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The Shot Peener

Sharing Information and Expanding Global Markets for Shot Peening and Blast Cleaning Industries

IN THIS ISSUE:

Peening Innovation

COVERAGE CHECKER

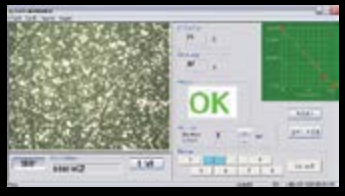
COVERAGE CHECKER

COVERAGE CHECKER the device for easy and precise coverage measurement

UV Light version
New arrival!

- UV light version Coverage Checker measures coverage by the fluorescent paint peeling rate, using UV light.Therefore, measurement result will not be affected by surface condition.
- UV light version Coverage Checker can measure the coverage even on oxidized surfaces and uneven peened surfaces, which was difficult to measure with normal version.

Coverage Checker (Original)
Easy USB connection to your PC



※PC is not included ※Device image
※Specifications of this device may be changed without notification.

Positron Surface Analyzer

PSA Type L-Ⅱ　　PSA Type L-P

Non-Destructive Inspection

by Anti-coincidence System

US Patent : US 8,785,875 B2

Application

- Shot peening inspection
  (Inspection Depth : Down to 100 micron)
- Evaluation of Fatigue behavior
- Evaluation of sub-nano size defect
- Free volume on Polymer and Glass

Specification

Device size : Type L-Ⅱ W400 X L400 X H358 [mm]
Type L-P W125 X L210 X H115 [mm]
Positron source : Na-22(under 1MBq)
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THE SHOT PEENER

Sharing Information and Expanding Global Markets for Shot Peening and Blast Cleaning Industries

OPENING SHOT

Jack Champaigne | Editor | The Shot Peener

Never Standing Still

The New LM Series MagnaValve

MagnaValves for wheelblast machines were developed in 1990 using cast aluminum for durability. We have seen valves still in good working condition after 10-15 years of service, but we wanted to offer a MagnaValve with a new design.

We took advantage of injected plastic moldings that are durable and easier to fabricate. We designed the internal opening with a wider center section instead of at the ends of the valve. This helps protect the ends of the valve from abrasion and erosion. We eliminated several post casting machining steps which allowed us to include aspiration air cooling of the internal valve components (patent pending).

The new LM MagnaValve series has a fixed size bolt-hole pattern. This also makes it easy for installers to exchange a valve if more or less maximum media flow rates are needed. Its polycarbonate casing makes life easier for the installers in other ways—the valve is lighter and easier to install if the valve is installed at a great height. This valve's new replaceable wear plate is easy to replace, too.

SAE Committee Continues to Seek Advancements for the Industry

The Surface Enhancement committees of SAE met in Troy, Michigan in May for their semi-annual meeting. These committees maintain the "J" Standard Practices and the "AMS" Aerospace Material Specifications relating to surface enhancement. Several topics were addressed:

- Improvements to computer-generated shot peening saturation curves SAE J2597 by including a "goodness of fit" criteria. This would identify data points too far removed from the generated smooth fit curve.
- Improvements to SAE J443 Procedures using Standard Shot Peening Almen Test Strip. These improvements will allow the aerospace specifications to refer directly to J443 without redundantly repeating information. When changes are made to J443, they flow through to the AMS 2430 and AMS 2432.
- A high-density Ceramic Shot developed by Saint Gobain Zirpro was added to the AMS media types. This higher density media will compete with cast steel and cut wire media in some applications.
- Walter Beach continued his campaign to get needed data either on the drawing or on the purchase order. This is a great resource for designers as a checklist for drawing callouts such as number and location for Almen test strips. He has seen numerous times how the same part but coming from different customers would offer different guidelines on quantity and placement of Almen holders.

If you are interested in joining the Surface Enhancement Committees and helping to shape the future of our industry, please contact me at jack.champaigne@electronics-inc.com. There is no fee to attend the meetings and you can also participate via WebEx.

Twenty-five people attended the meeting plus three by WebEx from Europe.

THE SHOT PEENER

Editor
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Electronics Inc.

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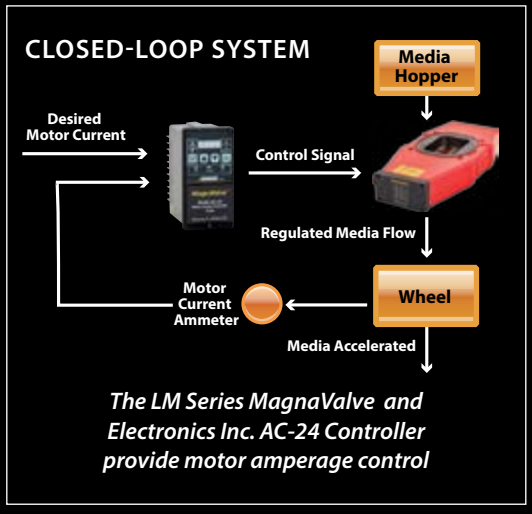

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* Patents pending

CASE STUDY
GelSight | www.gelsight.com

Kalitta Air Eliminates False Failures with GelSight Mobile™

GelSight's full digital mobile metrology solution enables $350K in end-customer savings

KALITTA AIR is an American cargo airline headquartered at Willow Run Airport in Ypsilanti Township, Michigan. As a leading provider of air cargo transportation, they run a fleet of over 350 Boeing freighters to provide scheduled or on-demand charter service for customers in the United States and around the world.

Kalitta Maintenance Power Plant Division, a division of Kalitta Air, is a world-class full-service MRO that offers a complete range of maintenance services for General Electric CF6-80C2, CFM56-3, and CFM56-7 engines, as well as Pratt & Whitney PW4000 engines and 901A APUs.

THE CHALLENGES

Before engaging with GelSight, Kalitta Maintenance relied on a variety of measuring tools including micrometers, calipers, optical micrometers, etc., to perform heavy checks and major overhauls/repairs. A lot of time was spent measuring and then re-measuring parts costing thousands of dollars and man-hours per year.

Kalitta Maintenance needed a solution to measure scratches, gouges, nicks, pitting, and various surface defects on blades, TRFs, and other miscellaneous engine and APU parts. Some parts have radii and angles where Kalitta Maintenance could not get quality, repeatable measurements which has resulted in long test set-up time, false failures, unnecessary scrap or rework, and higher costs.

For a CFM56-7B C-1 fan blade, the Kalitta Maintenance team faced extreme difficulty when using their existing tools to accurately measure the part to its 0.004" (0.1 mm) go/no-go tolerance since it has a compound, reflective, and curved surface. Seven of these blades were showing wear on the shank area due to contact with the platform seals and were ready to be scrapped due to being out of tolerance. Replacement blades are roughly $50K each, so Kalitta Maintenance was faced with billing their end customer $350,000 if the damage was truly out of tolerance.

THE SOLUTION

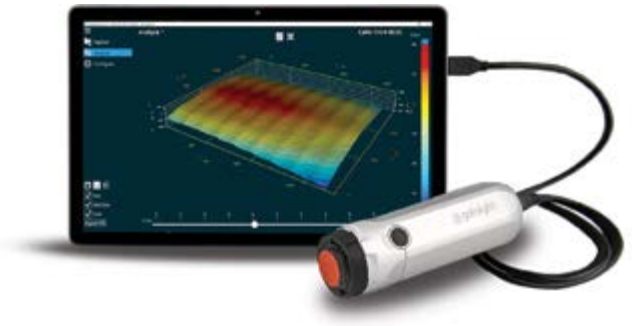
Knowing that their end customer would not be happy with a $350K bill for replacement blades, Kalitta Maintenance looked for a more accurate, repeatable alternative to their existing suite of surface inspection tools and identified GelSight as a leading candidate for consideration.

Kalitta Maintenance quickly found that GelSight was able to repeatedly measure the gouges on the CFM56-7B C-1 fan blades to well within the 0.004" (0.1 mm) tolerance. This enabled the team to put the blades back into service and pass the cost savings on to their end customer.

GelSight's ISO-17025, NIST-traceable accuracy to approximately 0.0002" (5 microns) provided more than enough spec headroom for these measurements. In addition, its fast measurement time, simple user interface, and high-resolution 3D display increase productivity when viewing the surface under test. The system's built-in software also instantly creates a PDF report with pictures, graphs, and data that Kalitta maintenance shares with their customers, who appreciate seeing the details for themselves. In summary, GelSight's surface inspection solution enables Kalitta Maintenance to make rapid and well-documented quality assurance decisions with confidence.

THE SUMMARY

By partnering with GelSight, Kalitta Maintenance now has a platform to provide a detailed, accurate surface inspection process that can generate significant gains in productivity in a variety of their MRO applications, while also reducing the costs associated with many manual or tool-based inspection techniques. The system is a great asset to their arsenal of measuring tools and speeds up their inspection process on certain parts they are examining. For one customer, Kalitta Maintenance was able to re-inspect damage on seven individual C-1 blades for a CFM engine and redisposition them into active inventory, saving the customer $350,000 in replacement parts using GelSight's technology.



GelSight Mobile™ is a handheld instrument that precisely visualizes and measures the 3D topography of any surface, revealing microscopic structures that are difficult to detect using traditional inspection techniques.

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Langdon Feltner and Paul Mort | Purdue University, School of Materials Engineering, Center for Surface Engineering and Enhancement

Stress Field Modeling in Context of Industrial Shot Peening

Abstract
The compressive stress field imparted by shot peening has distributed surface and depth profiles relating to media characteristics and impact conditions. While the average surface stress and depth profile may be consistent over a large area, variability depends on the local scale of scrutiny—for example, in relation to a feature size of the part being treated, or size of peening media. In this paper, we analyze datasets obtained from finite element modeling of peening with media having experimentally-measured size and shape distributions, with detailed attention to the variance of the stress fields over a range of reference scales.

Industrial shot peening – a distributed process
Considering industrial shot peening as a distributed set of discrete impacts, one can assess stress field uniformity based on spatial and temporal variation of surface impacts during the peening process. Fundamentally, shot peening is a stochastic process, with thousands of individual particles impacting each part in random positions (Miao et al., 2009). While the resulting surface stress may be fairly uniform averaged over the full part, the local variability of the stress field increases as the scale of scrutiny approaches the shot size. In this paper, we consider the systematic analysis of stress field averaging and quantification of its scale-dependent variability.

Media size and shape distributions change during the process, i.e., due to rounding, hardening, and breakage. Other machine parameters can also contribute to variability, complicating the prospect of modeling such a process. Though these sources of variability are certainly unavoidable in any shot peening process, they do not necessarily have to inhibit a practitioner's ability to make predictions about their process and parts. Through careful and thoughtful analyses, shot peening practitioners in any industry can make robust predictions about the stress states present in their parts and the variability therein.

Stress field simulation
A finite element simulation of the shot peening process was used as a reference model of the surface stress field (Figure 1). It was generated through random sampling of a shot media size and shape distributions, obtained experimentally using a SolidSizer (JM Canty, Lockport, NY) particle measurement system (Mort et al., 2022). The simulated target was a 5 mm by 5 mm representative volume element of an Almen strip; stress residuals were calculated using 65 m/s impacts with a Johnson-Cook isotropic hardening material model (Ghanbari, 2020). The flux of media was based on industrially relevant process parameters.

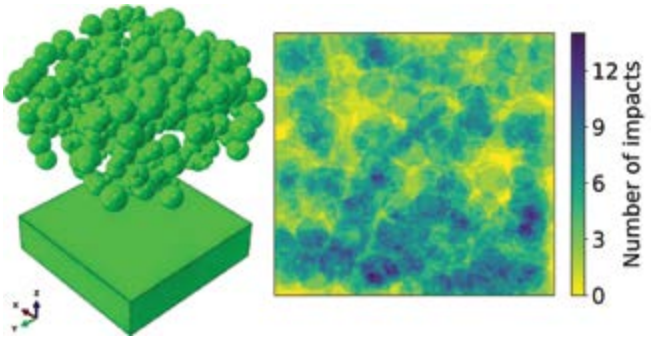

Figure 1. FEA model of shot peening process and map of spatial distribution of impacts on the surface of the substrate: a) media flux, pre-impingement; b) impingement locations.

The random placement of particles on the surface of the part creates both densely and sparsely impacted regions on the surface of the part. This is shown by the impact locations (Figure 1b) as well as the deviatoric analysis of the stress tensor in the X, or 11 direction, on the surface of the part plotted as the colormap variable (Figure 2). The average diameter of the shot particles was 0.837 mm and leaving dimples with a size of around 0.2 mm in diameter. The heterogeneous stress field suggests a need for textural model, i.e., one that predicts variation as a function of scale.

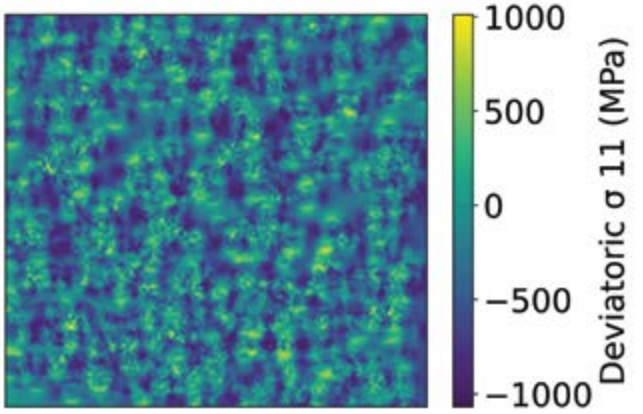

Figure 2. Spatial distribution in the deviatoric component of surface stress in the reference direction.

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Experimentally, residual stress analyses of shot peened parts often employ an X-Ray diffractometer to measure the in-plane linear elastic stresses. The sin2 (ψ) method (Prevey et. al, 2020) and the cosα method (Tanaka, 2018) provide an integral of the stress over lateral spacings on the order of 2 mm diameter, depending on the specifics of the X-Ray source and fixturing. This is a standard practice for process monitoring and/or validation. In this paper, we consider applications requiring higher resolution—for example, materials having structural features and/or failure criteria (e.g., critical crack length) <2 mm. Modelling extends the stress field resolution to the grain scale, enabling residual stress analyses at relevant scales of scrutiny, i.e., detailed spatial and statistical analyses of the stress state in shot peened parts, accounting for temporal, spatial, and stochastic variability present in the process.

To mimic a physical experiment, the entire second order Cauchy stress tensor was extracted from every node in the substrate FEA model. One of the limitations of XRD residual stress measurement is a lack of the ability to measure hydrostatic, or mean, stress; therefore, the stress tensor at every point is resolved into hydrostatic and deviatoric components and only the deviatoric portion is kept. Another assumption of the XRD stress measurement system is that the stress state in the substrate is purely in-plane, so only the stress values associated with the XY-Plane are considered. Feasibly, a shot peening practitioner would define a reference orientation for the part when they measure the residual stress on the surface of the part. Since the particles in this study impact the surface of the substrate in random locations at a 90˚ angle of incidence, the X, or 11, direction was assumed to be the reference orientation for this part, and the deviatoric component of σ11 was used in the analysis.

Scale of Scrutiny

The uncertainty of stress field analysis depends on the scale of scrutiny over which the residual stress is being measured or calculated. In the case of XRD measurements, residual stress is the arithmetic average of the stress within an irradiated region, which is typically greater than the size of the media. At this scale, the variability of the stress state is relatively low. In comparison, at a scale less than a shot particle size, the stress state varies in relation to the local distribution of impacts. To perform an uncertainty analysis of the stress field as a function of the scale of scrutiny, we consider: 1) a sampling technique to pick equally sized and continuous regions of the substrate, and 2) a method for describing the stress-depth profile and associated uncertainties at each scale.

The FEA substrate was subsampled into equally sized cubic elements with nodes at each corner (Figure 3). This means that the part is a three-dimensional grid-work, consisting of discrete values for stress at equally spaced intervals throughout the body. Since the substrate is 5 mm by 5 mm, the reference or mean state is the average stress state

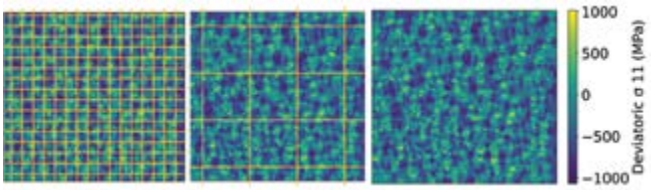

Figure 3. Slicing of the substrate into equi-sized subsections allows for the variability in stress state to be determined across scales of scrutiny.

for all nodes at each discrete depth. The sides of the substrate were divided sequentially into discrete length divisions. As the number of side divisions increased, the unit cell length decreased. The stress depth profile for each unit cell is calculated as the average stress value for the nodes at each discrete depth in each unit cell.

The stress state within each unit cell was described with equation 1, providing a continuous stress-depth profile. The ability to fit a continuous function to describe the stress depth profile greatly simplifies the shape of the stress-depth profile into interpretable coefficients. In this case, the stress-depth profile is modeled as a modified stretched exponential function (Equation 1), where, σ* is the stress on the surface of the part, x* is the characteristic depth, describing the curl or relaxation of stress close to the surface of the part, and m describes the rate of decay of the compressive stress into the thickness of the part and is related to the compressive penetration depth.

$$\sigma(x) = \sigma^* \cdot exp\left(1 - \left(\frac{x}{x^*}\right)^{\frac{x}{m}}\right) \quad \text{Eq. 1}$$

This function has added the convenience of being linearizable (Equation 2), and since the surface stress is fixed, a traditional linear regression is sufficient to fit the characteristic depth and decay factor to the simulation stress depth profile. This equation describes the mean stress depth profile in the substrate. The breadth of the distribution of stress values as a function of scale of scrutiny was analyzed relative to the mean.

$$ln\left(1 - ln\left(\frac{\sigma}{\sigma^*}\right)\right) = \frac{x}{m}\left(ln(x) - ln(x^*)\right) \quad \text{Eq. 2}$$

Discussion of Results

An example of the technique is shown in Figure 4, sampling the stress values at each depth across all unit cells. The mean stretched exponential fit is shown. Regardless of the scale of scrutiny, the mean remains the same. The main difference is the width or breadth of the stress values in the depth profile. The difference in breadth of the stress values is striking, when comparing a scale of scrutiny of 1 mm, similar to the XRD stress measurement scale, and 50 microns, similar to a grain scale.

In order to use this type of analysis as a quality measure in an industrial application, a user can predict the boundaries of the prediction interval for residual stress vs. depth curves

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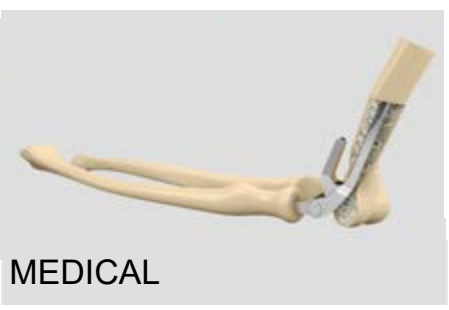

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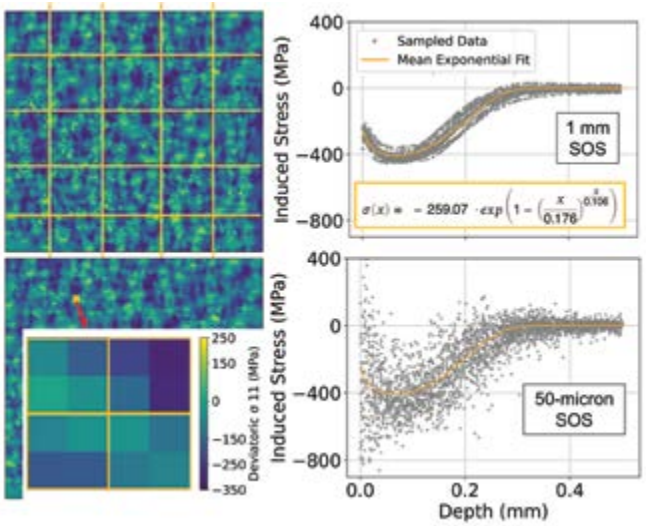

Figure 4. The breadth of the point cloud of stress values is determined by the size of the unit cell being evaluated and the depth at which the stress is measured.

in the body of the substrate as a function of the scale of scrutiny by constructing probability distributions for the stress values at each depth of the FEA model. In this case, each depth was assigned an individual Gaussian probability density function, with the mean value evaluated at the center of the mean exponential fit and the variability determined by the breadth of the prediction interval as a function of depth. Figure 5 shows the set of all stress-depth profiles from the FEA reference model, with the relative frequency of values in a particular region shown as the color. The 99% prediction intervals for the stress were based on the probability model assigned at each depth.

At a 1 mm scale of scrutiny, the entire prediction interval is in compression, and the width of the prediction interval is about 200 MPa at the surface of the part. At a 50-micron scale of scrutiny, the prediction interval for surface stress is much wider, spanning 1500 MPa. At this scale of scrutiny, localized stress fields can be tensile or compressive, ranging from 500 to -1000 MPa in residual stress. Evaluating stress

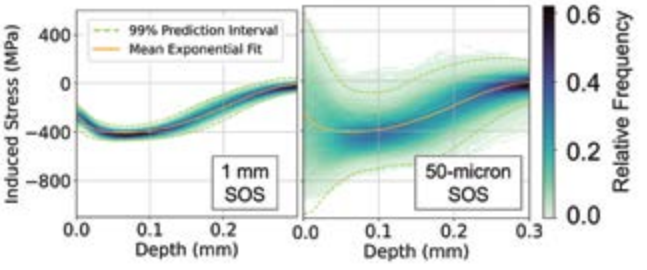

Figure 5. At a given scale of scrutiny, prediction intervals can be constructed for the stress-depth profile, showing the range of stress values present in a part at each discrete depth.

field prediction intervals as a function of scale can provide insight on part quality and performance metrics. As a next step, we propose to develop work-process guidelines relating the selection of media and process parameters to quality objectives on the basis of relevant scales of scrutiny.

Conclusion

Shot peening researchers and practitioners continue to refine and develop understanding of the peening process. In this paper, we consider peening as a distributed process having parameters affecting the variability of stress fields in treated parts. A statistical assessment of stress field variability is a foundation for building quality models relative to critical scales of scrutiny.

This paper illustrates the scale dependency of residual stress imparted by shot peening. The effect of scale on the prediction interval is striking, especially at the surface. As a quality measure, we anticipate using this framework to inform predictive performance models of shot peened parts, enabling industrial practitioners to link selection of media and process parameters with product quality objectives.

Acknowledgments

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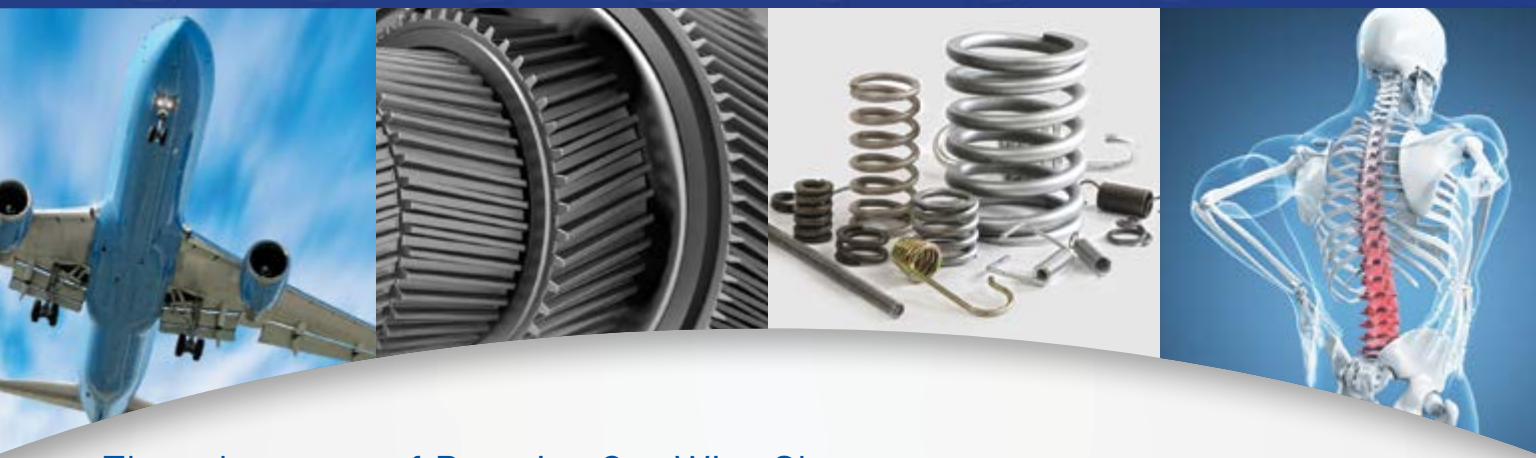

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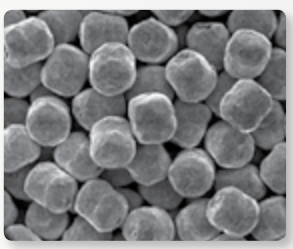

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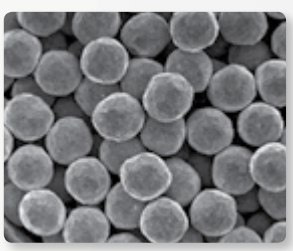

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Professionals performing mobile Rotary Flap Peening can benefit greatly from the ergonomic and easy-to-use angled handpiece of the RotoFlapMaster. Designed to provide increased comfort, improved control, and enhanced safety, it provides a smoother and more efficient working experience. The angled handpiece is fully compatible with the RotoFlapMaster control unit, making it an excellent choice for anyone seeking to upgrade their peening process.

Applications

Today's applications of Roto Flap Peening go beyond the well-known repair processes on aircrafts. Aerospace components, as well as large energy sector parts, can be peened easily without free-flying spherical media. The condition for a reliable process, above all, is accurate control of the flap speed. Having a well-engineered, intuitive tool simplifies the process and ensures it can be done correctly and safely.

Flap peening of a pin hole

The application though can be very tricky as the areas to be peened are often hard to access and to view due to narrow structures and difficult surface orientations.

Engineering an innovative Flap Peening tool thus means to address these challenges and to provide flexible operation, easy handling and control as well as versatility for various situations.

RotoFlapMaster

The innovative RotoFlapMaster by sentenso utilizes a drive system that has been developed in close cooperation with experienced operators from the aviation industry. The user interface assists selecting the correct flap speed per the operator's input of desired intensity and flap size. Starting and stopping, as well as timing, are controlled via a single membrane button on the handpiece.

One of the RotoFlapMaster's greatest benefits is its cordless battery operation allowing for real mobile and independent operation.

Straight and Angled Handpiece

The straight and the new 90˚ angled design of the handpiece enable the user to perform flap peening in many application situations—ergonomically and functionally. The design is based on customer-specific requirements through real repair jobs on aircraft components and all in accordance with AMS2950 and other specifications.

The ergonomic angled handpiece is available as an option for the RotoFlapMaster and is fully compatible with the established control unit. The change between straight and angled handpiece is extremely easy and quick with the help of the push-pull connector. Operating functions of the angled handpiece include:

- Starting and stopping the drive
- Starting the stopwatch or countdown timer
- Colour changing indicator for checking the correct speed

Other features are:

- Distinctive ergonomics and comfortable feel
- Quick change between straight and angled handpiece
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For further information, please visit https://flapmaster.sentenso.de.

The RotoFlapMaster with straight handpiece

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AN INSIDER'S PERSPECTIVE

Kumar Balan | Blast Cleaning and Shot Peening Specialist

Analyzing What We Know

Part 2

Opportunities arising from new developments

In Part 1 of our discussions in the spring edition of *The Shot Peener*, we discussed four topics of varying familiarity in blast cleaning and shot peening. We explored the effect of shot hardness on the resulting intensity and the possibility of increasing intensity without affecting coverage rate which is the case with the use of larger peening media. We debated the potential damage that broken media and unconditioned particles of cut wire could cause on the part surface. We suggested alternate means of validating peening intensity rather than Almen strips. Finally, we touched upon the subject of reclaim system efficiency—a discussion that is not often prevalent among users of shot peening equipment. These topics were chosen for their ability to generate a transfer of ideas that will be useful during an operational crisis such as when investigating foreign object damage on a peened component, or a new component requiring a higher intensity without sacrificing coverage rate, and so on. My hope and expectation are that this discussion will help the reader apply such possibilities before a crisis attains critical mass.

Continuing along the same theme, but looking ahead into developments in our industry, Part 2 of our discussion will focus on four other topics that I found interesting. These subjects could lead to increased efficiencies in existing processes and perhaps pave the way for some new ones: (a) Use of portable (handheld or robot-mounted) lasers, (b) controlling surface roughness through optimal shot distribution, (c) techniques to predict intensity and coverage, and (d) shot peening electric battery components to increase their charging speed.

Academic advancements run the risk of being deemed esoteric and therefore not commercialized. Here, I will use the following evaluation criteria to assess the concept's viability and adoption probability:

- Does the concept have practical adaptability?
- Has the concept been fully developed and tested?
- Is the concept financially feasible?
- Is the concept scalable?
- Are the resources required for its implementation readily available?
- Is the concept widely applicable (or is it specific to an industry sector?)

Portable lasers

Back in Fall 2021, we learnt the intricacies of Laser Shock Peening[1] and noted the multiple advantages of this alternate peening process over conventional shot peening. Higher depth of compressive residual stress, the absence of media (breakdown), and dust in the process make this process particularly attractive to critical sectors. These sectors include specialty aerospace, power plant component repair, and similar areas that have zero tolerance for foreign object damage.

Two papers on Laser Shock Peening were submitted at the 14th International Conference on Shot Peening (ISCSP) in 2022. The first article[2] in reference presents the following findings. A handheld pulse laser oscillator was used instead of the pulse laser device that is commonly employed for laser peening. The ensuing increase in fatigue strength confirmed its use as a viable laser peening source. Laser peening with this source, though responsible for creating a rough surface, the roughness average was still lower than caused by conventional peening and current laser peening techniques. The practical adaptability of this process can be matched with Rotary Flapper Peening which enjoys a special place in applications that require in-situ processing. We have known laser peening to incorporate elaborate equipment with techniques that have been custom developed for specific parts and peening targets. Whether this portable technique opens avenues to make this alternate process more approachable and universal and most importantly financially viable, remains to be seen.

A second paper[3] at this conference extends this theme with a compact laser peening tool including a handheld laser the size of a human thumb and mounted on a collaborative robot (COBOT)[4]. This project utilized a microchip laser as the powering device for the laser which is also responsible for the compact size of this unit. The following features of this system

[1] *"Laser Shock Peening", Kumar Balan, The Shot Peener, Fall 2021*

[2] *"Improvement of fatigue property of A7075 aluminum alloy by laser peening with handheld laser device", K. Masaki, Y. Sano, Y. Mizuta and S. Tamaki*

[3] *"Development of a peening device with a handheld laser on a collaborative robot", Y. Sano, Y. Mizuta, S. Tamaki, K. Yokofujita, K. Masaki, T. Hosokai and T. Taira*

[4] *Collaborative robots, also referred to as COBOTs, are designed to work in conjunction with humans and do not pose the same interference danger as conventional robots. They are deployed where flexibility is key as compared to a traditional robot that excels in repeated tasks.*


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make it an attractive package: A water circulation system, that is part of the power supply, recovers and reuses the water used in laser peening. The portability claim of the system is that it can be transported as "two checked pieces of airline baggage"! Since the handling is by a COBOT, the authors claim that this system eliminates the need for perimeter fencing and other such safety requirements. Though this claim will likely be location-dependent, and subject to verification by regulations, the high-power microchips along with the COBOT present opportunities for its use in onsite peening.

Evaluation: Laser peening is not commonly seen in high-production environments, but in specific applications that require compression beyond the extent provided by conventional peening. The above techniques certainly enhance the reach of this technology to new avenues (bridge repair, infrastructure maintenance, etc.). Laser peening is spreading its applicability, and the resources for its adoption are also available. Several companies (vendors and labs) are testing such systems for niche applications that are slowly bridging the applications gap between conventional and laser peening. At the present time, this technology continues to be in developmental stages for mainstream, high-production applications due to its known limitations of cycle time and investment requirement.

Media size distribution in shot peening

Blast cleaning relies on a healthy work mix of sizes of abrasive particles. Larger size particles dent the rust and scale, pulverizing them whereas smaller size abrasive in the mix get into tight areas to accomplish cleaning. However, we have always professed that this should not happen in shot peening where our reliance on constant shot size is high on the agenda to maintain uniformity of the residual stress generated and distributed in all part areas. But intensity and coverage are not always the only goals in peening—the resulting surface roughness after peening is also important. A paper[5] submitted by the Center for Surface Engineering and Enhancement (CSEE) at Purdue University explains a new possibility. The subject of this study was to predict roughness and residual stresses on a peened part as a function of shot size distribution and impact velocity. Surface roughness after peening needs to be limited since increased roughness runs the risk the developing stress rises leading to fatigue failure.

This test is explained in the context of dual peening. Dual peening is where a component is subject to two rounds of peening—the first with larger size shot that generates the required residual stress at the desired depth, and the second a smaller size shot to minimize surface roughness. Another documented advantage of dual peening is that it spreads the compression over a greater depth on the part. Calibration of this test was done by using experimental Almen strips. The shot sizes chosen were 0.6, 0.43 and 0.35 mm (S230, S170 and a size smaller between S110 and S170). The study arrived at two interesting conclusions. When the test piece was peened with a controlled distribution of shot sizes (for example: 33% of each size or 20-40-40 of the three sizes), the resulting surface roughness matched (was as smooth as) that created by sequential peening except that this was achieved in a single pass (around 25 Rz microns at 80 m/s shot velocity).

The second conclusion of this experiment was that the compressive residual stress generated with a mix of shot sizes was greater than that developed with sequential impacts (peening with large shot size and repeating with smaller shot). Evaluation: This study has far-reaching impact considering dual peened parts must be processed in a second cycle requiring additional processing time and resources (additional machine, space and associated operating costs). Though a pilot project, CSEE has the resources to scale the learnings to commercial applications for those readers that are interested in exploring this avenue for their production peening process.

Predicting coverage

I find it a bit unsettling that an important process variable such as coverage still relies on human assessment which is subjective at best. This unfortunate fact also validates drawings reflecting the end-user's skepticism requiring the peening provider to achieve greater than 100% coverage. Though tools such as fluorescent tracers, dye markers, replicas and computerized coverage checkers are employed for coverage assessment, all these require human validation at some point in the process. In a separate discussion last Fall[6], we learnt about the extent of AI in our world and how it could impact our immediate world of cleaning and peening equipment[6]. A group of scientists at the ARTC (Advanced Remanufacturing and Technology Center) in Singapore applied Deep Learning to predict coverage on a peened part[7].

At the core of Artificial Intelligence (AI) is Deep Learning (DL). As a subset of Machine Learning (ML), DL involves intensive analysis of data to make recommendations. Examples include analysis of medical data, creation of complex musical compositions, etc. This study has followed along this path and combined information from multiple datasets to predict coverage with a high rate of accuracy. The group trained the DL model with actual images from parts made of two different metals at varying percentages of coverage. Like

[5] *"Controlling surface roughness through shot media size distribution", David Bahr and Siavash Ghanbari, Purdue University*

[6] *"Artificial Intelligence in our industry", Kumar Balan, The Shot Peener, Fall 2022*

[7] *"Application of Deep Learning to predict shot peening coverage", YHA Chua, AB Wang, HC Ang and A Shukri, ARTC Singapore*

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with all modeling exercises, the validity is only as good as the input data. To increase the accuracy of their model, this group peened the test samples to five different coverage percentages, had two experienced operators examine them and used the average value as acceptable data. The data was further enriched by taking 30 images of each coverage percentage using a telecentric lens at five different coverage percentages and 10 coverage ranges. Efficacy of this model was based on its ability to predict the correct percentage of coverage over the total number of predictions made. The model accuracy was in values greater than 90%. Inaccuracies were not vague, but in the neighboring coverage range from the actual values.

A commercial software called SuaKIT was employed to develop and train this DL model. This performance of this model is limited to the extent of images that have been provided for its learning. This limitation can be overcome if a conscious effort is made to record coverage rate data over multiple material test specimens.

This technique is best suited for peening operations that process similar or same parts on a regular basis. The percentage prediction accuracy will get fine-tuned with capturing and learning from more images of parts with similar geometry and metallurgy.

Shot peening and electric batteries

No discussion today can be complete without an animated and opinionated conversation concerning the proliferation of electric vehicles! We studied the opportunities this new market can provide to us shot peeners in a recent article[8]. We concluded that a great opportunity exists if shot peening can be "built-in" as an advantageous process for new, high-torque components in an Electric Vehicle (EV). I was highly encouraged when I came across an article on shot peening of electrical battery components at the ISCSP 2022[9]. Rapid charging of electric batteries is a topic of intense research and source of competitive advantage among manufacturers in this sector. However, rapid charging presents a challenge that is brought about in this study, along with a possible solution.

Fast charging results in the generation of lithium dendrite that penetrates the Solid Electrolyte (SE) layer and damages the battery due to an internal short circuit. This limits the speed at which this battery can be charged.

An ASSLiMB (All solid-state lithium-metal battery) is preferred over a lithium-ion battery due to the energy density limitation of the latter. The ASSLiMB battery also uses fire-resistant material as the electrolyte, minimizing its ignition risk. However, as explained earlier, high-speed charging results in dendrite growth and potential damage if it exceeds a critical current density (CCD). The anode and cathode in such a battery is separated by the SE layer. The lithium dendrite grows into this SE layer by developing a crack and connects the anode and cathode, causing the short. Shot peening this SE layer increases its toughness and prevents crack generation. Further, surface roughness, a side-effect created by peening, enhances the electrochemical reaction between the electrolyte and the anode.

I am certain that there are other applications of shot peening and grit blasting in different EV components waiting to be discovered as this technology evolves.

Is peening evolving?

I am often confronted by the existential question—"what now?" In response, I have convinced myself that we are going to see evolution happen in regular, incremental doses. It is not reasonable to expect the same revolutionary impact that the steam engine and electricity had in our ancestors' lives! However, we are faced with some amazing technologies in our lifetime as well. Whether it be through AI, Machine Learning, or ChatGPT, the prudent step would be to utilize such tools to optimize our process responsibilities. I look forward to reporting more on such developments in future articles.

Note: ChatGPT could not have generated this article!

[8] *"Understanding changes to our industry", Kumar Balan, The Shot Peener, Spring 2022*

[9] *"Shot peening of all-solid-state lithium metal battery for high-speed charging", M. Kodama, K. Takashima and S. Hirai, School of Engineering, Tokyo Institute of Technology, Japan.*

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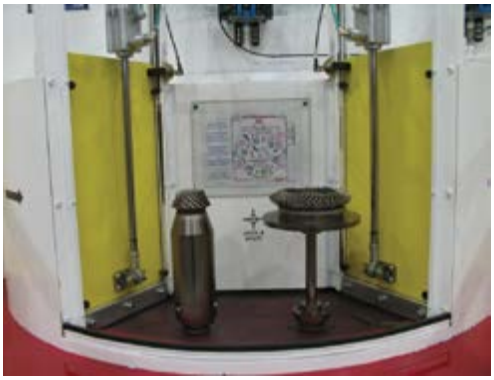

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Shot Peening Statistics

INTRODUCTION

The purpose of this article is to assist readers in understanding the increasing number of applications of statistics in shot peening. Mathematics here is kept as simple as possible. The worst abuse of statistics occurs when measurements are simply entered into a formula which is not appropriate. Statistical programs are now routinely available, e.g., within Excel.

Many shot peening factors vary including shot particle diameter, air pressure, wheel speed and Almen gauge parameters. Best practice demands that measurement values, i.e., data, are carefully stored and accessible. Every piece of data can be regarded as being a result from an experiment and has lasting value. It is regrettable that some companies discard data after it has served its immediate purpose.

Statistics is the science of making decisions in the face of uncertainty. We cannot know, for example, what exactly the arc height of an individual peened Almen strip will turn out to be. This is in spite of our best efforts. Random variation of measurement factors will always occur and there may also be systematic variation—as, for example, when supplied air pressure falls steadily.

METHODS OF ANALYSING DATA

The most commonly used methods of analysing data are either pictorial or arithmetical.

Pictorial Methods

Bar charts and histograms are familiar ways of displaying collections of data values. Playfair introduced bar charts in 1781 and histograms were introduced by Pearson in 1891. Table 1 is a hypothetical data set for thickness measurements on Almen strips.

Table 1. Hypothetical set of thickness data values for a box of Almen A strips.

Thickness band - mm	Number of strips
A 1.27-1.275	6
B 1.28-1.285	15
C 1.29-1.295	40
D 1.30-1.305	30
D 1.30-1.305	9
Total	100

Using the pictorial Bar chart method with Table 1 data we get fig.1.

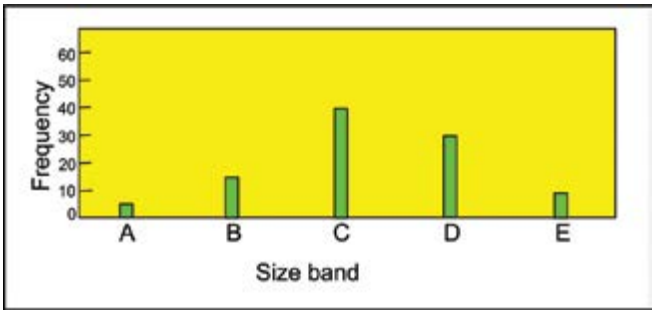

Fig.1. Bar Chart of Table 1 data.

Using the pictorial histogram method with Table 1 data we get fig.2.

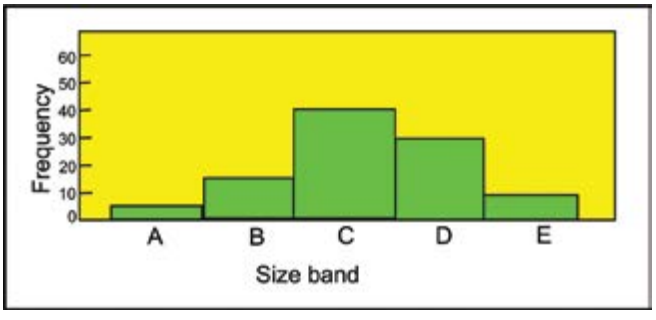

Fig.2. Histogram of Table 1 data.

A comparison of the same data, presented in figs.1 and 2, reveals the advantages of histograms. The principal advantage is that the size band width indicates the variation within each band. It is perhaps surprising that it took over a century for histograms to largely supersede bar charts.

Arithmetical Location Methods

Arithmetical methods produce quantities that summarize the data. Each quantity is then properly called a "statistic".

The **mean** is by far the most important commonly used measure of location. To obtain the mean we simply add up all the values in the data set and divide by the number of values in the data set. The term "average" is synonymous with "mean".

The **median** is the magnitude for which half of the data values are less than the median and half are greater than the median. It is meaningful if the frequency plot is severely skewed.

The **mode** is the value of the variable that occurs with the greatest frequency. The midpoint of the tallest box gives a good estimate of the mode. For the data given in table 1 this is 1.2925 mm (the middle of size band C in Table 1).

When the size distribution of data values is roughly symmetric, the mean, median and mode values will be very close together. If, however, the distribution is very skewed they will have quite different values. Fig.3 is an example of a severely skewed distribution.

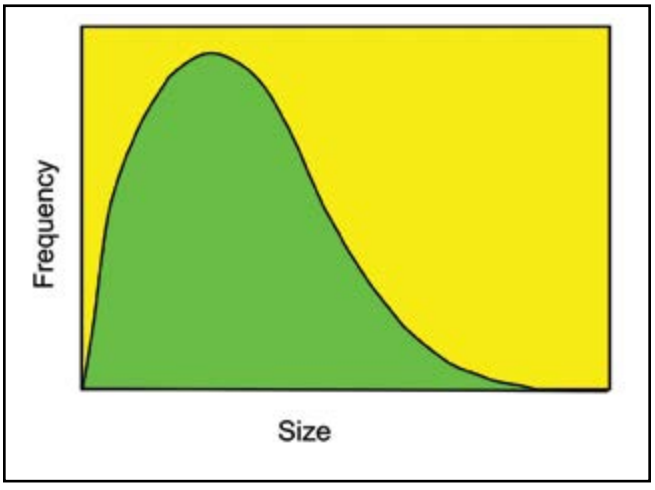

Fig.3. Skewed size frequency curve.

Arithmetical Variability Methods

It is often important to be able to quantify the variability of the data within a set. The simplest method is the **range**; this is the difference between the largest and smallest values in the data set. However, there are strong practical reasons for preferring a statistic called the "**variance**" , or its square root, which is called the "**standard deviation**". The mathematical bases for variance and standard deviation are of very limited interest to most shot peeners. Consider, however, a different situation. Imagine that we are trying to determine whether or not a set of newly minted coins are biased. Using the "heads or tails" approach, tossing a single coin would not allow any conclusion to be drawn. If two coins were tossed there are three possible outcomes—two heads, two tails or one head and one tail. The outcome would give a faint indication of coin bias. Tossing three coins would give a much better indication. A four-heads outcome would arouse significant doubt as to lack of coin bias. The moral is that the larger the number in any data set the lower will be its variance. An example of applying arithmetical variability methods is, however, given as follows:

Find the range, variance and standard deviation of these six measurements.

0.9, 1.3, 1.4, 1.2, 0.8 and 1.0.

Note that both variance and standard deviation values are easily calculated using readily available programs. For example, using Excel. Enter the six values of this data set into A1 to A6. Then highlight any other box. In the formula bar type = STDEV.P(A1:A6) and press Enter. The standard deviation value then shows up immediately as 0.216.

Excel results for this data set:
Range = 1.4 – 0.8 = **0.6**
Variance, s^2 = 0.0467
Standard Deviation, s = 0.216

ACCURACY AND PRECISION

Having been able to assess data set location and its variability, attention can now be turned to its accuracy and precision. Figs.4 to 7 illustrate the significance of the parameters of these normally distributed Almen arc heights. Fig.4 shows the ideal situation where (a) the average of the measurements coincides with the true arc height and (b) the measurements have a low variability, ranging from a to b.

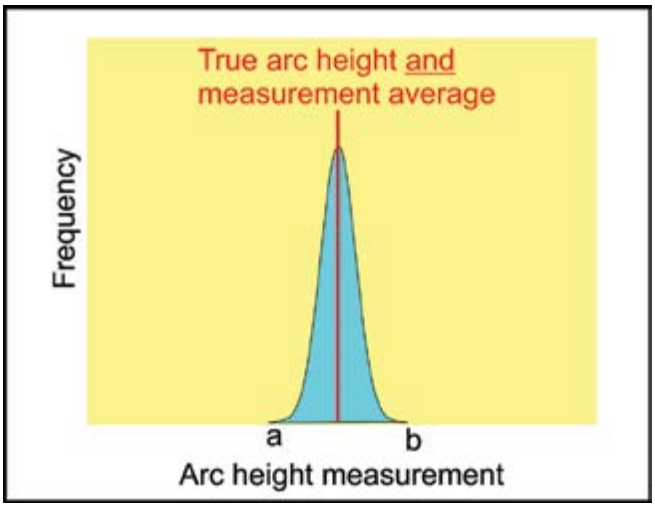

Fig.4. Good accuracy and good precision.

For fig.5 (page 30), the average of the measurements is substantially different from the true arc height—indicating poor accuracy. Bias is the name given to the difference between any true value and a measurement mean. The variability could, however, have been good—as good as that shown in fig.4—indicating good precision.

For the situation shown in fig.6, the accuracy is good since the measurement average is the same as the true value. The measurements do have considerable variability thus indicating poor measurement precision.

The worst case scenario is indicated in fig.7 where both accuracy and precision are poor.

COMPARISON OF DATA SETS

Table 2 illustrates how comparison statistics can be employed. For this example, two sets of Almen strips, A and B, from the same box, were peened. Each strip was given the same

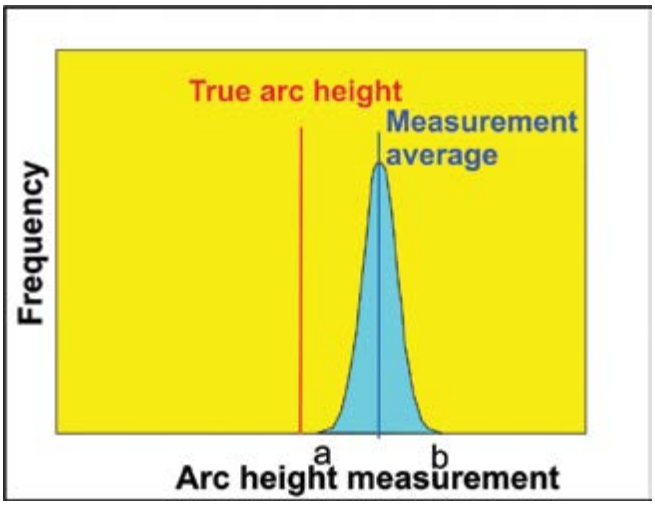

Fig.5. Poor accuracy but good precision.

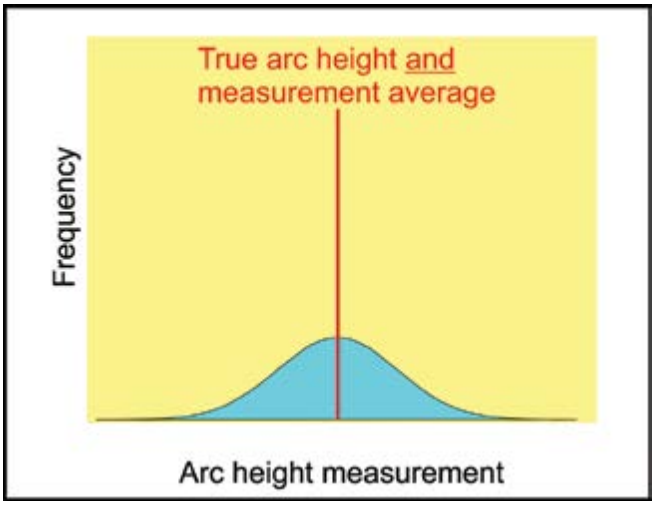

Fig.6. Good accuracy but poor precision.

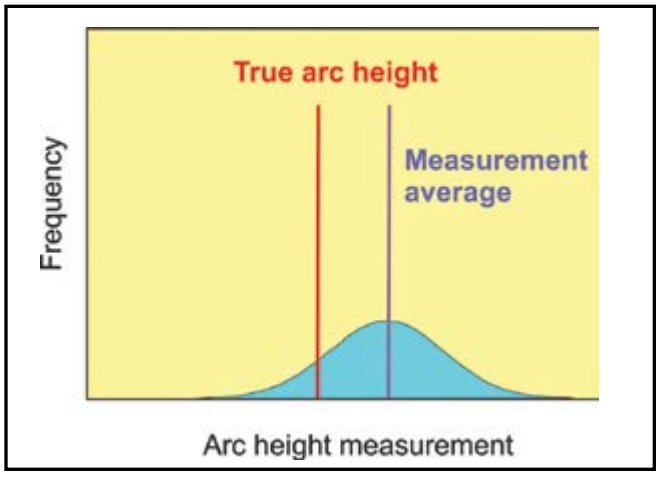

Fig.7. Poor accuracy and poor precision.

nominally identical exposure and intensity. Measured arc heights varied, with those in Set A being much less variable than those in Set B. The reasons will be discussed later in the article.

Table 2. Variability comparison for two sets of peened Almen strips.

Strip No.	Arc heights (inch x 1000)	
	Set A	Set B
1	6.2	6.3
2	6.3	6.5
3	6.3	5.9
4	6.2	6.7
5	6.5	6.0
6	6.3	5.9
7	6.3	6.4
8	6.4	6.3
9	6.2	6.2
10	6.3	6.5
11	6.3	6.7
12	6.1	5.9
Mean	**6.30**	**6.30**
Standard deviations	**0.1**	**0.30**

Table 3 presents a useful quantification of relative variability for the two sets of strips.

The magnitude of the standard deviation allows us to predict the probability of a future single measurement being away from the mean. This probability is stated in Table 3.

Table 3. Probability of a new measurement's value relative to the mean.

Number of standard deviations away from the mean	Probability of obtaining a new measurement value
1	**One in three**
2	**One in twenty**
3	**One in four hundred**

The universally accepted values given in Table 4 can be applied to the measurement values given in Table 2. Remember that "probability" is not the same as "certainty". For one standard deviation away from the mean, Set A contains four measurements—1,5,8 and 12—which just happens to be "one in three". For Set B there are five values—3,4,6,11 and 12—which is less close to "one in three". For two standard

deviations away from the mean Set A has just strip 5 outside —close to the probability of "one in twenty". Set B doesn't have any—still not too far from the probability of "one in twenty". For three standard deviations from the mean neither set has a strip measurement as expected from the probability of "one in four hundred". Any new measurement more than three standard deviations from the mean should ring alarm bells.

We can usefully quantify the origin of different values of standard deviation for Almen arc height determinations. In order to do that we use the term called "variance". Variance is simply σ^2, where σ is the standard deviation. The advantage of using variance is that total variability is simply the sum of the variances of the contributory factors. The total variability of repeated Almen arc height values, $\boldsymbol{\sigma^2_T}$, is made up of the separate variances due to strip variability, measurement errors, and variations in applied peening parameters. Hence, we have that:

$$\sigma^2_T = \sigma^2_S + \sigma^2_M + \sigma^2_{AP} \qquad (1)$$

where S, M and AP refer to strip, measurement and applied peening parameters respectively. Almen strips are produced to very close tolerances so that the σ^2_S contribution should normally be very small. "Premium grade" strips will produce a smaller variance than "standard grade" strips (other factors being equal). The σ^2_M contribution depends upon the quality of the Almen gage and the operator's skill/assiduousness. With good equipment and careful attention to detail, σ^2_M should also be relatively small. The major factor contributing to variability would then be predicted to be σ^2_{AP}. During actual shot peening there will always be some variation of the parameters that would affect strip deflection. Examples are: air pressure fluctuation, variations in flow rate and shot size (as when a batch of new shot is working its way through). Equation (1) quantifies contributions to total Almen strip measurement variability.

Consider, by way of illustration, two examples—A and B—reflecting good and poor combinations of factors respectively. Table 4 shows the results of applying equation (1) to hypothetical values (expressed in units of thousandths of an inch) of peened Almen strip.

Table 4. Effect of separate variances on total variability, σ^2_T , of Peened Almen strip deflection.

SET		σ^2_S	σ^2_M	σ^2_{AP}	σ^2_T
A (Good)	Variance	0.0001	0.0009	0.009	0.01
B (Poor)	Variance	0.0016	0.01	0.078	0.09

For the values given in Table 4, the applied peening variability predominates.

Data variability can, and should, be minimized by careful attention to all three contributory factors.

Bias

One obvious source of bias is the original strip curvature or "prebow". The origins and minimization of bias include: support ball wear, zero error and gage calibration over the full working range.

PEENING INTENSITY

Peening intensity is, perhaps, the most important statistic that we must deal with. It is estimated using a set of data comprised of four or more arc heights of Almen strips peened with nominally constant peening parameters. This procedure is, of course, familiar to all shot peeners. Fig.8 has the usual factors of a Solver Suite program with 99% confidence limits added. Each individual data point is subject to variability. Making repeat measurements at the same peening time would reveal the degree of variability. Careful attention to measurement factors can reduce, but not eliminate, the variability of each data point. The number of strips in the set is, however, important because it affects the variance of the derived intensity value. A larger number of data points in a set will improve the accuracy of the peening intensity estimate.

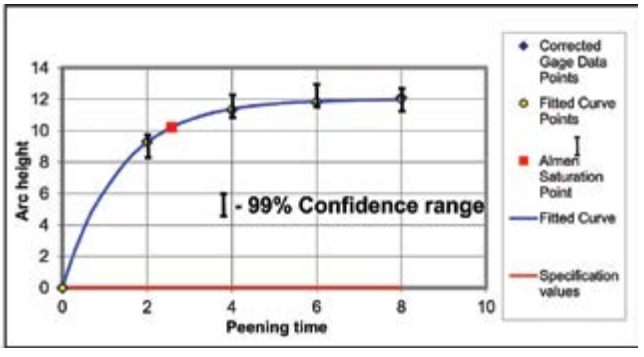

Fig.8. Variability of measured data points within a 99% confidence range.

CONCLUSION

Statistics is a subject that pervades everyday life. Several of the factors relevant to shot peening have been presented in this article. Consideration of those factors should feature in practical peening operations.

Are you looking for an earlier article by Dr. David Kirk?

The library at www.shotpeener.com has all of Dr. Kirk's articles from *The Shot Peener* and his conference papers going back to 1981.

Visit *https://www.shotpeener.com/library/kirk_articles.php?pn=1* to access the articles or scan the QR code.

CWST Facility in Brampton, Ontario Expands Capabilities

Curtiss-Wright Surface Technologies (CWST) operates a network of forty shot peening facilities in eighteen countries. These facilities were established to service manufacturers who are usually within a 100-mile (160 km) radius. Each facility is unique in that they are designed based on the regional customers' product mix.

The Brampton, Ontario facility opened in 1969 to service McDonnell Douglas in our 85,000 sq. ft. facility—our largest shot peening location in North America. It was designed to perform wing skin forming and job shop peening. The following aircraft had their wings formed at this location: C17 Globemaster (170-foot wingspan), MD-80 and MD-90.

Additionally, all types and sizes of aircraft, landing gear, engine parts and structures have been, and are still, shot peened at this location. General industrial, automotive, mining, and other markets also utilize this site for their shot peening needs. The facility is within the Greater Toronto Area, five minutes from major highways, and 10 minutes from Toronto International Airport.

The Brampton facility has always processed a large amount of aerospace components. During the past ten years, there has been increased interest in non-destructive testing (NDT), as this testing occurs just before shot peening. Using the floor space available from prior processing of C17 panels and wing skins, the space was repurposed for NDT inspection. Customers requested one-stop processing of the largest landing gear being produced. Therefore, both NDT lines and shot peening capabilities were sized accordingly.

Figure 1 shows a back row of tanks used to perform Nital Etch prior to magnetic particle inspection (MPI) for steel components. The front row of tanks is for Ti Etch of titanium components prior to fluorescent particle inspection (FPI). Both tank lines can process 14-foot-long components. (Note: The magnetic particle and fluorescent particle inspection equipment are not shown in the photos.)

Figure 1. Ti Etch and Nital Etch tank lines

This facility has performed OD and ID shot peening of all sizes of landing gear for decades. With the recent installation of the NDT inspection lines, the decision was made to upgrade the peening capabilities for large landing gear.

CWST's engineering staff designed and installed an automated peening room for large landing gear. A 6-axis robot was mounted on a track to traverse the length of long components and shot peen outside geometry. For ID processing, a second room has the capability to shot peen long cylinder geometry typical of landing gear.

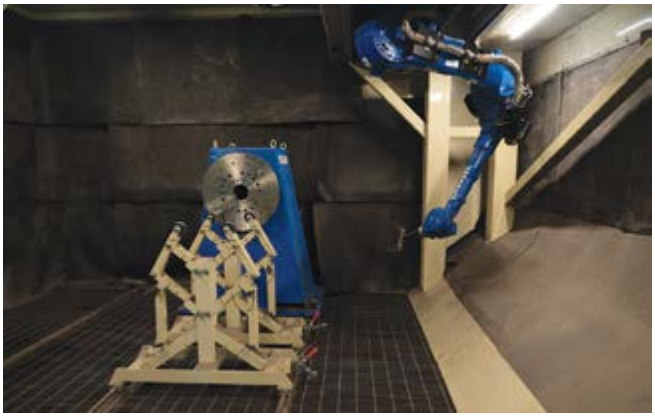

Figure 2. OD Robotic Peening Room

Figure 2 shows the automated peening room. On the floor is an adjustable bed to support various length landing gear components.

Figure 3 (page 36) shows the hardware outside the room used for ID lance peening.

This facility also has robotic peening capability for long aerospace shafts. The ID length of an 8-foot-long shaft can be peened. In addition, two identical machines are installed for ceramic peening of critical aerospace blisk geometry.

Figure 4 shows ceramic peening machines for aerospace blisks.

Another way the large peen forming floor space was repurposed is to shot peen very long shaft geometry. This area of the shop has a programmable machine to process 20-foot-long shaft geometry.

Figure 3. ID 10 ft. Side Lance Shot Peening

Figure 4. Robotic Ceramic Shot Peening

COMPANY PROFILE

With 67 facilities in 18 countries, Curtiss-Wright Surface Technologies (www.cwst.com) provides shot and laser peening, thermal spray, parylene, acrylic and urethane conformal coatings, dry film lubricants, Plasma Electric Oxidation and material analysis and testing.

We are surface treatment specialists providing solutions to fatigue, wear, stress corrosion cracking, corrosion, fretting, galling, seizing and erosion/abrasion.

Our proven surface treatments meet industry demands for lighter materials, improved performance and life extension in key markets such as Aerospace, Automotive, Semi-Conductor, Energy and Medical.

CONTACT INFORMATION

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Please visit us for a tour if you are in the Greater Toronto Area!

Abrasive Materials Announces New Location

Abrasive Materials announces the completion of their facility relocation from Hillsdale, Michigan to Battle Creek, Michigan. The new facility practically doubles the size of the previous location. This growth allows for additional inventory, increased production, and more space for lab facilities.

Known as "The Finishing Specialists", Abrasive Materials offers a large inventory of cut wire abrasives and other alloyed products. Stock items include various sizes of Zinc, Stainless Steel, Carbon Steel and Aluminum Cut Wire. Cast Stainless Steel Shot and Aluminum Shot are also available from the new location.

Their experienced customer service team is committed to assisting you with your cut wire needs. Recognizing the critical aspects of providing quality material to ensure that our products meet the stringent standards of SAE J441 and AMS 2431 specifications, along with a host of other industry standards and customer specific requirements. Material certifications accompany every shipment of conditioned cut wire product.

Undergoing annual 3rd party audits along with routine internal audits proving out their Quality System, Abrasive Materials is ISO 9001:2015 certified and compliant. Lot traceability, along with chemistry and sizing certifications verify the highest quality material is supplied on time, and at a competitive price.

A variety of packaging options are available to meet their customers' requests. Packaging considerations are made to comply with customers' limited storage and process areas in their facilities. Products are packaged to ensure that material arrives intact and contamination free. Abrasive Materials takes pride in expediting order processing, minimizing the timeline from order placement to order fulfillment.

Abrasive Materials partners with the largest and best distribution networks in the world and can assist any customer to find the appropriate finishing solution for their projects by providing free sample processing customized to each customers' machine, process, and media requirements.

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Abrasive Materials' new location in Battle Creek, Michigan allows for additional inventory, increased production, and more space for lab facilities.

Mike Wright | CEO | Wisdom Environmental Inc. | www.wisdomenvironmental.com

Innovative Solutions
Dust Collector Filter Cleaning

WITH TALK of sustainability and circular recycling becoming more and more mainstream, many companies are taking the time to revisit their recycling programs. Recycling waste streams, generated by the production process, is a great solution to meet those sustainability metrics and, in some cases, replace costs with revenue. Innovative solutions for difficult to recycle materials are appearing every year, and opportunities to recycle materials that did not have a solution in the recent past may now be available to manufacturers.

When it comes to recycling, the abrasives industry has been a leader in the adoption of recycling spent abrasives such as steel shot and brown-fused aluminum oxide. These waste streams are part of a larger system that includes not only the spent abrasives, but also the associated wastes generated from the dust collectors. This includes the dust generated from the blasting or peening processes and the filters that are contained in the dust collection system.

There are now opportunities to recycle both the dust and the filters from these processes and add to the manufacturer's list of recycled products. The associated dust streams now have outlets that utilize those waste streams as ingredients in products. In addition, the dust collector filters can now be cleaned and returned to the client, extending the lifespan of the filters and eliminating the "one and done" traditional approach. Tens of thousands of dust collector filters can be cleaned and re-used annually instead of being sent to the landfill after only a single use. There are some limitations on what filters can be cleaned, depending on the material contained in the filters, size of filters, and filter types. The most common type of filter that can be cleaned are the cartridge-type filters.

The cleaning of dust collector filters offers a significant cost savings to the manufacturer. The simple process involves boxing up the dirty filters and sending them to a company that receives, inspects, cleans with only air, and tests the filters for airflow performance as well as lightbar inspections that look for any holes in the filters. After the filters are cleaned, they are boxed, labeled, and sent back to the client. This process tracks the performance of each filter and records the performance after each cleaning. Depending on the material in the filters, some filters can be cleaned multiple times, extending the life of the filter and generating ongoing cost savings for the manufacturer.

"Before" and "After" photographs of a cartridge-type filter. It has been cleaned with air, inspected, tested, and is ready for shipment back to the client.

These recycling innovations mean opportunities for the manufacturer. Now a package of recycling solutions associated with the blasting and peening process—which involves the recycling of the spent abrasives, recycling of the associated dusts, and cleaning of the dust collector filters—offers an opportunity for manufacturers to expand their recycling programs and contribute to the circular economy.

About Wisdom Environmental Inc.

Wisdom Environmental specializes in the development of recycling programs for the business and manufacturing sectors. As the world moves towards a more environmentally friendly mindset and as landfills continue to fill and close, Wisdom Environmental serves the needs of both business and society. Wisdom Filter Clean is a division of Wisdom Environmental that specializes in the cleaning of dust collector filters.

For more information contact:
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www.wisdomenvironmental.com

PRESS RELEASE

Electronics Inc. | www.electronics-inc.com

Electronics Inc. Signs New Distributor in Italy

Techma, located in Monte Marenzo, Italy, is EI's newest distributor. Techma was recommended to EI by Renzo Giacometti of Serim. Serim was a strong promotor of EI's products for many years but Mr. Giacometti is retiring. "While we will miss working with Mr. Giacometti and his staff, we look forward to working with Mr. Frigerio, who along with his son Daniele, are running the day-to-day operations at Techma," said Tom Brickley, Vice-President of Electronics Inc.

About Techma

Techma was started in 1997 by Mr. Gianluigi Frigerio and Mr. Carlo Masieri. Their mission was to provide quality materials and technical assistance service to sandblasting users.

In the beginning, Techma sold steel sandblasting media, cut wire, steel shot, and grit from a warehouse in Lecco. Mr. Gianluigi Frigerio had been in the sandblasting business since 1980 and his experience helped Techma grow quickly.

Year after year new abrasives were added to the product line such as glass beads, aluminum oxide, plastic media, garnet, ceramic beads, and stainless steel media. In 2015, Mr. Frigerio took over the shares of Mr. Masieri. Spare parts for air sandblasting machines were added in 2017 to its range of products to fulfill clients' requests.

In 2020, Techma moved to a bigger warehouse and, faithful to its original idea of quality and service, installed both an air sandblasting and a wheel sandblasting machine and the company developed an innovative and modern laboratory to test abrasive media for its clients. In addition, Techma has certified its quality management system concerning marketing, pre- and post-sales assistance of abrasives for sand blasting, shot blasting and shot peening, according to the ISO 9001 international standard.

Techma will be representing the complete product line of Electronics Inc. Visit their website at www.techmasrl.com.

The Japan Society for Heat Treatment will hold the 28th IFHTSE in Yokohama from November 13th to 16th, 2023

The International Federation for Heat Treatment and Surface Engineering (IFHTSE) links organisations around the world active in the fields of heat treatment and surface engineering. The IFHTSE is a not-for-profit body founded in Switzerland in 1971.

This international group of scientific/technological societies and associations, universities, research institutes, and companies has a primary interest in heat treatment and surface engineering. The main function of the IFHTSE is to promote international collaboration and communication on heat treatment and surface engineering through the sharing of knowledge. This knowledge is communicated via worldwide conferences and international congresses.

The November 2023 IFHTSE conference will be in Yokohama, Japan and will be hosted by the Japan Society for Heat Treatment. It will cover critical topics in heat treatment including:

- Thermal processing of Iron and Steels (annealing, hardening, tempering, Q&T, Q&P)
- Thermal processing of Non-Ferrous alloys (annealing, age hardening)
- Thermochemical treatment (carburizing, carbonitriding, nitrocarburizing, nitriding)
- Surface hardening (induction, laser, electron beam)
- Quenching technology (equipment and quenchants)
- Thermal and thermochemical treatment in additive manufacturing
- Coating technology (PVD, CVD, plasma, thermal spray)
- Brazing (vacuum, induction)
- Physical metallurgy in heat treatment and surface engineering
- Control and investigation of heat and surface treated products
- Modelling and simulation of thermal and surface engineering processes
- Residual stresses and distortion
- Industrial heat and surface treatment equipment (design, process optimization)
- Reliability, process control and artificial intelligence in thermal processing
- Energy savings (process optimization, CO2-reduction, hydrogen)
- Environmental aspects in heat treatment and surface engineering
- Shot Peening

For detailed information on the conference, please visit https://jsht.or.jp/ifhtse2023.

Curtiss-Wright Receives Recognition for Technical Solution

Curtiss-Wright's Surface Technologies Division, a leading global provider of highly engineered surface treatments and analytical services, announces the CWST India team won second place for their work on "fatigue life improvement techniques for boiler tubes under cyclic operation, influenced by various material, operational and external parameters."

On-site shot peening services were offered at two thermal power plants in India on a pilot basis. This consisted of virgin boiler tube ID peening in free length state and also in an assembled condition in one of the power plants. The goal was to increase the service life of the super charger boiler tubes and to improve the microstructure of the tube by inducing compressive stress to avoid crack propagation at the edge bend section of the tubes.

David Rivellini, Senior Vice President and General Manager in the Curtiss-Wright Surface technologies Division, said, "In 2022, India added a capacity of 4,485 MW through eight thermal power plants and plans to commission ten thermal power plants in 2023 with an aggregate 7,010 MW capacity. We are happy to support these energy initiatives with our R&D and are very proud of our team for achieving this great milestone."

Curtiss-Wright Opens New Surface Technologies Facility in India

Curtiss-Wright's Surface Technologies Division announces the opening of its Hyderabad, India facility. In addition to the existing facility in Bangalore, India, this facility will be a new hub for aero structure and MRO operations as well as support the growing power generation industry.

The facility will offer a wide variety of services from shot peening to dry blasting, correction of distortion, and boiler tube ID peening.

David Rivellini, Senior Vice President and General Manager in the Curtiss-Wright Surface Technologies Division, said, "The need to have a second location in Hyderabad is because India is the third largest and fastest growing aviation market in terms of domestic tickets sold, and this is a core industry for the country. This new facility will support the growing aerospace sector and provide surface technologies services to ensure aircraft components are protected from stress corrosion cracking and other common problems they face under extreme heat and thermal variations. We will also be supporting power generation, industrial and off highway vehicles from this facility."

Visit www.cwst.com to learn more about Curtiss-Wright Surface Technologies.

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