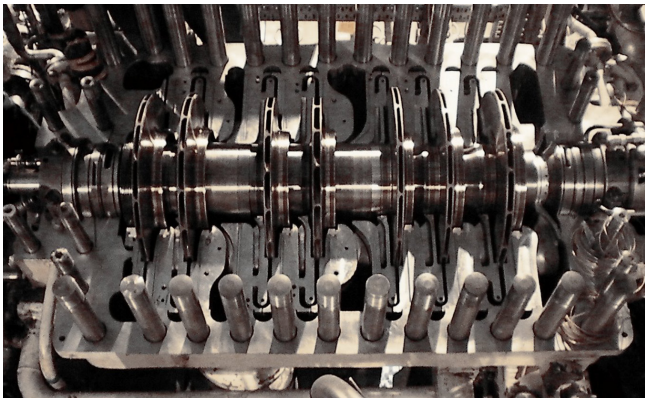
Drawing upon our strong history and expertise in materials, processes, applications, and testing, Elliott promises to maintain or enhance the integrity, reliability, and performance of our customers' machinery. We know what it takes to keep equipment performance and reliability high and maintenance costs low.

Non-Elliott compressor prior to rerate of flow path components.

CMM inspection of casing bore in preparation for field machining new diaphragms.



Field service engineer checking diaphragm fit in casing prior to assembly.



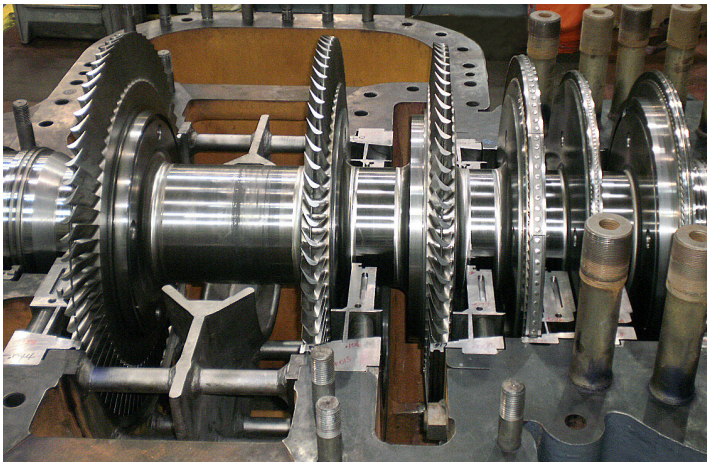
New Elliott flow path installed in casing at customer site.

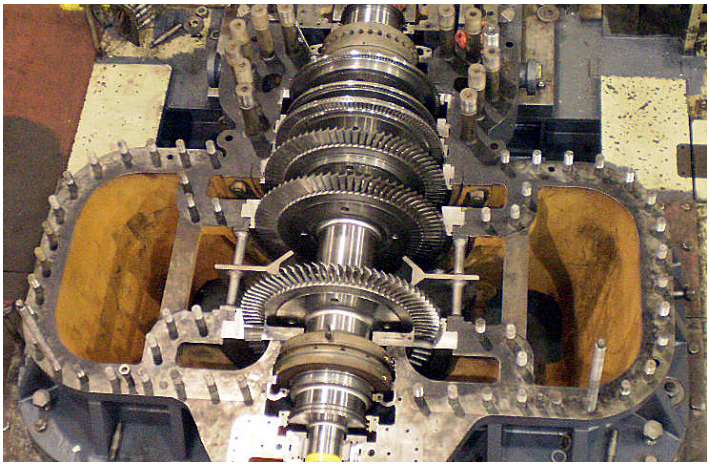
Elliott Engineered Solutions

Elliott Engineered Solutions has one focus – to help turbomachinery operators obtain the highest value from their critical rotating equipment. Elliott has more than 100 years of experience in engineering, manufacturing, repairing, and modifying all types of turbomachinery. Elliott Engineered Solutions specializes in the following areas:

- Modifications and rerates of turbomachinery to increase the operational life and value of your investment by optimizing performance and reducing downtime.
- Reverse engineering and comprehensive analytical studies such as lateral and torsional rotor analysis, root-cause failure analysis, mechanical evaluation analysis, finite element analysis (FEA), and aerodynamic analysis.
- Onsite audits to evaluate turbomachinery efficiency and determine potential reliability improvements to maximize your return on existing equipment.
- Reapplication of previously owned equipment for emergency installation or cost-effective replacement.
- Equipment configuration designs to precisely fit existing footprints.

Enhancement	Category	Benefit
Upgrade compressor flowpath (impellers, interstage and eye seals, diaphragms and rotors)	Efficiency	Increase performance, increase or decrease capacity
Seal Upgrades (DGS conversations, cartridge oil seals, abradable seals)	Reliability, Efficiency	Reduce emissions, improve reliability, improve efficiency by leakage reduction
Upgrade journal and thrust bearings to directed lube, offset pivot, or chrome copper pads	Reliability, Efficiency	Improve rotor dynamics, reduce parasitic losses, reduce bearing temperatures
Upgrade impellers and diaphragms with Pos-E-Coat	Efficiency, Reliability	Increase performance or capacity, eliminate deposits and corrosion
Upgrade turbine flowpath (nozzles, diaphragms, rotor, blades and seals)	Efficiency, Reliability	Increase performance or capacity, improve reliability with materials upgrades
Upgrade governor, servo motor and actuator	Reliability	More precise and reliable control, eliminate mechanical linkage wear
Upgrade control system	Reliability, Safety	Keep turbine or compressor operating within a safe range
Add electronic overspeed protection	Safety, Reliability	Increase trip speed accuracy and dependability





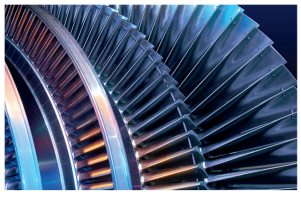
Rerate of 10,500 HP non-Elliott turbine

ELLIOTT GROUP
EBARA CORPORATION

901 North Fourth Street
Jeannette, PA 15644-1473
Phone: 724-527-2811
Fax: 724-600-8442
Email: info@elliott-turbo.com

www.elliott-turbo.com

THE WORLD TURNS TO ELLIOTT



COMPRESSORS ■ TURBINES ■ GLOBAL SERVICE

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