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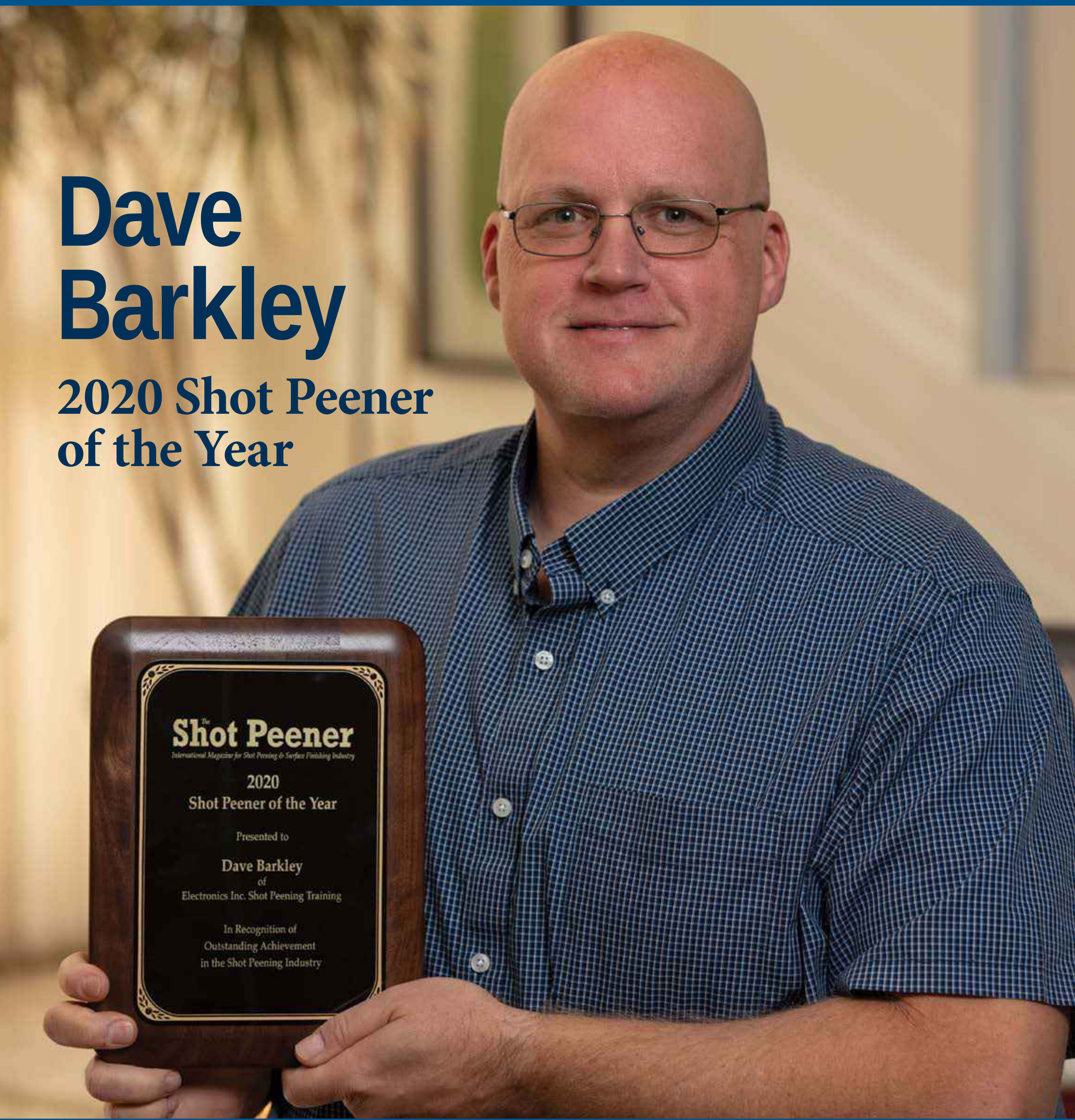
# The Shot Peener

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

## Dave Barkley

### 2020 Shot Peener of the Year




PLUS: ON-SITE SHOT PEENING | ROTARY FLAP PEENING TOOLS | TRIBAL KNOWLEDGE IN BLAST INDUSTRY | BACK TO BASICS: MAGIC SKIN










**THE SHOT PEENER**

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

OPENING SHOT
*Jack Champaigne | Editor | The Shot Peener*

# Appreciation

**YOU WILL PROBABLY** read this article in January, but I'm writing it during the USA Thanksgiving holiday and gratitude is on my mind. Here are a few things I've appreciated this year.

First of all, I'm grateful to Dave Barkley for the effort he made to keep our training program afloat during the pandemic. He scheduled and re-scheduled events until the global lockdown made many in-person training events impossible. He used the downtime to strengthen the training materials and plan for next year so we are ready for a busy training schedule in 2021. He richly deserves to be "Shot Peener of the Year."

Next, I'm grateful to all of our EI staff. They followed strict safety protocols and kept each other safe. Despite many challenges, they filled orders so our customers received the products they needed.

Finally, I'm grateful to our industry. Because aerospace is one of our largest markets, we felt the pain of its downturn during the COVID-19 crisis. Yet many of us not only survived, but thrived in 2020. This is exemplified by the people—and the companies they represented—that attended the 2020 USA Shot Peening Seminar. I've shared a few photos from the event.

Finally, never before have wishes for a healthy, happy, and prosperous new year been so meaningful. Best wishes to all.


## THE SHOT PEENER

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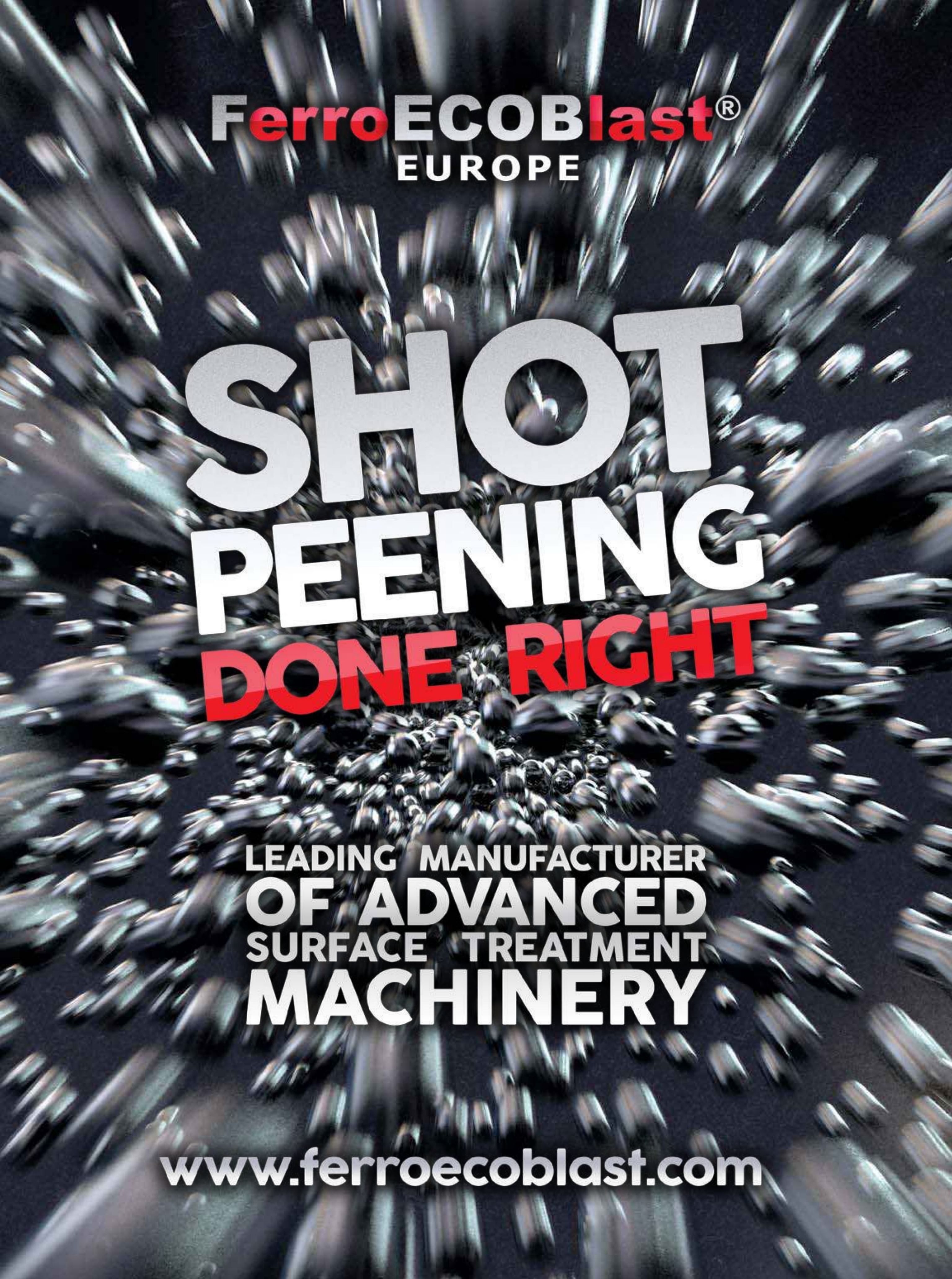
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# Dave Barkley
# 2020 Shot Peener of the Year

**THE STAFF** of *The Shot Peener* magazine is pleased to recognize Dave Barkley, Director of Training for Electronics Inc., as the "Shot Peener of the Year." Dave was chosen for two reasons: His extraordinary efforts to maintain a training program during the pandemic and his dedication to refining and expanding training for the shot peening and blast cleaning industries.

*Dave at the 2019 USA Seminar/Workshop*

Successful outcomes in 2020 required skill, perseverance, and creative thinking. Dave exemplified all three during a year that tested the shot peening industry like no other. Training, a critical part of a quality shot peening program, was hit especially hard due to lockdowns in air travel and hotel accommodations.

Dave led seminars in Ireland and Japan before the global lockdown started in February 2020. His on-site training events followed strict safety protocols but, even so, on-site training was down 30% from 2019. It seemed inevitable that the USA workshop would not be held for the first time since 1991. But Dave had an idea—he would organize a small seminar in South Bend, Indiana. Only 30 students and five instructors could attend—thereby maintaining social distancing. The program quickly sold out to 30 students from 22 companies.

These organizational skills have greatly contributed to Dave's success. He oversees all aspects of the seminars/workshops and on-site training sessions while continuing to conduct classes in fundamental and specialized peening processes. He is an active member of the SAE Surface Enhancement Committee which maintains industry specifications for Shot Peening and Rotary-Flapper Peening processes. He is the sponsor of SAE AMS2590A, Rotary Flap Peening of Metal Parts. Dave is a FAA FAASTeam Representative specializing in shot peening education.

Dave earned a degree in engineering from Purdue University's School of Technology where he later taught as an adjunct professor in the Electrical and Mechanical Engineering departments. Dave began working for Electronics Inc. (EI) in 1987 and his duties included regional training and product documentation. He left EI to work as an Electrical Control Engineer for an associate company but returned to EI in 2003 to serve as a Product Engineer and Engineering Manager. Dave began organizing training events in 2006 and he became Director of Training in 2008.

EI's training division has grown under Dave's stewardship. He took the solid program developed by Pete Bailey and Jack Champaigne and developed new presentations, classes, and workbooks based on his years of actively engaging with students. "Dave is passionate about shot peening and rotary-flap peening and wants the collective acceptance of the processes worldwide," said Tom Brickley, Vice President of Electronics Inc.

Dave oversees the practical aspects of the program, too. "Dave works closely with the hotels to secure the best rates and provide good value and a good experience for students," said Tom. He has expedited the certificate printing process so students get them quicker. He even coordinates the group photo at the USA seminar/workshop and designs the t-shirts for the event.

In addition, Dave not only handles the behind-the-scenes work but he is also a lead instructor. According to Tom, "Dave loves to interact with people and he has a gregarious personality. He has a roll-up-your-sleeves attitude to life and it carries over to teaching. Dave enjoys the interaction with students in their work settings. Seeing their peening facilities and how different companies approach the shot peening process around the world has been key to his success in his career."

Every student that takes an achievement exam receives a personalized email with their score from Dave. The following are responses from students at the 2020 USA workshop.

"Thank you Dave! Great class and I had no idea how much was involved in the day-to-day shot peening world. Very informative!"

—Brian Carey | CESCO, Product Manager

"Good afternoon Dave. Thank you for the wonderful presentations, as well as the tremendous amount of knowledge and insight you had provided. You were so helpful, and made me to understand the process properly. I still need to learn and understand a lot. Thank you again for everything!

—Darshan Talagalage, Process Engineer
(Balancing/Chem Processing/Shot Peen/Water Jet)
StandardAero Component Services

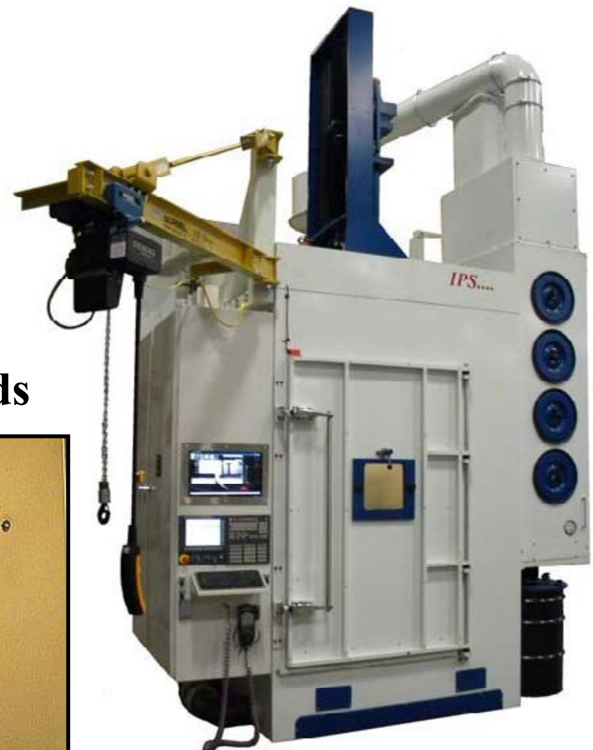
"Thanks Dave. Enjoyed the experience and fellowship amongst the group."

—Robert Arnett, Vice President, EARP Aviation Repairs

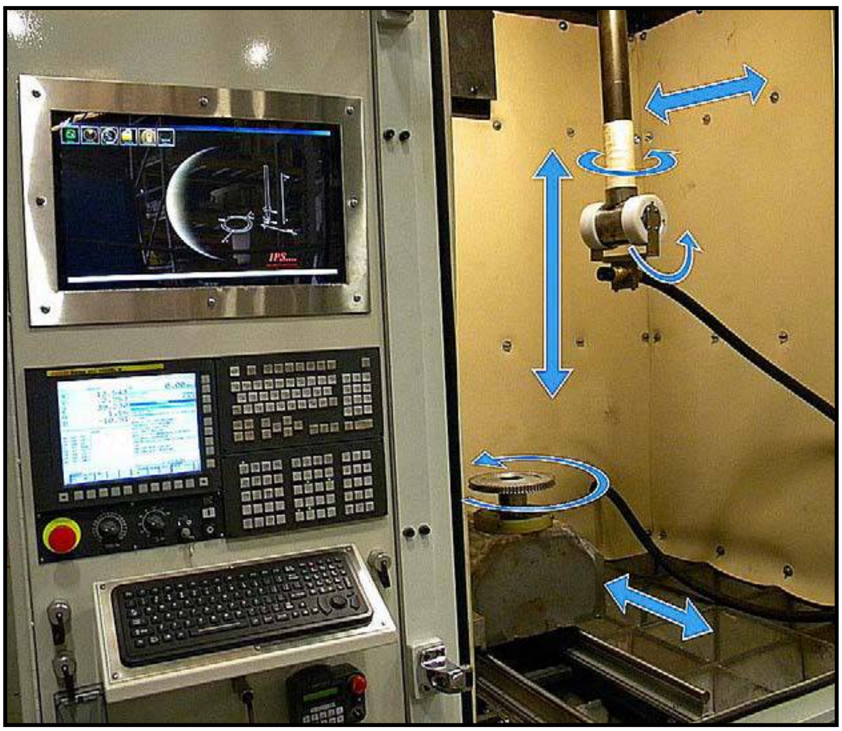
"Good morning Dave. I want to thank you for presenting your lectures the last two days. I learned a whole lot and I had as much fun as one can practicing saturation curves. Hopefully I'll get to come back next time."

—Jake Swenson, TOYO SEIKO North America Inc.

# Innovative Peening Systems



## High Performance for High Standards



CNC motion allows the nozzle to follow the contour of the part. This motion provides consistent intensities and coverages to occur with optimal speed and precision.

# *IPS....*

**Innovative Peening Systems**
5425 Progress Court, Braselton GA 30517
Phone: 770-246-9883
www.ipeenglobal.com

In addition to working with students, Dave has a close working relationship with the other instructors. Here are a few comments from instructors on why he deserved the "Shot Peener of the Year" award.

"With Dave being the face of Shot Peener training events all over the world, he is a great recipient for this award! His planning and attention to detail keep the events running smoothly. Everyone remembers the great food and social gatherings that keep this community together. I still have all of the t-shirts from past events with Dave's clever designs!"
—Dave Breuer, Director of Sales, North America, CWST

"I could not think of a person more deserving of receiving the "Shot Peener of the Year" than Dave. The award is given for achievement in the shot peening community and Dave has personally impacted so many with his dedication and perseverance to providing the best shot peening training experience for those new to peening. His passion for this role is amazing and his enthusiasm for the subject is appreciated by all who attend. Congratulations, Dave!"
—Jim Whalen, Vice President of Sales and Marketing
Progressive Surface

"Dave is like the assortment of components inside an engine that do the critical work that produces its magnificent performance. His accumulation of time dedicated to teaching the meaningful aspects of shot peening and his behind-the-scenes orchestration of nicely run Workshops, makes Dave most deserving of this award. Congratulations Dave, well done!"
—Joe McGreal, Vice President Sales and Marketing, Ervin

"I've worked closely with Dave as he tirelessly compiled workshops, seminars and exams over the years. "Good enough" has never been acceptable to Dave, and many users that he has trained around the world have benefitted from this perfectionist attitude. Over the years, Dave has polished shot peening training to the extent that it has fortified the desire in its users to do it right, and not just treat it as another blast operation. Dave has a knack of simplifying the understanding of concepts and making them palatable for practical use. It is only fitting that Dave was awarded "Shot Peener of the Year" this year, and my only surprise is that this didn't come sooner! I look forward to working with Dave as he continues to propagate his knowledge of shot peening into familiar as well as new industry sectors."
—Kumar Balan, Blast Cleaning and Shot Peening Specialist

For a complete list of others that have made significant contributions to our industry, see the list of "Shot Peener of the Year" award recipients at www.theshotpeenermagazine.com.

# The 2020 USA Seminar in Review

**DESPITE** the restrictions due to the COVID-19 pandemic, many aspects of the USA EI shot peening training seminar went on as normal. The FAA core-topic classes were presented, as well as specialized topics. Beginner and Advanced Achievement Exams were given and certificates were mailed.

South Bend, Indiana was chosen as the host city due to its centralized location and because Indiana did not have a mandatory two-week quarantine for visitors.

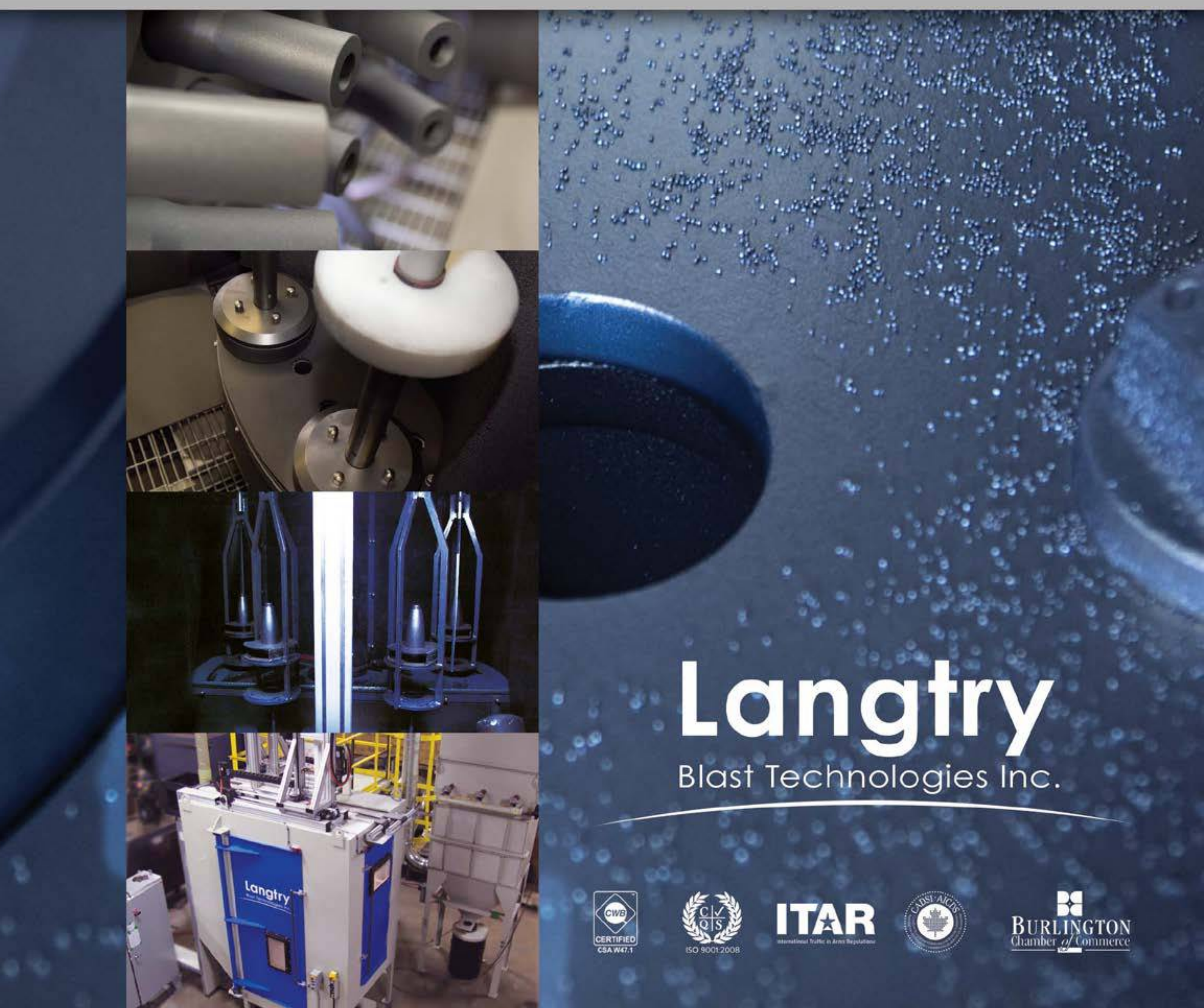
Dave Barkley, the Electronics Inc. Shot Peening Training Director, summed up the event nicely in an email to the seminar participants. "In a not-so-great time, The 2020 US Seminar was a great event. I am thankful that Dave Breuer from Curtiss-Wright and Edin Coralic from Progressive Surface shared their expertise of the process. I am especially grateful for Kumar Balan helping with EI SPT core-topic presentations as well as representing Ervin Industries. I want to thank everyone for coming and allowing us to shake some rust off. We all showed common sense and I have not heard of anyone falling ill from attending the event. Stay safe and we'll see you again," wrote Dave.

*Only 30 students were allowed to attend the USA seminar so that social distancing could be maintained. Masks were mandatory.*

*Mary Thomas, Administrative Assistant with Electronics Inc., took the temperature of students at registration.*


POWER ON

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*Dave Breuer | Director of Sales, North America | CWST | www.cwst.com*

# On-Site Shot Peening Considerations and Variations

**LARGE PARTS FAIL** in fatigue for the same reason as small parts. Hundreds of thousands to millions of load cycles cause surface cracks to initiate and grow. Cracks commonly originate at changes in surface geometry with some applications having an added corrosive element (stress corrosion cracking).

When parts have large dimensions, significant weight, or are installed on foundations, it is not practical to ship to a shot peening job shop. On-site shot peening is an excellent solution for these situations and is available in several forms to meet customer requirements. Some common on-site applications include aircraft, welded structures, power plants, refineries, and other processing facilities.

Similar to job shop shot peening, on-site shot peening offers significant longevity benefits to large components that are at risk of fatigue failure. Large equipment is very expensive and often times is custom designed which translates to long lead times for replacement. Shot peening significantly increases operating life and replacement costs are pushed far into the future.

Another large cost burden is equipment downtime. If the equipment being shot peened is essential to the operation of a power plant or other facility, downtime costs can be in the millions of dollars. Costs and timing associated with downtime are more critical when they happen on an unplanned basis.

This article will discuss some considerations and variations with on-site peening technology. One of the starting considerations when setting up an on-site project is shot containment. If a customer has an available blasting room that is suitable for the project, on-site time is reduced. Enclosing the peening area is commonly accomplished with a temporary tent for one-time projects. When peening the inside of a vessel, the walls act as a natural containment. Having fewer challenges with containing the shot presents other considerations such as confined space regulations.

Shot containment is most critical when peening fully assembled equipment such as aircraft. Needless to say, most all systems on an aircraft are not conducive to stray shot media.

The aircraft in Figure 1 required shot peening inside the opened section. The most important containment was preventing shot media from going inside the aircraft. The second priority was containment of shot to prevent any stray shot on the floor of the hangar.

A one-time project such as this is usually performed by an experienced operator with a manual operation. For projects that have repeating geometry and additional projects in other locations, usage of automation is preferred for the same reasons as automation in a job shop environment—improved setup and better repeatability.

*Figure 1: On-site shot peening of aircraft*

One of the most effective tools for automation is the usage of robots. Robots are programmable for almost any component geometry and offer a wide range of motion to deliver the shot stream into necessary high-stress areas. Figure 2 on page 12 shows robotic peening of a challenging geometry. This customer had multiple on-site projects with the same peening requirements. A temporary enclosure was constructed for the first project to protect sensitive hydraulics and electronics while exposing the area to be peened. Follow-up projects utilized a more durable custom enclosure. The area requiring peening is the metal in the middle of the blue protected area.

When working on-site, a number of environments can be experienced. Matt Heschel, CWST's on-site shot peening manager, states, "Every job is the same in that we bring the service of shot peening to a customer's location. However, every project is different in terms of the circumstances presented." Some examples are:

- Language barriers
- Working high in the air on scaffolding
- Challenging weather when shot peening outdoor equipment
- Potential exposure to nuclear radiation thus requiring additional training and PPE
- Additional site time for safety training
- 24 hour per day and weekend coverage

*Figure 2: Robotic peening of critical geometry*

- Lots of pressure to complete projects ASAP that have expensive downtime, such as those in power plants

In addition to propelling and containing shot, another consideration is returning shot back to the machine. For a small project taking less than a day, it is likely best to have an operator refill the peening machine a few times. Larger projects require additional planning on shot return especially when re-filling the shot peening machine presents an efficiency bottleneck.

Another project consideration is the type of failure being addressed. For example, when an application requires more compressive stress depth than shot peening can produce, laser peening (LP) is an excellent tool. On-site LP has been available for almost a decade. It offers the benefits of a compressive layer than can be 10 times deeper than shot peening. With LP, containment of shot media is not a concern. In addition, LP follows a CNC peening spot pattern so that overspray is not a concern.

Curtiss-Wright Surface Technologies (CWST) has engineering services to support our customers' design efforts. CWST's laser peening group offers finite element stress analysis, simulation and life prediction capabilities. These analytical tools help customers perform cost benefit analyses of laser peening on new and service life extension projects.

An article in the Spring 2018 Shot Peener magazine described CWST's on-site laser peening of nuclear storage containers (see Figure 3). The deep compressive stress from

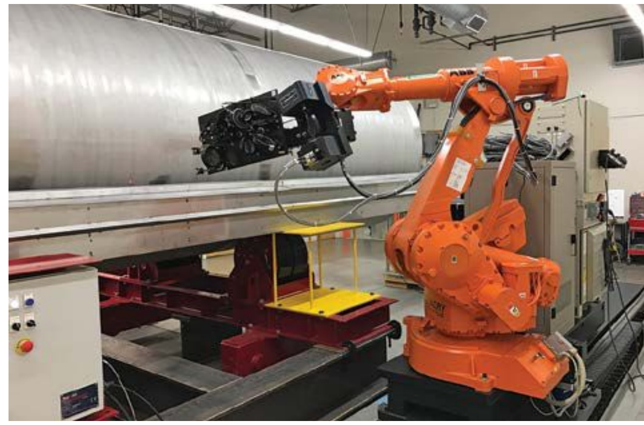


*Figure 3: On-site laser peening of nuclear waste storage container*

laser peening the longitudinal weld seams is calculated to provide thousands of years of protection.

Curtiss-Wright Surface Technologies has the ability to send technicians for on-site shot peening at most locations worldwide. Adherence to the customer specifications and timelines are provided as part of the work scope. Additional technicians can be sent to support 24-hour coverage or work on multiple peening locations simultaneously.

*Wolfgang Hennig | sentenso | www.sentenso.de*

# Evolution in Applications and Tools for Rotary Flap Peening

**ROTARY FLAP PEENING** (RFP) has been a well-known and established process in the aviation industry for many decades. Initially RFP was developed for repair peening on military aircraft and helicopter components. The technique can eliminate part disassembly and shipment to a dedicated shot peening facility. Today RFP is widely used in civil aerospace as well. With this smart process in place, excessive shipping time and organizational effort can be eliminated. Many different units, from landing gears and brakes to structure, wing and fuselage bodies to thin-walled components like flaps and wing spars, are flap peened during maintenance, repair and overhaul. Latest applications can be found in OEM aerospace parts production where the process allows for small spot repair of slight surface scratches thus salvaging expensive parts. Other application trends are in manual shape corrections of shot-peened and peen-formed parts.

## FLAP PEENING PRINCIPLES

The flexible flap, with its embedded tungsten carbide shots on both sides, is the standardized tool and the basis of all associated specifications, equipment and flap peening methods. The flap is defined in detail in the AS2592 specification. The equipment and the procedure are standardized in AMS 2590. A speed-controlled rotary drive runs a slotted mandrel that clamps the flap on its center line. The flap consists of a synthetic fiber fabric strip soaked in resin and fringe meshes which carry one or two rows of tungsten carbide balls with a fixed diameter of 0.045 inches. The flaps are available in three different sizes: 9/16 x 1, 9/16 x 1¼ and 1 x 2 inches. These different sizes allow the user to adapt peening intensity, provide ease of work, and meet the requirements of the application with respect to specifications and accessibility in an appropriate manner.

The RFP method has the same physical basic principles as shot peening. Round shot is propelled onto the component surface in a controlled manner and creates local plastic deformation in the part surface and, as a consequence, creates the desired compressive residual stresses. The benefits of this surface enhancement are the local restoration of the original stress state in previously peened components and the reinforcement of surfaces after grinding and blending.

The main process parameters are as follows:

- **Media hardness, size and shape** are clearly defined by the specifications of the tungsten carbide balls.
- **Peening intensity - impingement angle and intensity.** The impingement angle is close to 90˚ to the surface as long as the peening area is accessible and the tool is held at an appropriate distance. With this orthogonal impact, the energy transfer into the surface is maximized. The velocity depends on the tool rotation speed.
- **Coverage - impact dent density.** The impact dent size is mainly dependent on the flap speed. The peening time determines the impact dent density.

## FLAP PEENING EQUIPMENT

The following parameters provide controllability of the process. The parameters are the tool rotation speed that determines the peening intensity and the peening time that determines the peening coverage. The application of the process can be challenging due to limited accessibility of parts and the areas to be peened, or the required peening time at low intensities. Thus an appropriate flap peening tool should provide two main features:

- proper speed control in all situations during the procedure
- user-friendly tool operation

So it is worthwhile to compare the characteristics of well-known compressed air and electrically driven tools to alternative solutions and to new equipment in the market. Let's explore two systems.

### SUHNER ROTOmax 2.0

Users who prefer a simple and very powerful and robust flap peening drive should check out the ROTOmax 2.0 drive from SUHNER. This drive was originally designed for grinding tasks. It has a strong motor with simple dial of speed with membrane keys. The very high motor power and the closed-loop speed control allows for extremely stable rpm


*The ROTOmax 2.0 works as a rotary-flap peening tool and a grinder.*

even with high friction in the application. The motor rotation is transferred to the handpiece via a flexible shaft. The flap peening mandrels can be fixed in the robust handpiece with the help of collets.

The stability of the strong drive comes with some disadvantages in handling. The drive is very heavy. Even if installed on a trolley, it has limited mobility. The biggest mandrel requires a bigger shaft and quite heavy handpiece. The lack of the shaft's flexibility and the weight of the handpiece is exhausting for the operator. On the other hand, the drive is multifunctional as it can be used for other applications like grinding.

**sentenso RotoFlapMaster**

The new RotoFlapMaster from sentenso is an innovative development with several unique features. This system consists of a very compact control box with power supply, closed-loop speed control, membrane keys and colour display, a handpiece with brushless DC motor and a flexible connecting cable. The RotoFlapMaster is a compact system which provides specific usability. sentenso implemented the functionality of the RFP process in a user-friendly, cordless, and smart unit. It uses latest drive technology with a dynamic brushless motor with up to 10,000 rpm with very precise 14-bit closed-loop speed control and reversible operation. Under typical loads, this control keeps the rotation speed safely within a closed range far below the maximum value of +/-100 rpm required by AMS2590. The handpiece is designed in an ergonomic style so that it is easy to handle even in tight work areas. An angled handpiece is under design.

*The RotoFlapMaster kit*

*Advanced Usability*

The system controller provides an easy-to-read colour display and predefined speed settings for all flaps and Almen strips, depending on the desired peening intensity. The handpiece has two specific features which help the operator use the tool with just one hand without having to turn his view away from his work. One is the START/STOP button and the other one is the green and red light element that indicates the correct speed.

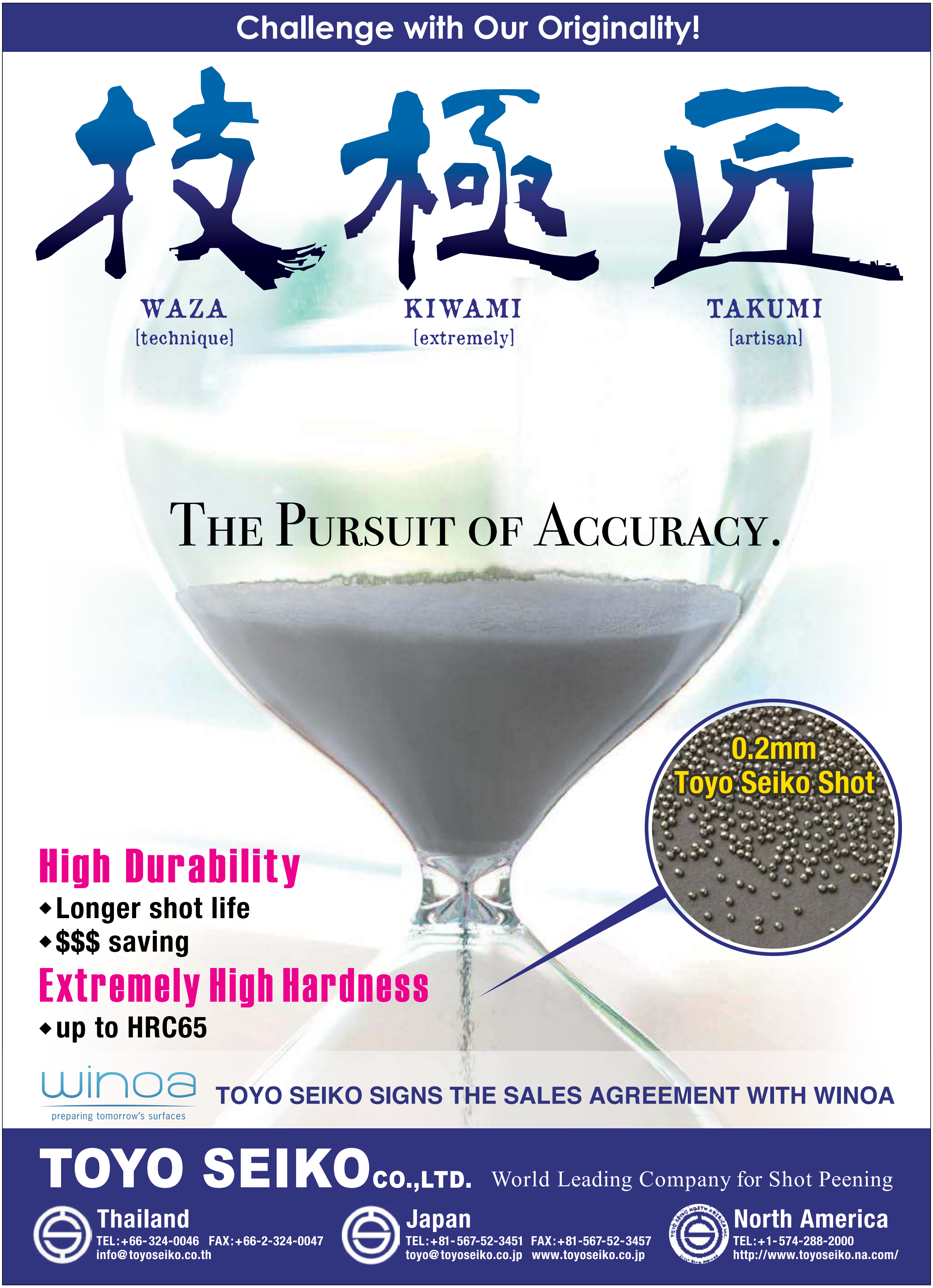
For ease of use and compact design, the controller functions are reduced to the core features. This was one of the consequences from a survey that sentenso performed with many operators. Only the necessary functions were implemented including:

- Set rotation speed
- Change rotation direction
- Preset of speed
- Preset of intensity with calculation of suggested speed depending on flap size and Almen strip type
- Timer function
- Various settings (flap size, Almen strip type, language, units)

The START/STOP functionality on the handpiece allows the operator to fully control the tool at any time and in any situation and whenever he wants to start or stop his work. This feature is especially helpful in difficult-to-reach areas. Moreover he can use the tool with the controller placed on a table close by but also with a belt around his shoulder or around his waist. With the controller on his body, the operator can work on a hinged step or ladder without the need to step up and down when the peening must be interrupted. In case the speed should be dropped due to extreme friction or blocking, this will be clearly indicated with the light element changing from green to red.

The quality of a rotary flap peening job is generally characterized by intensity and coverage. Some specifications allow just closed-loop speed control as a replacement measure for peening intensity. Most specs and AMS 2590 still demand the intensity determination and verification on a specific magnetic Almen strip holder. The proper full coverage on the peening area is assured by visual inspection. This inspection should gradually be checked by the operator during peening.

For the quality checks, the START/STOP button provides additional assistance. Pressing the button twice starts the system timer. The timer is very helpful when running



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saturation curves on Almen strips which need defined peening time cycles. The operator can work on the holder area beside the strip and start the cycle time when he is ready to peen the strip. The START/STOP function also allows interruption of work for intermediate coverage inspections during the peening job.

*Fully Mobile Operation*

The RotoFlapMaster receives its power from a rechargeable battery pack so fully mobile flap peening becomes available for the first time. With one battery fully charged and under usual working conditions, the tool will run a 9/16 x 1¼ inch flap at a speed of 5,000 rpm for more than four hours. With the second battery, the tool can be used more or less permanently.

The compact and lightweight controller can be carried by the user during operation which provides free and flexible use. The unique system is available separately or in operator-friendly and customizable equipment kits. Each piece of equipment is packed safely in a robust travel case with rollers and an extendable pullbar so it can be easily taken to the work site.

With the high number of user-friendly features, the new RotoFlapMaster represents an evolution in rotary flap peening equipment. ●

For more information on sentenso products, visit www.sentenso.de, send email to info@sentenso.de, or call +49 2363 3606988.

*The RotoFlapMaster tool in action*



# Ground-Breaking Ceremony for New USA TOYO SEIKO Facility

**ON SEPTEMBER 4, 2020**, TOYO SEIKO held a ground-breaking ceremony for their new facility in South Bend, Indiana USA.

The estimated completion date for the new 25,200 square foot building is in April 2021. The location has room for a 10,000 square foot expansion. The company had outgrown their current 16,000 square foot building in South Bend. The TOYO SEIKO facility will have room for offices, manufacturing, warehouse space, and shipping and receiving capabilities. The company will be adding a peening laboratory in the future. “We are very excited to have a facility that meets our specific parameters as opposed to adjusting to meet an existing layout. It’s much more efficient,” said Larry Catanzarite, General Manager with TOYO SEIKO North America. ●


*Dr. Watanabe, President and CEO of TOYO SEIKO, was unable to attend the event due to COVID-19 travel restrictions so he participated via a video conference.*

*The following people took part in the ground-breaking ceremony (from left to right): Jose Delgado, Plant Manager TOYO SEIKO North America Inc.; Tom Brickley, V.P. Electronics Inc.; Joe Leatherman, President Cadet Construction; Jeffrey T. Ballard, Vice President Danch, Harner & Associates Inc.; Larry A. Catanzarite, General Manager TOYO SEIKO North America Inc.; Honorable James Mueller Mayor, South Bend Indiana; Jack Champaigne, President Electronics Inc.; Shota Watanabe, Vice President TOYO SEIKO North America Inc.; Missy Varga, Operations Manager TOYO SEIKO North America Inc.*



**AN INSIDER'S PERSPECTIVE**

*Kumar Balan | Blast Cleaning and Shot Peening Specialist*

# Tribal Knowledge in the Blast Industry Part Two

## LOOKING AHEAD FROM PART 1

I hope you enjoyed Part 1 of our discussions in the Fall 2020 edition of *The Shot Peener*. The feedback from the global shot peening community was quite encouraging. It is either the pandemic that has afforded folks more time to read magazines or a genuine stoking of their nostalgia that the article partly intended to do! Regardless, it was enough impetus to prompt re-visiting this topic! In Part 1, we discussed the importance of velocity and tried characterizing the magic number of 240 feet per second that we were familiar within the industry. My four retired colleagues that contributed to the article's content had a variety of other information to share from the "tribe", but velocity being such a profound topic, I got lost in the depth of that discussion, necessitating a sequel to Part 1.

Most recently, I had the opportunity to work on an application to peen the ID of cylindrical aerospace components. This brought me face-to-face with another important aspect that could not find a place in our earlier discussion. That is, discharge velocity is also dependent on the nature of device responsible for generating it. For example, at 50 PSI, a venturi-style nozzle blasting in an open environment can generate the maximum velocity it is capable of (just like a blast wheel discharging its abrasive inside a contained enclosure, i.e., blast cabinet). In both cases, the discharge is unrestricted. However, when blasting inside a cylindrical tube, most applications require the media stream to be deflected on to the ID walls. This deflection, which is the function of a deflector tip at the discharge of the nozzle, results in loss of energy at that point. Velocity losses as high as 25% to 30% are common in such instances and the user needs to accommodate for this loss by increasing the air pressure (or by reducing media flow) to maintain the comparable impact energy as a conventional nozzle.

## FIXTURES

My colleague Ron Barrier at Wheelabrator was prolific with what we termed "Barrierisms." He was known to come up with terms that would challenge English majors, and one such term was "obviosity." When interviewing for this article, Ron related this story about fixturing a large bathtub for a customer demo that went in vertical and came back horizontal. Ron remarked, "the obviosity of the occurrence never struck me. Parts seldom stay in the loaded orientation once inside the machine. When impacted by multiple wheels, angles, and in some cases varying wheel velocities, re-positioning of the part was only obvious (validating his coining of the term!). The part came out shaded and demanded the need for drastic re-fixturing."

Fixturing is often the most ignored step in cleaning operations but thankfully taken seriously in shot peening. When cleaning, assuming the intent is to clean without any surface reservations such as masking or overspray concerns on the part, the operator only needs to ensure that the part stays long enough in the machine to get thoroughly cleaned. The work handling arrangement often dictates the type of fixture to be used. Batch style processes do not require individual part fixtures, whereas parts (or a single part) on a rotary table almost always need fixturing. In other cases, parts are suspended and spun from a hanger hook, or passed through on a monorail or placed on a work car without elaborate fixturing. Though it sounds easy, fixturing details are usually finalized only before an actual production run as a last minute rush. The reason being that parts perform differently under blast conditions and no matter the time and effort one has invested in designing a fixture in advance, change is inevitable. Though Ron does not discourage preparation work in advance of the actual testing, he recommends making allowances for the shift during the actual production run.

Fixturing in shot peening applications is better defined. This is due to the nature of the operation and expected results. The shot peener relies on use of an MVT (Machine Verification Tool) or PVT (Part Verification Tool). The former (example in picture on page 22) considers the possibility that parts of varied geometry will be processed in the machine and that the machine should be able to produce repeatable results no matter the part geometry.

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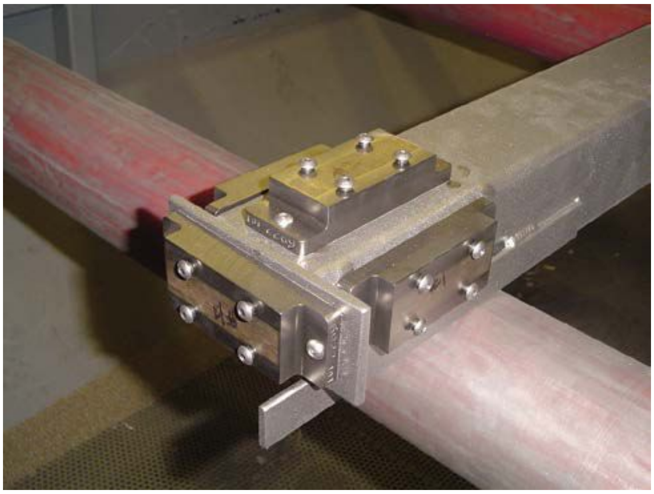

A PVT, on the other hand, is part specific and mimics the actual part. Fixturing this in the machine offers insights into what the actual part-holding fixture might look like. The PVT accounts for areas needing intensity verification, and considers aspects of overspray and masking.

Ron adds some common tips to be followed during fixture design: (a) avoid multiple moving parts and design single-piecepart fixtures, (b) ensure that fixture wear will not dislodge or re-position parts without adequate warning (routine wear) and finally, to re-iterate, (c) plan for the impact of multiple blast wheels or nozzles on your part positioning.

There are instances where part masking also doubles up as fixtures. An example of this fortunate situation is when separately peening the root and airfoil section of engine blades. Different intensity ranges in the two critical areas of the blade require masking of one when peening the other. In this case, masks perform a dual function when fixturing the part on a rotary table.

As a side note, blast wheel positioning has other ramifications in addition to shifting the part during blasting. This can be better quantified in peening machines where we indirectly measure the transmitted energy through deflection of the Almen strip. "All upblast wheels generate lower arc heights and most of them are victimized by 'rain down' from the downblast wheels," explains Ron Barrier. We have often heard that the optimum blast angle is when the media stream impacts the part at about 70 to 80 degrees. This eliminates the likelihood of energy loss due to opposing stream interference when blasting at 90 degrees. This situation is sorted out quite easily in an automated airblast machine by simply altering the angle of impact, but not so in a wheelblast machine where wheels are mounted in fixed positions. Ron's solution to this situation is to plan for higher wheel speeds (using inverters) in upblast wheels, and stagger the upblast from downblast wheels if that is a possibility. Such situations, though not common, are often noticed in pass-through wheelblast machines that shot peen complex aircraft structures requiring blast wheels to be located at compound angles and sometimes in upblast orientation.

## TUMBLAST MACHINE CHARACTERISTICS

Switching gears from fixtures, masking, and wheel positioning, let us discuss some characteristics common to machines of interest. During the maiden days of shot peening (and to date) in the automotive industry, tumblast-style machines were largely employed to peen valve springs in small batches. Such tumblasts range from 3 CFT up to 14 CFT in volumetric capacity. Tumblasts are also seen in foundries, where "the rule of thumb is to load them up to 180 lb per CFT of volumetric capacity," explained Bill Raby, a knowledgeable, retired colleague that invested a significant time in foundry applications. "The capacity calculation is a general rule of thumb, part geometry will dictate the actual loading capacity in a tumblast. When parts present the threat of nesting into each other, or 'bond' with one another due to surface tension, you will need to introduce dummy pieces along with the actual part load to break this bond and allow the flat parts to achieve proper exposure during cleaning. An example would be to mix cylindrical parts instead of processing all flat parts," added Bill Raby. Loading a tumblast, though seemingly straightforward, can get complicated fast depending on the part type. I recall an instance where the customer was cleaning heavy duty anchor chains in a tumblast. Due to the rigidity of the links, the chain started "climbing up" inside the tumblast mill to a point where it started physically interfering with the blast wheel and damaging the unit!

Tumblasts are one of the oldest machine types used in blast cleaning and shot peening applications. As such, everyone has a tumblast story or tip to offer. The highlight of my tumblast experience was seeing a 100 CFT capacity tumblast in a Brazilian foundry—the largest I have seen in my 30+ years in the industry! Later, I learnt that Wheelabrator used to demonstrate the volume (size) of this machine by positioning a VW Beetle inside the mill. Jay Benito (retired from Wheelabrator and Pangborn) had his own set of tips to share on this machine type. "Tumblast machines suffer when they're loaded at less than 2/3rd their capacity. At lower volumes, the parts tend to travel towards the left of the mill,

exposing the right to the brunt of the blast wheel. Depending on the direction of wheel rotation, this could shift to the opposite side, but nonetheless result in improper cleaning and undue wear of machine components (slats and end liners). Tumblasts are most efficient when they are loaded to their full capacity," explains Jay. On the topic of part nesting and drop in exposure, Jay recommends welding or bolting a "tumbling bar" (as shown in above image) at defined intervals along the width of the belt.

In the shot peening world, I have often recommended that users, instead of simply tossing in an Almen block with a strip inside the tumblast to check arc height, use a flat bar or angle with Almen test blocks in at least two locations and then check results. Not much is written about blast wheels in the shot peening world, especially in the aerospace industry. I would like to take advantage of this lacuna and transfer the sage advice offered by my retired colleagues. "Blast wheels with eight and twelve blades are the most common ones that prevailed in the market," says Ron Barrier. Having worked for a large company, Wheelabrator, Ron's exposure has always been to such wheel designs. Though wheels have been designed with lesser (four and six blades), eight-bladed wheels were found to offer the best compromise between cleaning speeds and an efficient blast pattern. Jay Benito adds, "Eight bladed wheels offered a distinct hot spot that was diminished in the twelve-wheel design. The selling feature of the 12-bladed wheel was that the abrasive was spread over 12 blades, effectively reducing the wear on each blade. There wasn't much conclusive evidence whether this factor actually played a role in cleaning efficiency, resulting in this wheel not gaining wide popularity."

Let us compare this with the airblast world where a similar analogy can be made between straight-bore and venturi-style nozzles. The latter is preferred for most applications today due to its uniform blast pattern. In terms of blast pattern, an ideal pattern is about 1.25" to 1.5" diameter with a pressure blast nozzle and significantly smaller with a suction-style gun. For this reason, a good designer follows a "convergence" pattern where two or more nozzles, when used in an automated airblast machine, are located so that they converge to form a pattern consisting of ovals overlapping each other.

## SHIFTING OF PATTERNS IN BLAST WHEELS

It is common knowledge that wheel and nozzle wear will cause a shift in the blast pattern. This shift, unless corrected (compensated), will lead to cabinet areas, instead of parts, receiving the wasted impact of media and a drop in coverage on the part being peened. So, how does one go about checking the pattern?

Ron Barrier explained this technique used in his demo lab: Right after the blast wheel has been fitted with new wear parts (control cage, impeller and blade set), perform a blast test with a 14 ga sheet of metal. In a multi-wheel machine, perform this test for each blast wheel separately. When blasting this thin metal sheet, make sure that blasting is carried out for a short duration of about 15 seconds. Mark the hot spot on this template. You now have a template to compare against after the wheel has worked for a few hours and experienced wear. Repeat this test periodically through the wheel's useful life. Compare the pattern with the original template. Shifting of blast pattern does not mean that the wear parts must be replaced. It could be a simple case of re-setting the control cage to bring back the pattern to as close as possible to the original. If shifting the cage still does not bring back the pattern to its original location, it may be time to change the main wheel wear parts, such as blades, impeller, and the control cage.

Though tempting, always change the entire blade set and not just the ones that are worn. Blades are dynamically balanced as a set and changing just one or two blades will result in imbalance in the wheel, especially when turning at considerably high speeds. Similarly, changing the shot size will also result in a pattern shift. Switching from one shot size to another will result in a linear shift in pattern. Run your template after the size change so that the control cage can be re-set accordingly. Along similar lines, the abrasive leaves the blast wheel around 140° to 160°from the opening of the control cage. This will also need to be monitored when adjusting your blast pattern.

## TO BE CONTINUED...

A few other topics were unearthed when I discussed this article with my colleagues. Such subjects included shot storage, airwash separator settings, use of rotary screen, etc. This makes it worth continuing our discussion to Part 3 of this subject. I expressed optimism that such information, though absent in textbooks, is still available with these profound human repositories! My goal is to bring them out to you, the regular users of this process, with the hope that they will add value to your peening and cleaning operations. I look forward to writing for you again in a few weeks.

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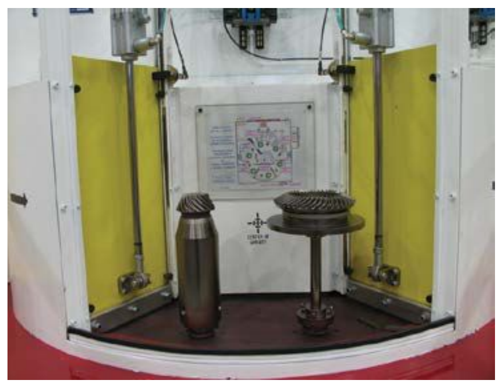

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# Back to Basics: The "Magic Skin"

## INTRODUCTION

The whole point of shot peening is to improve the service life of industrial components. Peening achieves this aim by inducing a "magic skin" into the components. This skin is a thin surface layer that has two defining characteristics—work-hardening and compressive residual stress. For too long it was assumed that compressive surface residual stress was the only significant factor. Nowadays it is recognized that work-hardening is an equally important factor. As a simple equation we have that:

**WORK-HARDENING + COMPRESSIVE SURFACE RESIDUAL STRESS = INCREASED SERVICE PERFORMANCE**

The term "magic skin" was coined to express the unique features of shot-peened surface layers. The word "Magic" is employed because protection is afforded without any visible indication of its presence. "Skin" is synonymous with the surface layer of all flora and fauna. Banana skin, orange peel and elephant hide exemplify the protection that they afford.

It is important to remember that shot peening cannot always improve the service performance of every component. By way of illustration, consider the term "Victorian Engineering". This was coined in the 19th Century during the reign of Britain's Queen Victoria and coincided with their Industrial Revolution. Many machines were constructed using iron or steel components that were so thick that maximum applied stresses were reduced below their fatigue limit. Fig. 1 illustrates this principle. Ferritic materials normally exhibit a linear shape of applied stress versus cycles to failure when plotted on a logarithmic scale. An applied stress level greater than the fatigue strength is required in order to cause failure. With "Victorian Engineering" the applied stress level never came near to the fatigue strength so that fatigue failure never occurs. Indeed, some mighty machines are still operating two centuries later. The drawback is that excessive amounts of material and energy are required for such machines. Shot peening comes into its own (thanks to the "Magic Skin") when the maximum applied stress levels would otherwise exceed the fatigue strength.

Fatigue is a massive subject in its own right so that only a very brief consideration is possible. To better understand the

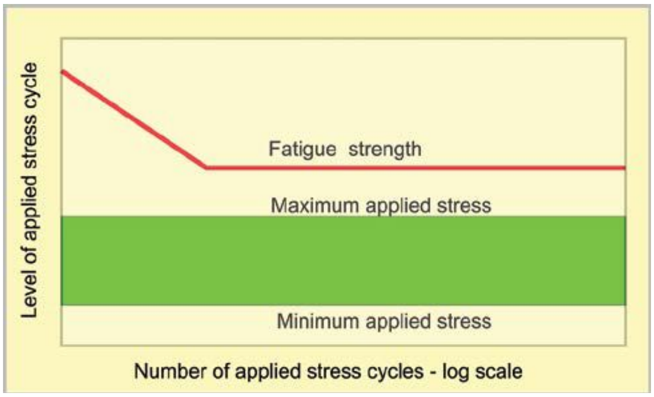


*Fig. 1. Fatigue stressing below a component's fatigue strength.*

Magic Skin we should consider the separate effects of work-hardening and surface compressive residual stress.

## WORK-HARDENING

Work-hardening involves two distinct factors: work and hardening.

### Work

A flying shot particle has a kinetic energy, ½Mv$^2$, where M is its mass and v is its velocity. This kinetic energy allows the particle to produce a dent when it strikes a component's surface. The amount of kinetic energy is equal to the work that had to be done on the particle to accelerate it.

Example: A steel shot particle having a mass of 2 milligrams (roughly S330) and a velocity of 100 ms$^{-1}$ will have a kinetic energy, k.e. given by:

$$\text{k.e.} = ½.2.10^{-3}\text{kg}.10{,}000\text{m}^2\text{s}^{-2} = 10\text{kgm}^2\text{s}^{-2}$$

1N = 1kgms$^{-2}$ where 1N is 1Newton. Hence k.e. can be represented as 10kgm$^2$s$^{-2}$N/1kgms$^{-2}$ or

$$\text{k.e.} = 10\text{Nm}.$$

By way of comparison, consider lifting up a 1 kg peening hammer, see fig. 2 on page 28, by a distance of 1 m. 1 kg exerts a force of 10N due to gravity. The work done in lifting the hammer is therefore 10Nm which is exactly the same as that

*Fig. 2. Typical peening hammer.*

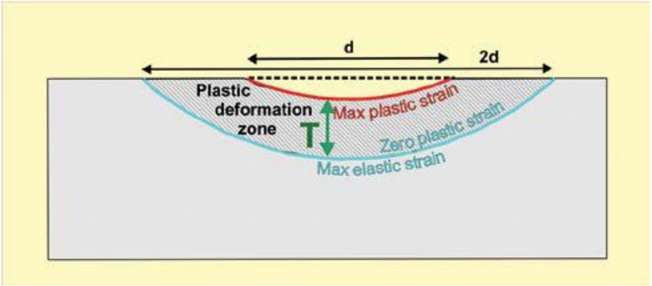


*Fig. 4. Thickness, T, of work-hardened surface layer induced by shot peening.*

which had to be done on the shot particle to accelerate it to 100ms$^{-1}$.

**Hardening**

Shot peening is a cold-working process. As such, the more work is done on a component the harder it becomes to do more work hence the term "hardening". Hardening is caused by the vast multiplication of lattice defects called "dislocations". As an analogy, think of traffic carrying passengers in a city. If the streets were almost empty traffic could flow freely. With more traffic, however, the more flow rates decrease. Eventually, traffic will stop.

The greater the amount of cold-work, the higher will be the applied stress required to induce further cold-work. This is illustrated for peening by fig. 3.

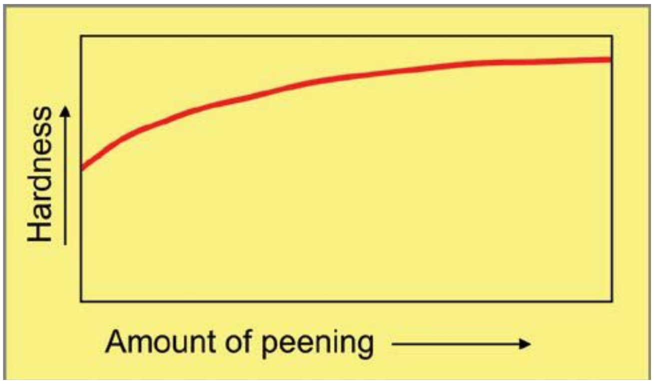


*Fig. 3. Hardening depends on amount of peening.*

**Thickness of Work-Hardened Surface Layer**

The thickness, **T**, of the work-hardened surface layer is proportional to the size of the indentations. This principle is illustrated by fig. 4. The amount of work-hardening increases with increase of amount of plastic strain.

**COMPRESSIVE SURFACE RESIDUAL STRESS**

Residual compressive stress occurs at the extreme surface of shot-peened components. The compressive stress level then increases to a maximum just below the surface. Thereafter the compressive stress level falls to zero and then becomes a balancing tensile stress. A model residual stress profile is shown in fig. 5. Stress levels depend upon the yield strength of the peened material. At the extreme surface, the compressive stress level is always about 50% of the yield strength. This compares with about 67% being reached below the surface. It is worth noting that the maximum compressive residual stress is often greater than the yield strength of the unpeened component material. This is because of the large rise in yield strength that occurs in the magic skin.

Depth of compressive stress below the surface depends mainly on the peening intensity.

The shape of the residual stress profile approximates to that of a cubic equation. For fig. 5 the equation used was:

$$\mathbf{S= -3335E4x^3 + 1.444669E^2 -3000.5x -500}$$

where **S**= stress and **x** = depth below the surface.

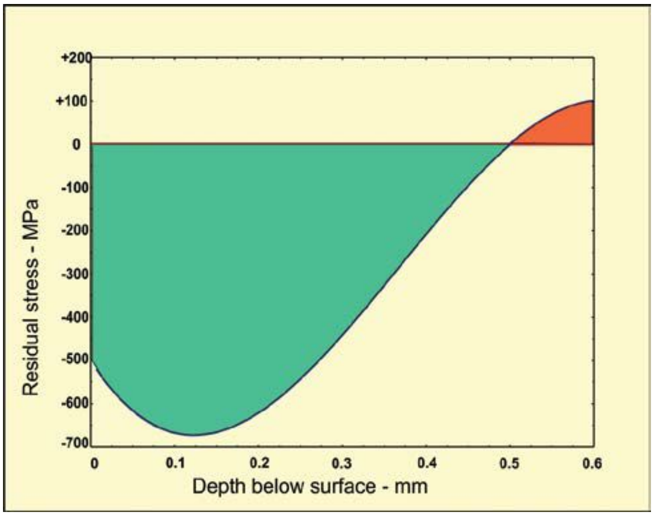


*Fig. 5. Model of typical residual stress profile on peening.*

Perhaps the most important question in the English language is "Why?" For a residual stress profile, a significant question is "Why is the compressive stress lower at the extreme surface than it is beneath the surface?" The author is not aware of any published explanation. Hence an attempt is made in the following section. This takes the form of a fictional tutorial given to a group of mechanical engineering students. It strays from being "Basic" so can be skimmed


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through. A simple equation is, however, presented:

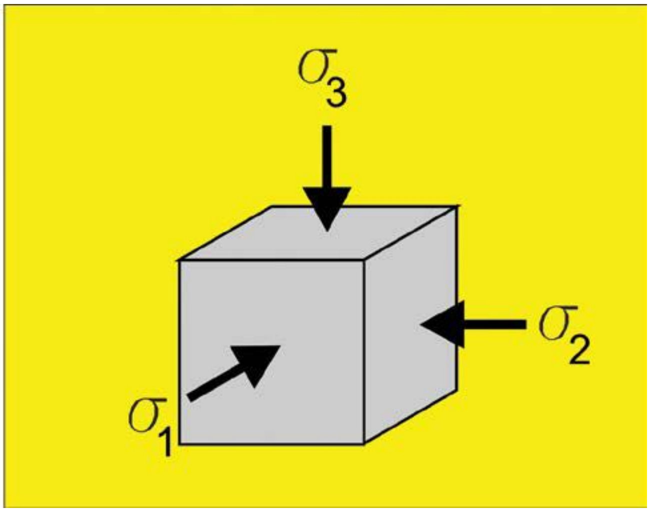
$$q_x = \Delta p_x - Y/2 \qquad (1)$$

where $q_x$ is the residual stress just below the extreme surface and $\Delta p_x$ is the change in the residual stress perpendicular to the surface.

**Why is the compressive stress lower at the extreme surface than it is beneath the surface?**

"By way of revision you all know what principal stresses are as displayed in Slide 1. They are three stresses applied perpendicular to the faces of a unit cube of material. Together they represent the "State of Stress" ($\boldsymbol{\sigma_1, \sigma_2, \sigma_3}$). With only one stress being applied, the State of Stress is ($\boldsymbol{\sigma_1}$, 0, 0). With two stresses being applied we have ($\boldsymbol{\sigma_1, \sigma_2}$, 0).

With just one stress being applied, plastic yielding will occur if $s_1$ reaches the yield strength of the material, **Y**. For two or three stresses being applied simultaneously the situation is not so simple. We have to invoke what is known as a "Yield Criterion". The Tresca Yield Criterion is the simplest to employ for our purposes. Stated verbally, Tresca said that yield will occur if the difference between the largest and smallest principal stress reaches the yield strength of the material. As an equation, we have yielding when $\mathbf{Y = (\sigma_1 - \sigma_3)}$ where $\boldsymbol{\sigma_1}$ and $\boldsymbol{\sigma_3}$ are the largest and smallest principal stresses. Which is the largest principal stress for a state of stress (0, 0, q) where q corresponds to a compressive stress? The answer is 0. A bank overdraft corresponds to a minus quantity so you would be much happier to have a zero amount than a negative amount. Applying the Tresca yield criterion we now have yielding when (0 – q) =Y or q = Y with Y being the compressive yield strength.




*Slide 1. Principal Stresses.*

Remember that stresses are additive. For example, stresses of +200MPa and -100MPa acting in the same direction add up to +100MPa.

Revision over, we can now go on to tackle our problem.

The state of stress at the extreme surface of a shot-peened component is (0, $q_s$, $q_s$) with $q_s$ being compressive. The stress perpendicular to the extreme surface is always zero and the two compressive residual stresses act parallel to the component's surface. An important property of residual stresses is that their maximum value is always much less than the stress, Y, needed to cause plastic deformation. As a guide, the compressive residual stress at the extreme surface can only reach half of Y but reaches two-thirds of Y at some point below the extreme surface.

Below the extreme surface the state of stress starts to change. Δp is the change in the residual stress perpendicular to the surface and $q_x$ is now the compressive residual stress acting parallel to the surface. Our key question is "What is the maximum level of compressive residual stress that can be tolerated below the extreme surface where the state of stress is now three-dimensional?" Before tackling that question consider the following analogy. A survey is to be carried out on student height variation for groups of three. Results have to be presented in the format of "State of Height" ($h_1$, $h_2$, $h_3$) where h represents height. For one trio their heights are 6 feet, 5 feet and 5 feet represented as (6, 5, 5). These values can also be presented as (5, 5, 5) + (1, 0, 0). For height variation, we can ignore the first term, (5, 5, 5). This leaves us with simply (1, 0. 0) as the only values representing height variation. The (5, 5, 5) has no effect. This is obviously trivial mathematically, but reveals a vital principle that we can now use to solve our peening problem. To answer our peening problem, we again manipulate the state of stress in order to find an <u>effective</u> state of stress. The state of stress at the extreme surface of a shot-peened surface is two-dimensional and can be expressed as (0, $q_s$, $q_s$) where $q_s$ is the residual stress parallel to the extreme surface. Experimental evidence tells us that $q_s$ is approximately equal to half of the yield strength, Y. Applying Tresca's yield criterion we therefore have that (0 – $q_s$) = Y/2 or $q_s$ = -Y/2. The state of stress below the extreme surface becomes three-dimensional and can be expressed as ($\Delta p_x$, $q_x$, $q_x$) where $\Delta p_x$ is an increment of residual stress perpendicular to the surface and $q_x$ is the maximum residual stress parallel to the surface that can be sustained. Now ($\Delta p_x$, $q_x$, $q_x$) = [0, ($q_x$ - $\Delta p_x$), ($q_x$ - $\Delta p_x$)] + ( $\Delta p_x$, $\Delta p_x$, $\Delta p_x$) and, ignoring the second term as not contributing to stress limitation, we have: [0, ($q_x$ - $\Delta p_x$), ($q_x$ - $\Delta p_x$)]. Applying Tresca's yield criterion gives us: $q_x - \Delta p_x$ = -Y/2 or $q_x = \Delta p_x$ -Y/2.

$$q_x = \Delta p_x - Y/2 \qquad (1)$$

Let us now assume that $\Delta p_x$ corresponds to a compressive residual stress. Using imagined quantities of -10MPa for $\Delta p_x$ and 500MPa for Y, equation (1) tells us that $q_x$ = -10MPa – 250MPa or $q_x$ = -260 MPa. That compares with -250MPa (Y/2) at the extreme surface indicating an increase in compressive stress level below the surface. This does, however, rely on the assumption that $\Delta p_x$ is a <u>compressive</u> residual stress. A basic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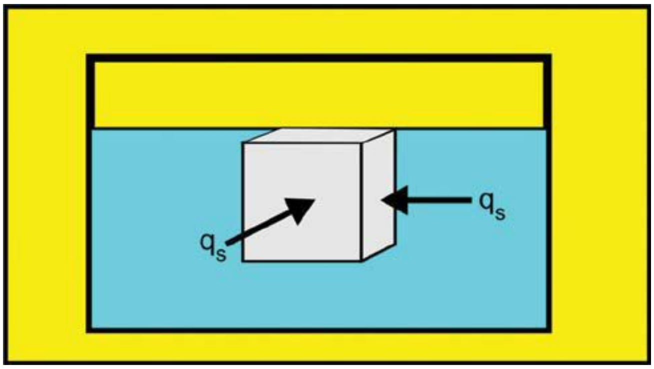
rule in both science and engineering is that we should be able to validate any assumptions made.

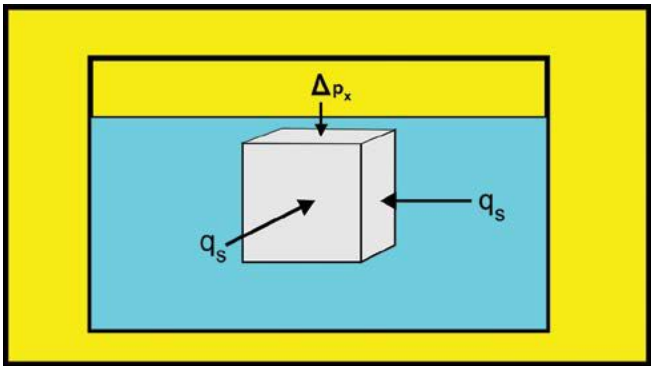
Consider the analogous situation illustrated in slide 2. A cube of material having exactly the same density as water (1g/cc) is placed carefully into a tank of water. The cube just stays at the water's surface. There it is subjected to a two-dimensional state of stress (0, $q_s$, $q_s$) with the pressure of water corresponding to the compressive stress, $q_s$.




*Slide 2. Two-dimensional cube stressing at surface of fluid.*

Now imagine the cube has been pushed down to just below the water's surface. Pushing the cube down requires a compressive stress, $\Delta p_x$. We now have the situation illustrated in slide 3.

If it helps to get the idea, think of an aquarium with a cube of fish food either floating at the surface or being pushed below the surface of the water.




*Slide 3. Three-dimensional stressing below surface of fluid.*

Assumption justified, albeit analogously!

End of tutorial – let's go for a beer.

## FATIGUE OF COMPONENTS

Fatigue of metallic components has a parallel with that of humans in these pandemic times. We get fatigued by the cycles of stress associated with lockdown. The higher the levels of stress the lower are the number of cycles needed to cause fatigue. If the combination of stress level and number of cycles is severe enough, we can exceed our endurance limit and simply crack up. Similarly, for metallic components when the combination of stress level and number of cycles exceed their endurance limit they also crack up.

The fatigue behaviour of metallic components is commonly represented in the form of S-N curves where S is the level of stress and N is the number of stress cycles. A simple version is shown as fig. 6. Note that both x and y coordinates use a logarithmic scale.

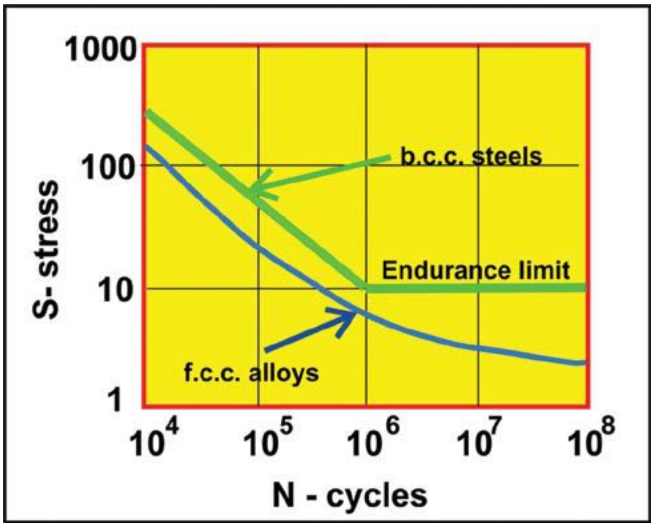



*Fig. 6. S-N fatigue curves.*

Different types of material have different shapes of S-N curve. Two characteristic shapes are shown in fig. 6. A range of from $10^4$ to $10^8$ cycles is commonly employed. At 50 cycles per second it takes about 3 minutes to apply $10^4$ cycles, 5 hours to apply $10^6$ and about 23 days to apply $10^8$ cycles.

The significance of the number of cycles involved depends upon the use to which the component is being employed. Blades of an aero engine, for example, typically rotate at about 104 r.p.m. Knowing the cyclic stress required to induce failure in one minute is of little practical use! Running times between overhauls are about 4,000 hours or 240,000 minutes. At $10^4$ r.p.m. this corresponds to stress cycles of about 2,400,000,000 or 2.4 x $10^9$. Testing at 50 cycles per second would take over a year. By way of contrast, aircraft landing gear is subjected o far fewer stress cycles so that stress to induce failure after $10^4$ cycles is now relevant.

Fatigue testing to high numbers of cycles does not rely on mains frequency. Two main approaches are to use either high-speed rotation under load or resonant frequency push-pull. The rate of loading does, however, affect the cycles to failure. Work is being done on the test sample during every stress cycle. Some of this work generates heat in the sample, raising its temperature.

A notable feature of fatigue tests is the amount of variation in cycles to failure that occurs when repeat tests are carried out at the same stress level. A variation of a thousand to one is not uncommon but is less obvious on S-N curves because of the logarithmic scale being employed. Surface condition of test specimens is a critical factor so that electropolishing is often employed. The surface condition of peened test specimens is then quite different from that of polished specimens.

Shot peening generally increases the stress required to induce failure at a given number of cycles as illustrated schematically in fig. 7.

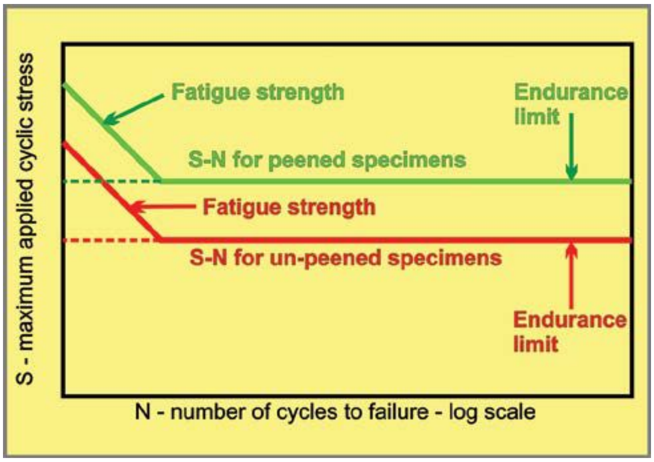



*Fig. 7. Schematic of effect of shot peening on S-N curves.*

A basic feature of fatigue tests is the large scatter of results. This is evidenced by the actual data presented in fig. 8. Consider the three data points for unpeened specimens tested at 200MPa. Failure occurred at 110,000, 2,000,000 and 2,100,000 cycles. Translating these figures to Almen arc height scatter would give 0.11 mm, 2 mm and 2.1 mm!

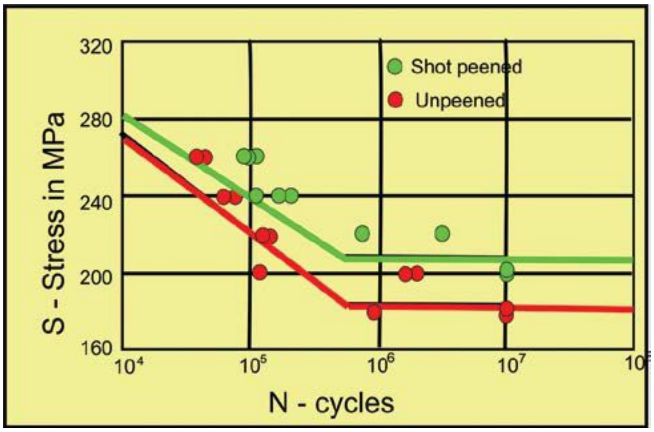



*Fig. 8. Test data for effect of shot peening on S-N curves.*

**COMBINED EFFECT OF WORK-HARDENING AND COMPRESSIVE SURFACE RESIDUAL STRESS**

Shot peening produces the double-headed benefits to fatigue life of both work-hardening and compressive surface residual stress. In service, components are normally subjected to both alternating stress and a fixed loading stress. This is illustrated by fig. 9. Imagine a railway wagon being pulled along a track using a force P. This will impose cyclic stressing—shown as S—with stress level increasing with increased track roughness. The weight of the wagon will impose a force, F, on the wagon's springs which translates to a constant applied stress. Goodman diagrams give us a neat way of combining these two effects of cycling and constant applied stress.

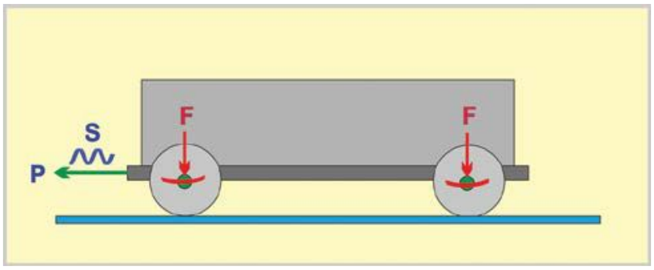



*Fig. 9. Schematic of wagon spring fatigue cycling.*

A basic Goodman diagram is shown as fig. 10. An area, such as the red one, indicates that the material should not fail given the combination of applied stresses. The area above the area represents likely failure.

Imagine a wagon, having unpeened springs, being progressively loaded. Eventually the springs would collapse, as their yield strength was reached at point A. No cyclic stress could then be applied before the train even started. Now consider what happens if the springs had been shot peened. The "magic skin" raises the stress at which the springs would collapse by AB and BC. More realistic wagon loading is indicated by E, M and H corresponding to Empty, Medium, and Heavy loading respectively. The fatigue strength, F.S., of the springs is correspondingly raised, from A to B and C. For wagons in motion the applied cyclic stress will increase as track roughness increases.

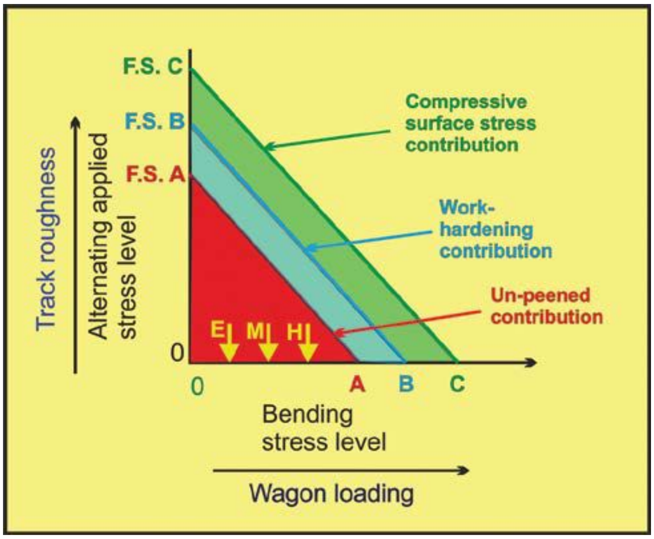



*Fig. 10. Goodman diagram modified to show separate contributions.*

**DISCUSSION**

This article has attempted to explain how the magic skin produced by shot peening increases the service performance of components. Of necessity, the treatment is relatively superficial. It tries, however, to stay within the framework of "Back to Basics." It cannot be stressed too highly that the "magic skin" works because of equally-important contributions from work-hardening and compressive residual stress.

# Viking Blast Systems Introduces Y-Track Spinner Hanger

**VIKING BLAST AND WASH SYSTEMS** introduces the newest in its line of heavy duty shot blast systems: The SHY 4848 Y-Track Spinner Hanger. The SHY 4848 in this configuration is totally automated upon loading your parts.

Spinner Hangers are very efficient as you can load and unload parts while the blaster is blasting another batch of parts. This unit allows for one touch of the HMI to initiate a full cycle of trolley discharge, trolley entry into the blast unit, door closing and blasting. In the Automatic mode, a light curtain surrounds the loading and unloading area, preventing workers from coming in contact with moving trolleys or parts. Three Viking VK PowerMax blast wheels blast the side, top, and bottom of the parts, giving thorough coverage. The blast chamber is completely lined for heavy duty, multi-shift operations.

Owned and operated in the United States, Viking Blast & Wash Systems manufactures and distributes a full line of industrial cleaning machines including abrasive shot blast machines, parts washers and vibratory deburring equipment.

Viking also offers an extensive line of replacement parts, including replacement parts for their competitors' equipment. Additionally, the company offers a wide range of premium quality abrasives and cleaning compounds.

Send email to Viking Blast and Wash Systems for further information at sales@vikingcorporation.com or call (316) 634-6699.

*Lane Barnholtz | Senior Editor | Clemco Industries Corp. | www.clemcoindustries.com*

# Clemco Opens Enhanced Sample Processing - R&D Lab

**CLEMCO INDUSTRIES** opened its enhanced Sample Processing - R&D Lab in early 2020. The new facility is 4,500 square feet—more than double the size of the old facility. It has 13 machines while the old lab had six. In addition, four industrial dust collectors have been installed outside of the building. The expanded facility is a reflection of how much Clemco's business has grown and how committed Clemco is to the new lab's twofold mission:

1. State-of-the-art sample processing
2. Ground-breaking research and development for the abrasive blasting industry

**Expanded Sample Processing Capabilities**

The new lab's sample-processing capabilities allow it to more accurately simulate a wide range of industrial blasting applications. After a customer sends samples of parts to be blasted along with details about the desired end results and their current process, the lab replicates the conditions of the customer's facility and researches solutions. The lab then uses the data it has collected to recommend the best equipment, media, and process required to solve the customer's blasting needs. Recommendations could range from modifications to the customer's current facility or process, purchase of standard or modified Clemco equipment, or a consultation with Clemco Engineering about custom-designing equipment for the customer. This service is free of charge to Clemco customers.

**Industry-Leading Research and Development**

We live in an information age, and Clemco is committed to being the recognized source of information for the abrasive blasting industry. To this end, the new lab:

- Explores methods for enhancing dust collector, reclaimer, and blast system efficiency.
- Researches how to develop better equipment components and safety equipment.
- Develops more productive blast machines, cabinets, and rooms.
- Performs ongoing research and shares new findings on how best to use media, equipment, and new procedures.

*Lucas Cahill, Clemco's Sample Processing Manager, in the company's enhanced Sample Processing - R&D Lab.*

**From Demolishing Cars to Overseeing the Lab**

Clemco's Sample Processing Manager, Lucas Cahill, never would have guessed that he would guide the opening of Clemco's new lab. When he was 14 years old, Lucas had his first welding job, helping to fabricate roll cages for his father's and uncle's demolition derby hot rods. Lucas eventually went on to compete as a derby driver while making a living as a welder. In 2005, after Lucas had seven years of welding experience under his belt, Clemco hired him. He continued to work as a journeyman welder until 2013, when Clemco promoted Lucas to Sample Processing Technician. Lucas worked under the wings of Herb Tobben until 2015 when Herb retired after more than 40 years as the lab's manager. Lucas stepped into Herb's shoes.

"If you would have told me 25 years ago when I was welding derby cars for my family that one day I would oversee the opening of Clemco's new Sample Processing - R&D Lab," Lucas jokes, "I probably would have told you that you were as crazy as my family. Funny thing is that I stopped driving in the derbies in 2008 to focus on family and career and I have no regrets."

**Request Sample Processing**

Contact Clemco Customer Service through email at custserv@clemcoindustries.com or by phone at 636-239-4300.

*Lucas Cahill (right) and his younger brother Clinton sit in front of what was a 1981 Ford LTD Station Wagon. Clinton drove and Lucas rode shotgun.*

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# The 2021 East European Seminar/Workshop

***Sponsored by EI Shot Peening Training, KrampeHarex, sentenso GmbH, and strahlportal***

*March 9 - 11, 2021*
*Ostrovačice, Czech Republic*
*Hotel D1*

**ANNOUNCING** the first shot peening training seminar and workshop to be held in the Czech Republic. This three-day training event is based on SAE specifications and it will cover all aspects of shot peening including techniques and applications. The program will be presented in English. Professional instructors will explain how to do the process correctly, how to make needed adjustments, and how to perform inspections.

## TRAINING TOPICS

This event will include the core FAA peening courses developed by EI Shot Peening Training, plus bonus lectures and shop training by sentenso GmbH.

- Shot Peening Introduction
- Peening Media
- Peening Intensity and Masking
- Peening Coverage
- Saturation Curve Generation
- Shot Peening Applications
- Durability and Energy Transmission
- Peening Media Inspection and Maintenance
- Particle Size and Shape Analysis (shop training)
- Basics of Residual Stress Measurement
- Process Parameters and Control
- Practical Residual Stress Measurement (shop training)
- Shot Peening of a Sample Part with Intensity and Coverage Development (shop training)
- Rotary-Flap Peening Introduction
- Rotary-Flap Peening Certification

The third day of the program will be held at the KrampeHarex facility in Ostrovačice. This hands-on workshop will cover media testing, peening intensity and coverage. The instructors will cover real-life applications in shot peening practices.

## ACHIEVEMENT EXAMS

Every Seminar/Workshop participant will receive a Certificate of Attendance. Students will also be eligible to take an EI Achievement Exam. Beginner, Advanced and Professional exams in shot peening will be offered as well as the Rotary Flap Peening exam. **Students must pre-register for the exams when registering for the Seminar/Workshop.**

## INSTRUCTORS

**Barkley, Dave.** Mr. Barkley is the Director of Shot Peening Training for Electronics Inc. He is also the 2020 "Shot Peener of the Year." Mr. Barkley oversees all aspects of the seminars, workshops, and on-site training programs that are conducted around the world. He also leads classes in fundamental and specialized peening processes.

**Hennig, Wolfgang.** Mr. Hennig is the sentenso Training Manager. He has worked in the aviation industry since 1990, focusing on shot peening. He has worked as a shot peening trainer since 2005. Mr. Hennig's training focus is on applications in aviation and engine components.

**Schneidau, Volker.** Mr. Schneidau has worked in blast cleaning and shot peening technology since 1997. The mechanical engineer worked for 10 years as a designer, project and sales manager in machine construction. In 2007, he founded the strahlportal engineering firm. In 2009, he founded sentenso GmbH. His training focus is on applications in automotive drive and chassis components.

*Wolfgang Henning leads a workshop class in rotary-flap peening.*

## SPONSORS

**Electronics Inc (EI)** manufactures products that improve the quality and control of the shot peening process including the MagnaValve media valve, controllers, Almen gages and strips. EI also publishes *The Shot Peener* magazine and maintains the largest online resource for shot peening and blast cleaning at www.shotpeener.com.

EI conducted the first public shot peening training event in 1991. Since then EI's Shot Peening Training division has issued over 14,000 certificates to shot peening professionals at seminars, workshops and private on-site trainings worldwide.

**KrampeHarex** is a specialised manufacturer of blast and peening media with operations all over the world. KrampeHarex produces high standard blast and peening media for a variety of industrial applications. Product quality is compliant with international standards and is routinely checked and documented in its own QM laboratory.

**sentenso GmbH** has delivered services and innovative equipment for process and quality management in shot blasting and shot peening since 2009. sentenso offers shot peening training through workshops with Electronics Inc., through training at their technical center, and at their customers' facilities.

**strahlportal** is an engineering service provider owned by Volker Schneidau. It has provided blast cleaning and shot peening technology services since 2007.

## HOW TO REGISTER

Visit www.shotpeeningtraining.com for information on fees, hotel accommodations, the schedule, and the training topics. A secure registration form is also available at the website. Students must pre-register for the event.

## PRESS RELEASE

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# Plastonium Purchases Sinto Spinner Hanger for Plastic Application

**SINTO AMERICA** is pleased to announce that Plastonium, located in Azcapotzalco, Mexico, has purchased their first DZB-2MT Blast machine. Plastonium was established in 1997 and has expanded to multiple plants since that time. Plastonium has more than twenty years of experience in the molding of thermosetting parts for leading companies in the market for electrical distribution and industrial control products.

Plastonium chose Sinto equipment due to the outstanding and efficient process the DZB offers. "We are very happy with the machine we purchased. It has given us better cleaning with low energy usage. The machine is very quiet as well. We are looking forward to purchasing more of the DZB machines in the future," said Cesar Roberto Vargas (Plant Manager).

*Left to right: Felipe Garza (Sinto Sales & Service Manager), Javier Alonso O (Plastonium Plant Director) and Cesar Vargas (Plastonium Plant Manager)*

The DZB Spinner Hanger features:

- Variable speed blast wheels
- Zero part impingement
- Safely uses zinc abrasive, lowering the risk of explosions
- Explosion prevention design
- Compact size with integrated dust collector
- Easy installation due to small footprint
- Indexing table allows operator to easily load/unload
- Robotic load/unload optional

Sinto shipped the equipment in September 2020 and is currently installing the equipment. The Sinto America team is looking forward to partner with Plastonium in future projects and supporting them throughout the years to come.

Sinto America, Inc. is the North American group holding company, of Sintokogio, Ltd., Japan. Sinto America focuses on six primary markets: Foundry, Mold and Core Making, Sand Processing, Automation, Surface Technologies and Surface Treatment. Sinto also provides contract blasting and precision shot peening services through our National Peening and Technical Metal Finishing divisions and cut wire abrasives through our Frohn North America division.


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