APRIL 2024 AEROSPACEMANUFACTURINGANDDESIGN.COM

AEROSPACE MANUFACTURING and DESIGN

Dedicated to the Design, Manufacturing, and MRO of Aircraft and Aerospace Components

MASTERING COMPLEX

precision machined parts

JR Machine uses Mastercam software to circumvent hardware limitations.

HURCO's 5-Axis Cantilever Machining Center

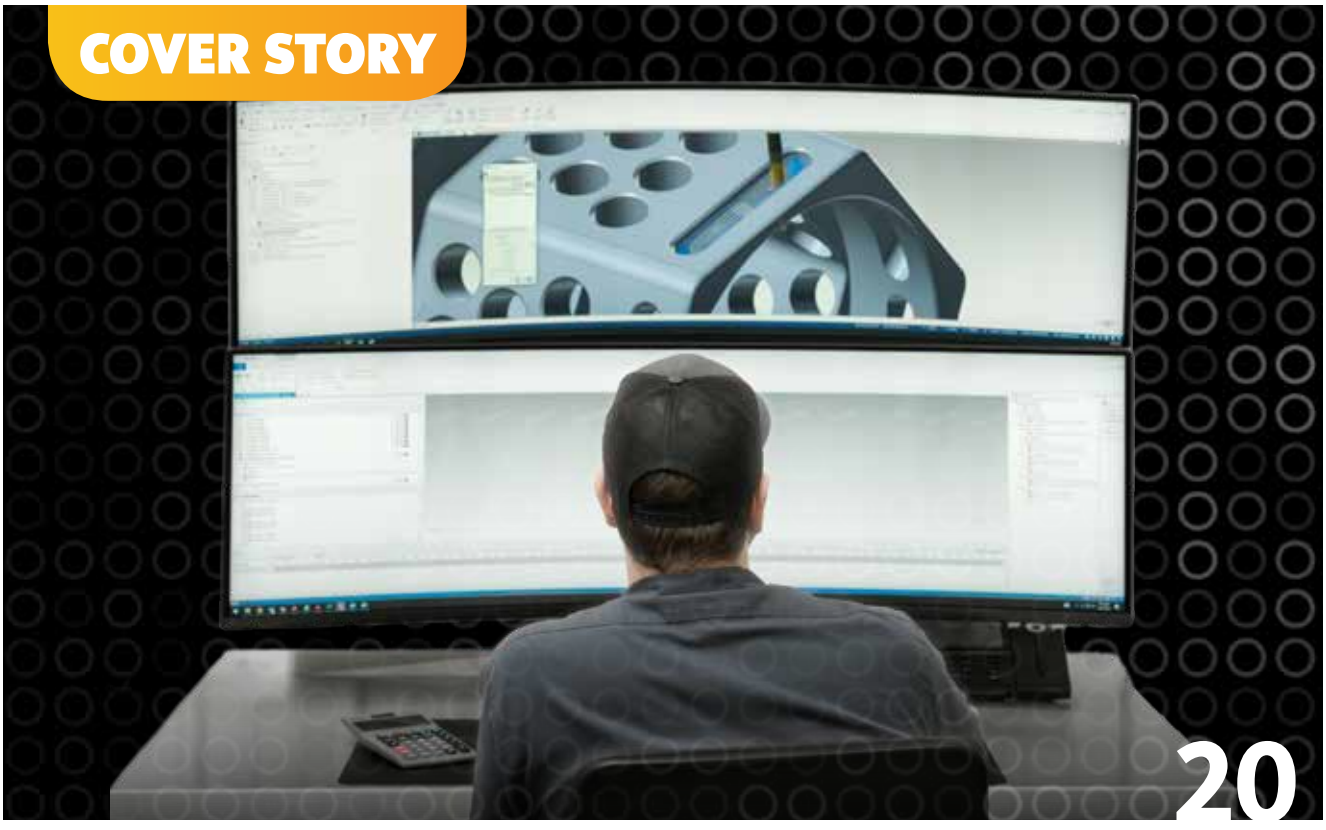
MILLSTAR TOOLING's Variable Helix Variable Flute End Mill

SMW AUTOBLOK's Zero-Point Vise System

AEROSPACE MANUFACTURING and DESIGN

APRIL 2024
Volume 18 Issue 3

COVER STORY



COVER PHOTO COURTESY OF JR MACHINE

DEPARTMENTS

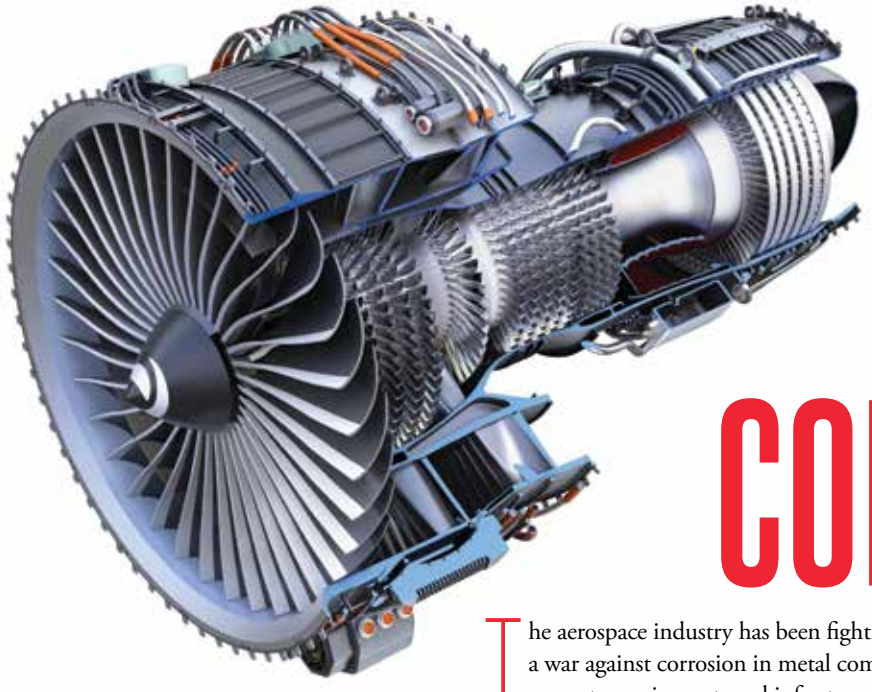
FEATURES

COVER STORY

16

28

AEROSPACE MANUFACTURING AND DESIGN (USPS #025-557) is published semi-monthly: January/February, March, April, May, June, July, August, September, October, November/December. Subscriptions and classified advertising should be addressed to the Valley View office. Periodicals postage paid at Cleveland, Ohio, and additional mailing offices. Postmaster: Send address changes to AEROSPACE MANUFACTURING AND DESIGN 5811 Canal Road, Valley View, OH 44125. Canada Post: Publications Mail Agreement #40612608 Canada Returns to be sent to The Mail Group, P.O. Box 25542, London, ON N6C 6B2



LASERS REMOVE CORROSION

Clean technology lasers offer superior corrosion removal in multiple aerospace applications.

By Del Williams

The aerospace industry has been fighting a war against corrosion in metal components, equipment, and infrastructure at great expense for generations. From the production line to the flight line, to the maintenance, repair, and overhaul (MRO) hangar, aerospace manufacturers, operators, and technicians combat corrosion. Through time, corrosion inevitably degrades readiness, airworthiness, and safety, reducing the time aircraft or spacecraft are available for operations.

"The global cost of corrosion is estimated to be $2.5 trillion, which is equivalent to 3.4% of the global gross domestic product (GDP)," according to a National Association of Corrosion Engineers (NACE) Int'l IMPACT study to examine the role of corrosion management in industry and government and to establish best practices.

Given the massive outlay, proactively controlling corrosion is imperative and can have an equally impressive return on investment (ROI).

"By using available corrosion control practices, it's estimated that savings of between 15% and 35% of the cost of corrosion could be realized, i.e., between $375 and $875 billion annually on a global basis… The fact that corrosion control provides a cost benefit is a lesson learned over and over again by industry, often too late and following catastrophic events," the NACE Int'l IMPACT study continues.

However, traditional methods of removing aerospace corrosion can be messy, laborious, time consuming, and can even pose serious health hazards.

Today, one of the easiest to use and most effective alternatives in the war against corrosion is the increasingly important category of industrial-grade, clean technology lasers.

With this approach, precision laser-based systems are used to remove corrosion, contaminants, paint, and residues with a high-energy laser beam leaving the substrate unaffected. Preparation and clean-up time are minimal, and the low-maintenance equipment can last decades. The technology minimizes operator exposure to potential environmental health hazards. In addition, no consumables are necessary.

Limits of conventional corrosion control

Any industry with metal components, production equipment, or infrastructure exposed to water, fluids, moisture, or atmospheric humidity continually fights corrosion which causes deterioration and loss of materials and their critical properties due to chemical and electrochemical reactions of the exposed surfaces with the surrounding environment. Corrosion affects the microstructure, mechanical properties, and physical appearance of the materials.

The direct cost of corrosion includes a loss of materials, equipment, and produc-

PHOTOS COURTESY OF LASER PHOTONICS

OPPOSITE PAGE:
Pretreating metal surfaces of engine parts to remove corrosion, grease, residue, old coatings, or to roughen the surface of metals prior to coating is critical in aerospace manufacturing.

tion, plus the cost of repair, maintenance, and replacement. Additional losses can result from accidents, injuries, and even loss of life, as well as payments to repair environmental damage.

An important niche area of corrosion control involves pretreating metal surfaces to remove corrosion and contaminants before coating or welding. Although metal surface pretreatment is a small portion of industrial corrosion control, it's crucial to ensure the safety, performance, and longevity of components and structures.

Insufficient coating pretreatment can lead to inadequate protection from the environment, leading to potential coating failure, moisture entry, and accelerated corrosion as well as increased maintenance, early replacement, and warranty issues. Insufficient weld pretreatment to remove corrosion and contaminants can lead to weakened or failed welds and necessary rework as well as substantial safety, liability, and litigation risk.

Eliminating corrosion

It's necessary to remove corrosion, residue, oil, grease, or paint before coating a component, production equipment, or infrastructure to improve coating adhesion. Toward this end, laser-based systems have significant advantages over traditional methods, starting with ease of use.

"With laser-based systems, an operator simply points and clicks a high-energy laser beam at the surface. The substrate isn't affected by the laser, and the systems don't create any mess or byproducts. The approach is eco-friendly, energy-efficient, and completes the job in approximately half the time of traditional methods when preparation and cleanup are considered. Also, no consumables are required," says Wayne Tupuola, CEO of Orlando, Florida-based Laser Photonics, a provider of industrial grade CleanTech lasers for cleaning and surface conditioning. The company's systems function either as mobile standalone units or can be integrated into production lines.

Laser Photonics' laser systems are available in portable and stationary models ranging from 50W to 3,000W with chamber sizes from 3ft x 3ft to 6ft x 12ft. The systems can also be installed in manufacturing lines in cabinets or operated by a robotic arm.

Laser pre-treatment of metal surfaces can be used to streamline manufacturing processes and remove rust from various components. CleanTech lasers are also used to refurbish production equipment or infrastructure, such as when removing a previous coating along with any corrosion to facilitate the new coating's adhesion to the surface.

Another common laser application involves pre-weld treatment to remove corrosion, mill scale, residue, and any impurities on the surface of the base material that would compromise the weld's effectiveness.

Laser treatment is also used for post-weld cleaning to increase life expectancy and corrosion resistance of a welded joint. Post-weld cleaning is important for stainless steel as well. Welding can cause a heat tint, a discolored, thickened top layer on stainless steel around the weld bead within the heat affected zone, compromising corrosion resistance. Removing the heat-tinted top layer is necessary to restore stainless steel's full corrosion resistance and aesthetic value.

A further benefit of the laser systems is some of the most advanced units are designed to last for decades. For example, CleanTech laser systems can last for 50,000 to 100,000 hours. In addition, little maintenance is needed, and no consumables are required.

Given the enormous cost of corrosion and inherent limitations of typical control methods, lasers are becoming a best-practice technique to combat corrosion. Laser treatment effectively removes corrosion for many applications, minimizes cleanup time and operator exposure to potential environmental health hazards, lasts for decades, and requires no consumables. **A**

Laser Photonics
www.laserphotonics.com

About the author: Del Williams is a technical writer based in Torrance, California.

Using industrial-grade, precision laser-based systems is a better option to remove paint, contaminants, rust, and residues with a high-energy laser beam while leaving the substrate unaffected.