Summer 2022
Volume 36, Issue 3 | ISSN 1069-2010

The Shot Peener

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

Bringing Shot Peening In-House

Quality Specialist Maria Crawford (CeCe) contributes to the success of the new shot peening program at Collins Machine Works

PLUS: CURVE SOLVER TEMPLATE UPDATE ▮ A MACHINE WISH LIST ▮ BACK TO BASICS: ACCURACY OF PEENING MEASUREMENTS

Peening Innovation

COVERAGE CHECKER

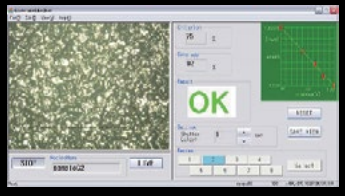
COVERAGE CHECKER

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

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)
Option : Autosampler function (4 - 8 stage)

Distributor

Country	Company	TEL	E-MAIL
USA	Electronics Inc.	+1 574-256-5001	sales@electronics-inc.com
CANADA	Shockform Inc.	+1 450-430-8000	sales@shockform.com
EUROPE	SONATS	+33 251-700-494	sonats@sonats-et.com

TOYO SEIKO CO.,LTD.
World Leading Company for Shot Peening
TEL:+81-567-52-3451 FAX:+81-567-52-3457
toyo@toyoseiko.co.jp
https://toyoseiko.co.jp

6
Bringing Shot Peening In-House
In only two years, Collins Machine Works has developed a successful shot peening program, specializing in new construction and the overhaul work of Naval shafting.

10
Curve Solver Template Update
Dave Barkley outlines his updates to Dr. Kirk's popular Saturation Curve Solver Program.

12
The Development of High-Speed Commercial Aircraft

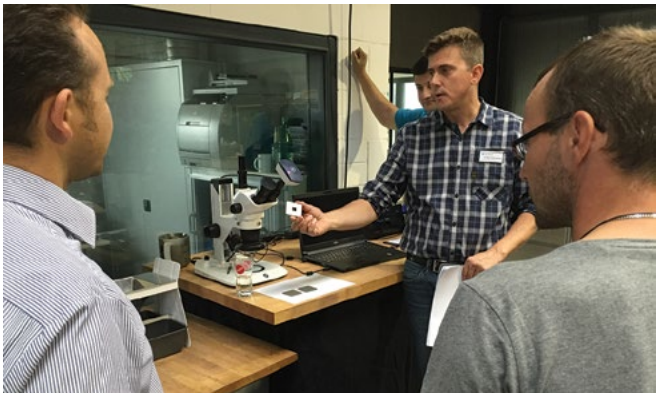
A press release by Hermeus on their relationship with NASA for the research and development of high-speed aircraft.

16
I Wish My Machine Did This
Kumar Balan explores the "wishes" in our industry and their importance to the end user. He also tests their viability in production conditions.

26
Back to Basics: Accuracy of Shot Peening Measurements
Dr. Kirk's article considers the implication of the three factors—assumption, precision and bias—on the accuracy of shot peening measurements.

34
Cavitating Jet: A Review
A research paper by Hitoshi Soyama on cavitation peening, cleaning and drilling.

36
Shot Peening Workshops with Practical Training
Volker Schneidau with sentenso shares how a dedicated combination of theoretical and practical elements in one training event provides numerous benefits to students.



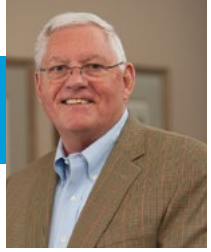
38
The New Four-Four-Two
Dave Barkley, sponsor of the updated J442, highlights its changes.

40
The 2022 Mid European Shot Peening Workshop
The September workshop is sponsored by EI Shot Peening Training, KrampeHarex, sentenso, and Wista.

44
Clemco Donates the "Ferrari of Blast Cabinets"
A high school welding program is the lucky recipient of the new Pulsar Plus 55-Suction Blast Cabinet.

45
OEM News
The latest developments in shot peening automation from FerroECOBlast.

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



OPENING SHOT
Jack Champaigne | Editor | The Shot Peener

Particle Analysis Research

PURDUE UNIVERSITY students and staff from the Center for Surface Engineering and Enhancement (CSEE) are researching the benefits of the JM Canty Industrial SolidSizer™ Particle Analysis System. The SolidSizer™ is an on-line particle sizing tool to determine particle size, shape, and distribution, thereby eliminating the need for sieve analysis. The project is funded by Electronics Inc. (EI) and JM Canty.

I recall my entry into SAE committees in the early 1980's. I was enthusiastic about shot peening, hoping to sell valves and Almen gages. It didn't take long to get confused about peening media requirements, both new and in-use. I was trying to understand the amount of media that must pass through a screen, the amount that must be retained on a screen, or the amount that can drop down to a pan. Dean Davies from Ervin Industries asked me once, "Did you want small S-110 or large S-110?" He was serious. The screening requirements are very broad.

Bob Gillespie of Premier Shot used a micrometer and measured 1,000 pieces of S-110 media. He discovered that the average size was close to 0.0014". For those that thought that it should have been 0.0011", this is a surprise until you realize that the screen mesh size that requires 50% capture is 0.0011". I'm looking forward to computer-controlled image analysis.

Electronics Inc. recently hosted a demonstration of the SolidSizer™. In addition to the EI engineering staff, the event was attended by Paul Mort, Professor of Materials Engineering at Purdue; Larry Catanzarite with Toyo Seiko; and Langdon Feltner, a Purdue engineering student.

Paul Mort, Professor of Materials Engineering at Purdue University, points out data from the JM Canty Industrial SolidSizer™ Particle Analysis System.

THE SHOT PEENER

Editor
Jack Champaigne

Associate Editor
Kathy Levy

Publisher
Electronics Inc.

For a free subscription of the *The Shot Peener*, go to www.theshotpeenermagazine.com

The Shot Peener
56790 Magnetic Drive
Mishawaka, Indiana, 46545 USA

Telephone: 1-574-256-5001

www.theshotpeenermagazine.com

Easy Controlled Peening for the Operator...
Peace of Mind for the Supervisor!

FlapSpeed® PRO Flapper Peening

- The leading reference tool in the industry
- Meets AMS 2590, BAC5730-2 and all EOM specs
- Guides the operator through the repair
- Monitors and adjusts RPM in real time
- Calculates peening intensity with the solver
- Saves process data to USB key
- Includes everything in one small case

Spiker® Needle Peening

- New tool developed for on-wing repairs
- Meets AMS 2545
- No risk of Foreign Object Debris (FOD)
- Great for difficult-to-reach locations
- Two peening heads for different geometries
- Individual needle monitoring
- Saves data to USB key for easy reporting

SHOCKFORM
Shockform Aeronautique Inc.

Call us at (450) 430-8000
or visit us online at
www.shockform.com

Dan Crawford | Quality Supervisor | Collins Machine Works | collinsmachine.com

Bringing Shot Peening In-House

AT COLLINS MACHINE WORKS, we are always striving to perform all our work in-house. One of the few processes we outsourced was shot peening. In January of 2020, our company CEO Robert Twine challenged us to research and develop a plan to perform shot peening. Our role previous to this was limited to scheduling the peening company, performing the 10x visuals of the completed surfaces, and scanning and saving the paperwork. For the most part, we knew little of the actual process of shot peening.

We were starting at ground zero with drawing references pointing to SAE AMS-S-13165 as well as SAE AMS-2430. Thoroughly reviewing those specs helped us to make our blast media selection and choose the correct equipment. We also knew we needed the best training our people could get. Our research led us to one destination—Electronics Inc. (EI). We already planned on purchasing an Almen gage, "A" strips, strip holders, etc., from them. Why not have them perform the training?

One major problem, however, was quickly developing—COVID-19. In the summer of 2020, there were still many unknowns about COVID-19 and the proper preventative measures and equipment required. All EI seminars and classes had been cancelled. Dave Barkley, Director of EI training, worked closely with us and was able to safely hold a class in our Charleston, South Carolina location. Our class consisted of an engineer, two machinist apprentices, a Quality Supervisor, and a Quality Assistant. After completion of the class, Quality Supervisor Dan Crawford, wrote the shot peening procedure. With a few adjustments from company peers, the procedure was approved for use.

In July of 2020, we had our first shot peen job to perform on a Navy propeller shaft. This particular shaft is unique in that it is 100% forged steel, but one end is clad with Inconel. The steel end of the shaft is shot with AMS 2431/1 cast steel shot, but the Inconel end requires AMS 2431/7 ceramic shot. Due to the size and configuration of marine shafting, temporary containment must be built around the area to be peened. Our temporary containment is a tent of commercial quality.

The complex geometry at the ends of the shafts requires the nozzle to be re-directed after each peened band achieves the required coverage. This requires the operator to be inside the containment during the peening process. Quality Specialist Maria Crawford (CeCe) stepped-up and said, "I want to be the one inside, peening the shaft." This came as a shock to everyone in the mostly male shop. How is this 5'3" fragile-looking little girl going to withstand this harsh environment?

Like a champ!

CeCe and Quality Supervisor Dan Crawford worked together to dial-in the equipment, peen multiple Almen strips, and plot the saturation curves for the steel and ceramic shots. Generating the saturation curves was not an easy task. Setting the "A" strips on a 70-foot-long shaft that weighs 70,000 lb., getting the mass rolling at the desired speed, then peening for 1, 2, 4, and 8 rotations, only to find out your intensity is too high or too low. Make some adjustments and try it all over again. New "A" strips affixed 1, 2, 4, 8 rotations, getting closer! Make adjustments, new "A" strips affixed and hopefully you have it right this time. Once it is right, set Almen strips for the "IN" and verify your intensity is correct. Once intensity is verified, shoot the part in its entirety and check for coverage. If all is well, set-up the "out" Almen strips.

But wait, that is only one end of the part! Now we must clean the machine out, clean the containment structure (tent) and perform all the above for the other blast media! New Almen "A" strips 1, 2, 4, 8 rotations all over again until we get it right. As we were going through these motions, Dave Barkley was our "phone-a-friend". Dave made great recommendations and got us going the right direction. Remember, we started from ground zero with nothing but determination. Dave taught us well, and along with the guidance he gave us, he referred us back to our training. This clarified his recommendations and made it seem less like voodoo magic and more like a science.

Being a small-ish company, Collins Machine Works (CMW) has employees that wear many hats. CeCe and the women of CMW are no exception to this rule. Add to this, CeCe's family immigrated to the USA from the Philippines 26 years ago when she was 12. She and her family spoke little English back then and she had a very tough time with language skills. For her to take the EI Level 1 and Level 2 class and get the same score as an engineer really shows her determination. Her continued determination has also led her to welding and fabrication, borescope inspections, shop safety officer, as well as obtaining her certification in rotary-flap peening.

WE HAVE THE WORLD COVERED

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

HIGH DURABILITY CUT WIRE SHOT (REDUCTION OF WASTE)
NON-DISTRUCTIVE INSPECTION DEVICE (POSITRON SURFACE ANALYSIS)

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

PEENING PROCESS USING NEEDLE PEENING EQUIPMENT FOR WELDED INFRASTRUCTURE (BRIDGE AND VESSEL)

TOYO SEIKO CO.,LTD

The World's Leading Company for Shot Peening

Thailand
Tel:+66-324-0046
Fax:+66-2-324-0047
info@toyoseiko.co.th

Japan
Tel:+81-567-52-3451
Fax:+81-567-52-3457
toyo@toyoseiko.co.jp
toyoseiko.co.jp

North America
+1 (574)-288-2000
sales@toyoseiko-na.com
toyoseiko-na.com

TOYO SEIKO SIGNS A PARTNERSHIP DEAL WITH winoa
preparing tomorrow's surfaces

With CeCe leading the way, CMW has now peened nearly 30 shafts in under two years. Others in the Navy shafting industry have taken notice of our newfound abilities and have now contracted CMW to perform peening on their shafts. CMW has also peened experimental test pieces for a major Navy shipbuilder. The shipbuilder is researching and measuring the effects of various media types, differing intensities, and their effect on various materials.

CMW has an abundance of peening work to perform in Charleston and at other Naval overhaul facilities. CMW performs new construction and overhaul work of Naval shafting in Charleston and Portsmouth, Virginia. CMW also performs on-site machining of Naval vessels, power generation, steel and paper mills worldwide. Shot peening and rotary-flap peening will be no exception to this. Our equipment is housed in custom transport boxes and can be delivered anywhere in the world.

Our peening capabilities compliment our other services, providing one-stop shopping. Quality Supervisor Dan Crawford said, "We learn with every job we perform and just keep getting better, every time. I highly recommend EI for their products and their training. Without the education and continued guidance from EI we would not have been successful in our endeavors."

About Collins Machine Works

Since 1960, Collins Machine Works has specialized in industrial-scale solutions. In addition to shot peening, the company provides the following services:

- On-site service
- Pump repair
- Industrial engineered machinery
- Quality assurance
- Large/heavy machinery
- CNC machinery
- Specialized welding services
- Machine shafting and components
- Project management

Collins Machine Works serves these industries:

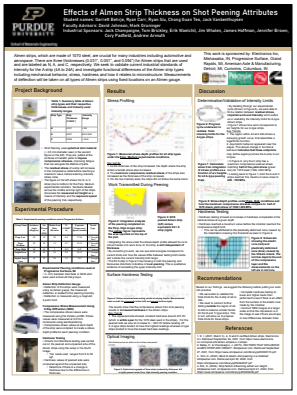
- Marine
- Steel
- Power generation
- Mining
- Paper and pulp
- General industry
- Municipalities

Facilities:
Charleston, South Carolina
Portsmouth, Virginia

Contact:
702 5th Street, Portsmouth, Virginia 23707 | 757-399-7777

Almen Strip Research

ENGINEERING STUDENTS at Purdue University recently presented their senior-year project work in a poster session.



One such poster was titled "Effects of Almen Strip Thickness on Shot Peening Attributes." The participating students are Garrett Behrje, Ryan Carr, Ryan Siu, Chong Guan Teo, and Jack Vanbenthuysen. The faculty advisors are David Johnson and Mark Gruninger. The industrial sponsors for this project through the Center for Surface Engineering and Enhancement program are Electronics Inc., Progressive Surface, American Axle & Manufacturing, and Cummins.

Poster Introduction

Almen strips, which are made of 1070 steel, are crucial for many industries including automotive and aerospace. There are three thicknesses (0.031", 0.051", and 0.094") for Almen strips that are used and are labeled as N, A, and C, respectively. We seek to validate current industrial standards of intensity for the A strip (4A to 24A) and investigate functional differences of the Almen strip types including mechanical behavior, stress, hardness and how it relates to microstructure. Measurements of deflection will be taken on all types of Almen strips using fixed locations on an Almen gauge.

Recommendations

Based on our findings, we suggest the following before putting our work into practice.

- We were able to validate the finite limits for the A strip of 4A to 24A.
- We need to conduct further testing **outside** the region of 4A to 24A to observe similar trends for the N and C type strips. This in turn will allow us to propose finite limits for these strips.
- Complete hardness testing at lower and higher loads than performed to see if there is an effect from the surface or the elastic core made by the indenter.
- Conduct SEM images at a larger scale so that the impression is in the image to see if there are shape or size differences between trials.

Visit www.shotpeener.com or scan the QR code for the complete poster.

CURTISS-WRIGHT
SURFACE TECHNOLOGIES

LEADERS IN SURFACE ENGINEERING

Increasing the performance and life of critical components

SHOT PEENING AND RELATED SERVICES:

- Shot & Laser Peening
- Peen Forming & Distortion Correction
- On-Site Shot & Laser Peening
- Vibratory Superfinishing
- Non-Destructive Testing
- Approvals: AS9100, NADCAP, ISO9000, FAA/ EASA & most OEMs

OTHER SERVICES:

- Solid Film Lubricant & Liquid Coatings
- Thermal Spray Coatings
- Parylene Coatings
- Materials Testing

GLOBAL FOOTPRINT

65 FACILITIES | 16 COUNTRIES

United States, Mexico, Canada, United Kingdom, Belgium, France, Germany, Ireland, Poland, Portugal, Spain, Sweden, Switzerland, China, India and Singapore

CWST.COM | INFO@CWST.COM | 201.518.2979

Our Brampton, Ontario facility is installing equipment for robotic peening of large landing gear. This complements our magnetic particle and fluorescent penetrant inspection of large landing gear.

Dave Barkley | Director of Training | EI Shot Peening Training

Curve Solver Template Update

Professor David Kirk's Saturation Curve Solver (SCS) was one of the first offered to us shot peeners. The original spreadsheets debuted as a demonstration of Microsoft Excel's usefulness, but the industry quickly embraced it as a replacement to traditional graph paper and French curves. Today it remains the most used tool for finding peening intensity.

The last major revision of the SCS Template Suite was in 2009 when it was updated to work with Microsoft's then new Excel program and file extensions. More recently the COVID-19 pandemic slowdown gave me the opportunity to add features to a new version of the SCS templates – Version 10.

Aesthetically, the coloring has been changed and some text softened to direct focus on the more pertinent information ① (see the screenshot on page 11).

Years ago, I created macros for some of my personal SCS templates. Doing this along with adding a button ② make using the templates easier by automatically running the last few steps to find intensity. Only a few on-site training students got copies of my personal versions because email systems would usually red-flag files containing macros thus preventing them from getting to the people that requested them on the shotpeener.com website. All SCS Version 10 templates now have a macro version and are bundled in a ZIP file to make distribution via email easier.

Periodically verifying intensity of a process involves peening a single test strip for a specific time to confirm an established saturation curve is still valid thus verifying the intensity has not changed. Often the test strip is peened for a time not equal to the established curve's solved saturation time (T). SCS Version 10 templates can now provide a target arc height ③ for a peening time ④ other than the solved saturation time (T).

As an SAE Surface Enhancement Committee member, I've advocated for computer-generated saturation curves to have a minimum "fit" quality, and the SCS Version 10 templates include my recommended method of evaluation. To declare the fit of a curve as "Good" or "Poor" the template calculates the percentage difference of each data point's given arc height value to the arc height value from the fitted curve. All the data points' error percentages are also averaged to evaluate the curve as a whole. The whole curve fit, as well as each individual data point is declared "Poor" if an error is 5% or more, or "Good" if an error is less than 5% ⑤. Please note that this declaration is for informational purposes only as saturation curve fit quality is currently not required by SAE J2597, however this may be added in future revisions.

Lastly, the template's file naming convention has been changed to reflect the template's legacy name, its purpose, the curve generation method, and its individual release date.

Excel Curve-fitting to Almen Strip Data
Height = a(1 - exp[(-b*time^{c}))

SATURATION CURVE SOLVER, PROGRAM SCS3m

EXP3P STANDARD vers.10 Macro

⑤

Strip No.	Time	Arc Height	Pre-bow	Corrected Height	Calc Y	Residuals	Res Sqrd
	0	0	0	0		0	0
1	2	3.5	0.2	3.3	3.4	877	0.0352
2	4	5.2	0.1	5.1	4.7120	-0.3880	0.1505
3	8	5.6	0.1	5.5	5.7985	0.2985	0.0891
4	16	6.8	0.3	6.5	6.4515	-0.0485	0.0023
5	32	6.8	0.1	6.7	6.6633	-0.0367	0.0013
6				0.0	0.0000	0.0000	0.0000
7				0.0	0.0000	0.0000	0.0000
8				0.0	0.0000	0.0000	0.0000
9				0.0	0.0000	0.0000	0.0000

①

Parameter Values		AvError
a	6.69	4.0%
b	0.45	POOR
c	0.73	5.7%
Start value for a=	6.7	7.6%
Start value for T=	7.5	5.4%
Sat. Intensity =	5.91	0.7%
T=	8.72	0.5%
f(x) =	-7.92342E-05	0.0%
		0.0%
		0.0%
		0.0%
If WARNING or ERROR appear above, read note below graph.		0.0%

Upper Limit = 7
Lower Limit = 4

SUM = 0.27856 RMS-R= 0.2360

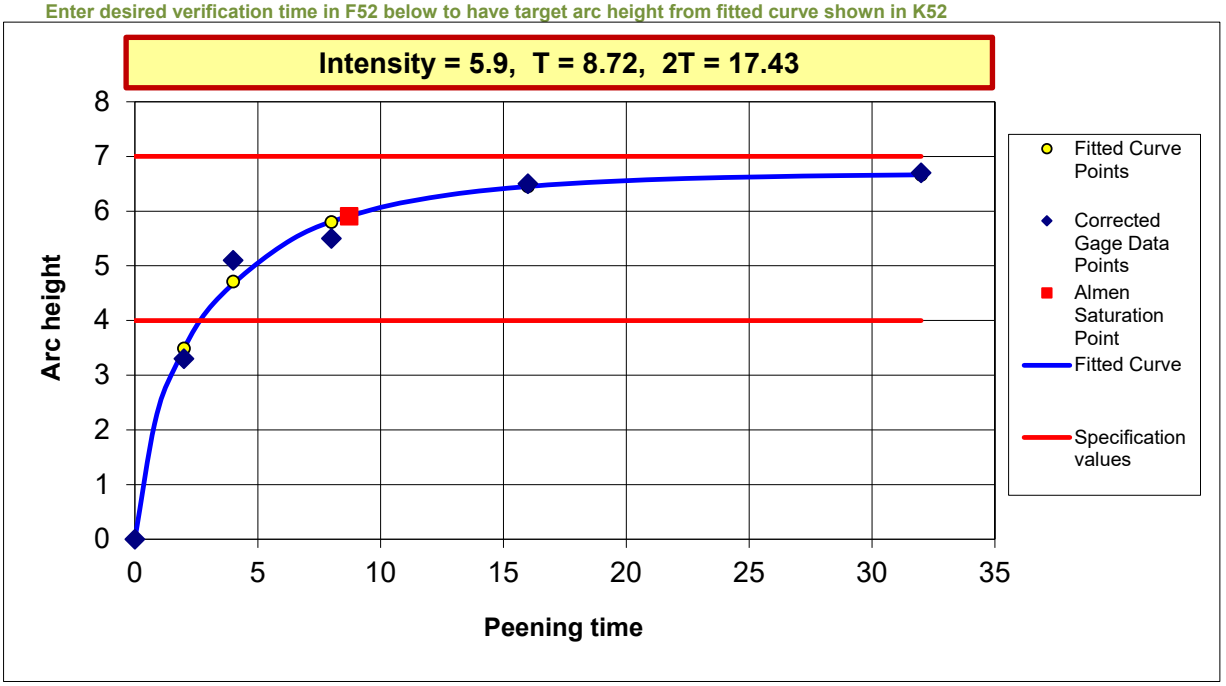
STEP 1 Enter data values within blue frame after deleting previous values
Arc heights to be in thousandths of an inch or micrometers

STEP 2 Enter I
Enter a
STEP 3 Select
STEP 4 Select
and K

RUN SOLVER
EXECUTES STEPS 2-4

②

STEP 5 (Options) Enter lower and upper intensity spec limits in the E17 & E18 above to display on graph below
Enter desired verification time in F52 below to have target arc height from fitted curve shown in K52



Verification time 13 ④ Verification target arc height 6.3

NOTE: "ERROR" signifies that the longest strip peening time is less than 2T.
"WARNING" signifies that the shortest strip peening time is greater than T. ③

This updated version of Dr. Kirk's Curve Solver is a free download at www.shotpeener.com.

PRESS RELEASE
Hermeus | www.hermeus.com

Hermeus Teams with NASA on Development of High-Speed Commercial Aircraft

HERMEUS, the aerospace company developing Mach 5 aircraft, has a Space Act Agreement (SAA) with NASA for research and development of high-speed aircraft.

NASA has a long history with hypersonic planes. Its most recent hypersonic aircraft was the X-43, an experimental aircraft that flew Mach 9.6 in 2004. Before that was the X-15, a piloted rocket-plane, which flew Mach 6.7 in 1967. Now, 17 years after X-43's record-breaking flight, Hermeus is teaming with NASA to commercialize high-speed flight technology NASA has been exploring for decades.

Under the agreement, NASA will evaluate technological maturity and exchange subject matter expertise. Both organizations will collaborate on the development of aircraft concepts of operation, including analysis of high-Mach thrust performance, thermal management, integrated power generation, and cabin systems.

This partnership reflects NASA's investment in drastically increasing how fast people move around the planet through the development of commercial high-speed flight. "High-speed flight represents the next frontier in commercial passenger travel and has the potential to radically impact how people interact. NASA looks forward to working with Hermeus towards that faster future," said Chuck Leonard, Project Manager of NASA's Hypersonic Technology Project (HTP). The project focuses on sustaining hypersonic competency for national needs while advancing fundamental hypersonics research.

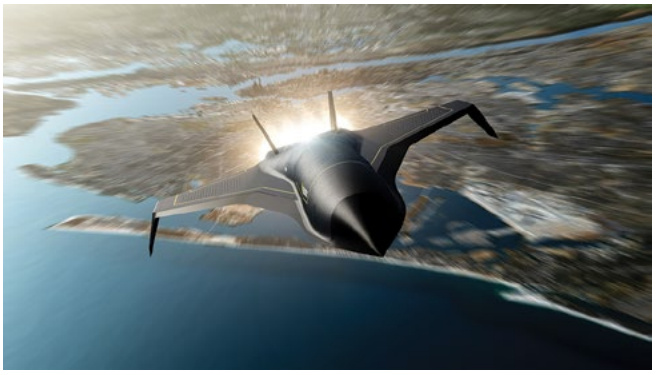
This further indicates US governmental interest in Hermeus' vision of Mach 5 commercial flight. In 2020, Hermeus was selected by the US Air Force to study how Hermeus' Mach 5 aircraft can support the objectives of the Presidential and Executive Airlift Directorate, whose fleet includes Air Force One.

Hermeus is committed to transforming the global transportation network with the fastest commercial aircraft, and the research done with this partnership will be key to getting there quickly. The technical solutions developed by NASA and Hermeus under this partnership will be applied directly and tested on Hermeus' GE J85 jet engine, which will be the core of the turbine-based combined cycle (TBCC) for their first series of aircraft. Over the coming months and using their Series A funding, Hermeus will modify this engine to be Mach 5 capable, utilizing lessons learned from its nine-month demonstration engine test campaign.

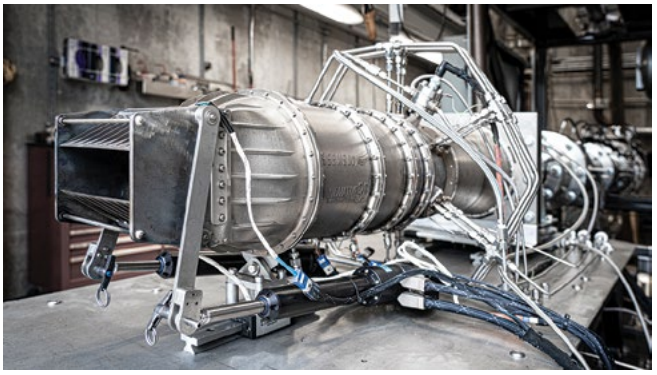
"NASA has been at the forefront of developments in high-speed flight since its creation in 1958," said Michael Smayda, Founder and Chief Product Officer at Hermeus. "We are excited to partner with NASA as we develop the technology to revolutionize long-distance air travel."

ABOUT HERMEUS

Hermeus is a venture-backed startup with the long-term vision of transforming the global human transportation network with Mach 5 aircraft. At Mach 5, travel is not just supersonic, it's hypersonic. At these speeds—over 3,000 miles per hour—flight times from New York to London will be 90 minutes rather than seven hours. Mach 5 aircraft have the potential to create an additional four trillion dollars of global economic growth per year, unlocking significant resources that can be utilized to solve the world's great problems.



The Halcyon prototype: This Commercial Passenger Hypersonic Aircraft has a titanium alloy primary structure and 4,600 mile range

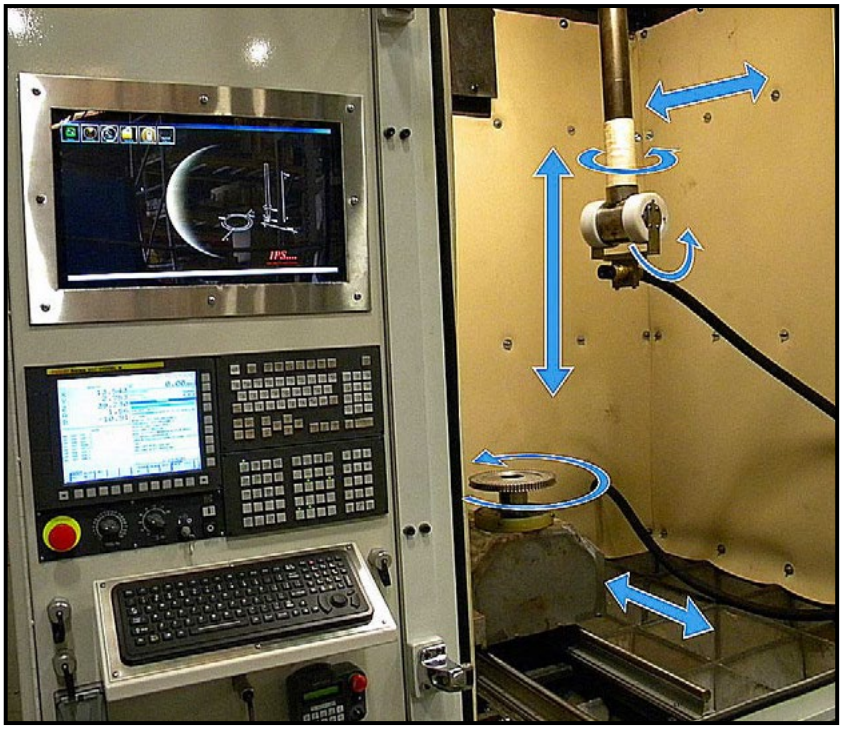


A Hermeus Mach 5 Prototype Engine

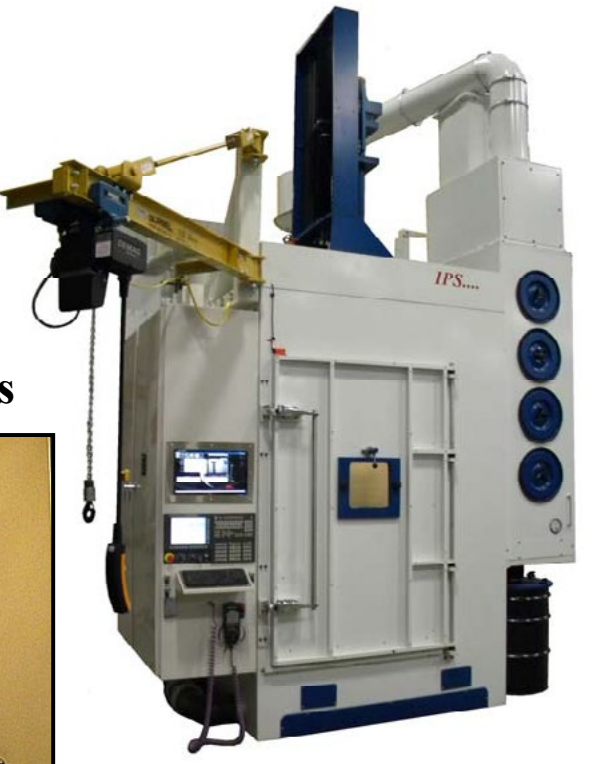
(Photos used with permission from Hermeus)

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

Web: www.ipsmachines.com

Email: info@ipsmachines.com

The only *Double-Sided* Numbered Almen Strips

with Coverage Check Finish*

The Electronics Inc. Almen strip lot number is printed at the top of both sides of our Numbered Almen Strips with Coverage Check Finish.* This insures that you always have a legible lot number and plenty of room to add your own notes.

Printing our lot number on both sides of the strips is just one more way our Almen strips contribute to a validated shot peening process.

*** U.S. Patent No. 6,568,239 for Coverage Check Finish**

Electronics Inc. – The Almen Strip Experts Since 1987

We are responsible for every aspect of the manufacturing process to ensure that EI Almen strips qualify to industry specs from standard MIL to aerospace specifications.

Our grading system (3™, 2™, 1™, 1S™) makes it easy to choose the best strips for your shot peening process including automotive, aerospace and medical applications.

Electronics Inc. maintains a large inventory of Almen strips to insure fast delivery around the world.

1-800-832-5653 or 1-574-256-5001 | www.electronics-inc.com

Ask for the results of our Almen Strip Consistency Testing Program. We can prove that our strips are nearly identical in lot-to-lot arc height results from month to month, year to year.

Electronics Inc.
Shot Peening Control

SINTO SURFACE TECHNOLOGIES

NATIONAL PEENING AND TECHNICAL METAL FINISHING

SOLUTIONS PROVIDER

- ☑ **SHOT PEEN**
- ☑ **FINISHING**
- ☑ **BLAST/CLEAN**
- ☑ **BURN-OFF**

First and Foremost **Customer Focused**

Mobile services that come to you

On Time Delivery and Proven Reliability

Exceptional **Quality** and Customer Service

Cutting Edge Solutions and Technologies

Nadcap Administered by PRI ACCREDITED Surface Enhancement

nqa ISO 13485 MEDICAL DEVICES | nqa ISO 9001 QUALITY MANAGEMENT | nqa AS9100 AEROSPACE & DEFENSE | ANAB ACCREDITED MANAGEMENT SYSTEMS CERTIFICATION BODY | JQA JIS Q 9100 | JAB MS CM009 | URS ISO 14001 | UKAS MANAGEMENT SYSTEMS

SEVEN Surface Enhancement centers located in the **Northeast, Midwest and Southeast**!

sinto

New Harmony ≫ New Solutions ™

NATIONAL PEENING
SINTO AMERICA
Tel 336-488-3058 / 203-641-3179
NP.info@sintoamerica.com
SintoAmerica.com

TECHNICAL METAL FINISHING
SINTO AMERICA
Tel 336-488-3058 / 203-641-3179
TMF.info@sintoamerica.com
SintoAmerica.com

www.sinto.com

sinto SURFACE TECMART™

AN INSIDER'S PERSPECTIVE

Kumar Balan | Blast Cleaning and Shot Peening Specialist

I Wish My Machine Did This

WHAT IS WRONG WITH THIS PROCESS?

If it seems like I am starting this discussion on a negative note, I urge you to re-construct this question as, "what would I like this process to be?" By process, I am referring to blast cleaning, shot peening, grit blasting and all such associated applications that you are involved with. In here, we have all accepted the inevitability of dust and media leakage, noise, and unanticipated maintenance to be part of this process. However, these undesirable characteristics need not prevent us from dreaming of what it could be. Our discussion here is to give life to some of these "wishes," learn why they are important to the end user and test their viability in production conditions.

At the recent CastExpo in Columbus, Ohio, I met with seasoned foundry professionals who had spent over 40 years in the industry amongst blast machines. Their musings are my inspiration for this article. Before I start, I would like to share a discussion from over 25 years ago with a senior executive of a blast machine company. He was reporting on a technological breakthrough that his company was working on where the operator could "dose" the abrasive storage hopper with a concentrated liquid, which when mixed with the abrasive, would enable the abrasive to not only clean the part, but also coat it with the subject liquid. My impressionable mind then did not want to question the wisdom of this technology for fear of reprimand, but if this had been fruitful, SSPC[1] (AMPP now) would certainly wonder how they were going validate the cleanliness of steel if it emerged all painted from a blast machine! I promise not to humor you with such "wishes" but instead will present some gems my industry colleagues have brought up that are worth debating.

THE WISH TO RECOVER LEAKED SHOT

Let us start from some basics by following the shot particle through the machine. Bob Schoen is the Field Training at Blast Cleaning Technologies in West Allis, Wisconsin and a well-respected industry professional. "Media leakage is endemic with this process. No matter how robust your maintenance program, spillage from part carryout, worn seals or badly designed spill hoppers under access doors result in media spillage around the machine perimeter. I find that 80% of the media leakage is within 5'-8' of the blast cabinet, with the exit handling system such as vibratory shakers and such contributing to the remainder," explains Bob. "For a solution, consider strategically placed inlet (suction) points around the machine at floor level. Such points, when operated individually, in a defined sequence open up a high capture area to return either swept or shoveled abrasive back into the system. This abrasive could be diverted to the abrasive adder, or to an alternate storage arrangement. A dedicated suction source similar to an industrial vacuum can work independent of the machine ventilation system and can continue to be functional even when the machine is shut down. This will help recover some of this spillover and make the area less prone to personnel slippage."

There is certainly merit in exploring this further. Though the risk of introducing foreign particles such as fasteners and other impurities greater than the size of steel shot is certainly high, this can be addressed by installing screens at multiple points within the reclaim system to separate and prevent them from approaching the blast wheel spinning at 3000 plus RPM, or the blast nozzle.

CAN WE TALK NEAR THE MACHINE?

I admit to have nodded knowingly when someone talks to me near an operating machine, without actually being able to hear the person. Thankfully, after all these years, most equipment issues have a past reference in my brain that I draw on! As an industry, we have begrudgingly accepted that "Hearing Protection Required" is a norm for blast machines. My colleagues in the shot peening world, especially those low-intensity aerospace applications in the N and low A strip values, are exempt from this part of our discussion since they can still carry on a conversation with the machine peening

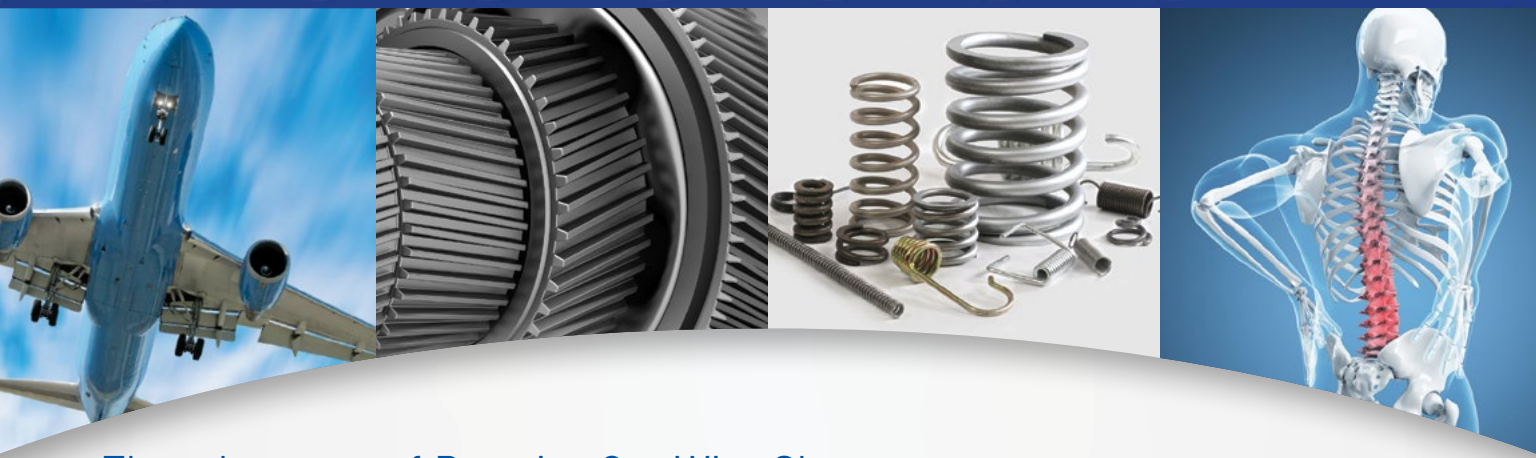
[1] SSPC (Society for Protective Coatings) is now united with NACE and is called AMPP (Association for Materials Protection and Performance). AMPP publishes standards for metal surface preparation.

PREMIER

PREMIER SHOT COMPANY

1666 Enterprise Parkway Twinsburg, OH 44087

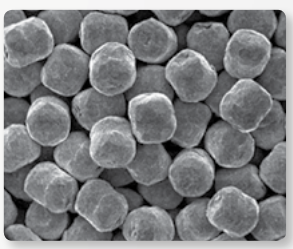
A Cut Above



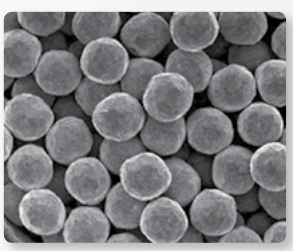
The advantage of Premier Cut Wire Shot

- **Highest Durability** Due to its wrought internal structure with almost no internal defects (cracks, porosity, shrinkage, etc.) the durability of Premier Cut Wire Shot can be many times that of other commonly used peening media
- **Improved Consistency** Highest consistency from particle to particle in size, shape, hardness and density compared to commonly used metallic media.
- **Highest Resistance to Fracture** Premier Cut Wire Shot media tends to wear down and become smaller in size rather than fracturing into sharp-edged broken particles, which may cause surface damage to the part.
- **Lower Dust Generation** Highest durability equals lowest dust levels.
- **Lower Surface Contamination** Cut Wire Shot doesn't have an Iron Oxide coating or leave Iron Oxide residue — parts are cleaner and brighter.
- **Improved Part Life** Parts exhibit higher and more consistent life than those peened with equivalent size and hardness cast steel shot.
- **Substantial Cost Savings** The increase in useful life of Premier Cut Wire Shot results in savings in media consumption and reclamation, dust removal and containment, surface contamination and equipment maintenance.

As Cut



Normal Conditioning



Special Conditioning

Premier Shot Cut Wire Products for

Automotive ● Medical

Aerospace Applications Worldwide

(330) 405-0583

1666 Enterprise Parkway,
Twinsburg, Ohio 44087

premiershot.com

at low air pressures! But for the rest of us, a Time Weighted Average of 85 plus dBA is "business as usual"! Most times, especially in foundries and forge shops, the ambient noise clouds the noise generated by our not-so-innocent blast machine, and we get a free pass! The industry has innovated with sound mitigation measures such as thicker cabinet walls, inflatable door seals, rubber sound insulation (in addition to hanging rubber liners), hanging sound curtains around classifiers, silencers for dust collector fan outlets and so on. But there is something more fundamental about sound—it has a definite frequency, or it appears within a frequency band.

How about if a sound engineer invests some time to determine the frequency bands where our machines create noise and produce a counter-noise to nullify the effect of the source noise? If white noise can help people sleep, surely something can be done to reduce the blast machine noise so that we can have a conversation with the machine running.

I HAVE NO SPACE FOR A NEW MACHINE

It is common for the blast process to be an after-thought in a production line, especially in cleaning applications. Even in peening, I have worked on several projects where the benefits of peening were accepted only after experiencing a component failure. Though we welcome all users, new and existing, late adoption does present a unique problem about space constraints to new users, in all three dimensions! To quantify this, I reviewed a few common machine sizes, both airblast and wheelblast. With a classifier in the system, whether vacuum reclaim or mechanical, the system requires at least about 18' (5.5 M) above floor level for its location. This is predicated by the standard reclaim tower with a cyclone on top, a classifier and then a blast tank underneath, with some media storage squeezed in between. A mechanical reclaim system works in a similar set-up, with the media reclaim duct and cyclone replacing the bucket elevator and airwash separator.

Though the part size (work envelope) plays a major role in determining the cabinet height, the reclaim system requirement described above is quite generic. Is it time to re-think our basic premise of a reclaim system and re-design parts of it by de-escalating them from their penthouses? I know what you are thinking—if they do not go higher, they will consume more floorspace (as in a dual elevator system to decrease overall height). I am not giving into that; I am hinting towards something a lot more drastic—I am suggesting a completely different way of handling media that we have not thought of yet. I am going to leave this thought for you to build upon.

On the other hand, perhaps it is time to consider alternate peening technique. We have discussed a list of them in these columns back in 2018[2]. David Lahrman, VP Business Development at LSP Technologies in Dublin, Ohio, has the following to add, "The conventional wisdom that laser shock peening is an expensive alternative to shot peening is being challenged with every application we work on at LSP Technologies. Undeniably, there are specific applications that can be addressed only with lasers, but we are also innovating to the possibility of bringing this technology to mainstream applications such as transmission gears and aircraft parts. All that without the need for shot reclaim, ventilation and all those maintenance-prone aspects of conventional shot peening." More of this technique was discussed back in Fall 2021[3].

MEASUREMENT OF COVERAGE

My next stop along this journey was at Toyo Seiko for discussions with Shota Watanabe and Larry Catanzarite. They are good friends and colleagues on different SAE and Surface Enhancement committees. They introduced me to the latest UV version of their coverage checker. Shota explained, "Our new ultraviolet LED with a wavelength of 375 nm with a light source, measures the degree to which fluorescent paint applied to the surface prior to peening is peeled off during peening. Unlike the previous version with white light, there is no need to prepare a measurement condition. This new technique allows us to measure dual-peened surfaces such as seen in case-hardened material like heavy-duty transmission components." More about this can be found here.[4]

SAE J2277 lists several direct methods involving optical analyzers and indirect ones such as fluorescent tracers, dry marker inks, replicas, coupons, etc., all of which are validated by 10X-30X magnification. However, the validation continues to be subjective. I have had several customers approach me enquiring about economically viable, inline techniques to assess coverage on each and every part. Though I have discussed process controls in your peening operations that will ensure every part is impacted by the same quantity of media, at the same velocity, the answer to automate inspection of each and every part for coverage remains evasive. Operators and engineers realize the criticality of complete coverage, and misgivings of excess coverage. More efforts need to be placed to explore better coverage techniques in a critical process like peening.

WORKING MIX IN A FOUNDRY

The inspiration for this article came from foundry colleagues that work with a completely different set of goals (cleaning) as

[2] *"Non-conventional Peening Techniques", The Shot Peener, Winter 2018*
[3] *"Laser Shock Peening", The Shot Peener, Fall 2021*
[4] *https://toyoseiko.co.jp/en/product/coverage-checker-uv*

AUTOMATED SHOT PEENING SOLUTIONS

EMPIRE ABRASIVE EQUIPMENT

HIGH PRODUCTION

- Fixed gun and horizontal/vertical linear operations.

GUARANTEED REPEATABILITY!

PRECISION PROCESSING

- Six (6) axes of robotic manipulation.

CONSISTENT & UNIFORM BLAST COVERAGE!

CUSTOM PEENING SOLUTIONS AVAILABLE

Gibson Abrasive Equipment Co.

NO MANUAL FLIPPING REQUIRED!

MULTIPART PROCESSING

- Versatile in-line processing capabilities.

- Dual chamber design for increased production.

PROCESS LARGE BATCHES OF SMALLER PARTS TOGETHER!

360° PART COVERAGE!

Empire Abrasive Equipment | 2101 W. Cabot Blvd. | Langhorne, PA 19047 | 215-752-8800 | airblast@empire-airblast.com | www.empire-airblast.com
Gibson Abrasive Equipment | 7988 Centerpoint Drive Suite 400 | Indianapolis, Indiana 46256 | 317-758-6775
Toll Free: 888-867-1619 | ggibson@gibson-equipment.com | www.gibson-equipment.com

compared to Aerospace and Automotive users of shot peening equipment. Interestingly, as a side note, foundries often employ the MagnaValve to monitor and meter media flow since it affords the luxury of no moving parts in the valve—foundries have enough maintenance issues with moving parts in other equipment to contend with!

Balanced working mix or operating mix is a critical factor when discussing shot (or grit) in a foundry cleaning application. These terms refer to the perfect blend of large and small size abrasive particles where the former is responsible for denting and pulverizing the scale and rust while the latter sneaks into the crevices and tight areas in the castings. As you can imagine, this concept of an operating mix is not permissible in shot peening where we rely on the classifier and our regular inspections to constantly eliminate contaminants larger than the shot or smaller fines that do not fit within a narrow threshold and endeavor to maintain consistent shot size in the process.

Foundries are familiar with shot screening with their experience of carrying that out that exercise regularly with sand. However, it is a chore. Robert (Bob) Adelman, Manager of Value Added Services at Grede Reedsburg Foundry in Wisconsin, explains, "Shot screen analysis on the fly will greatly help with managing our process. This, when combined with a reliable, automatic shot adder eliminates reliance on the operator to carry out this task. If left for too long, and if there is an issue with our operating mix, it leads to improper cleaning and possible re-work. Not adding shot in regular intervals results in a working mix that is too fine, adversely affecting cleaning time. Adding a large quantity of new shot all in one go upsets the balance once again, with the work mix running too coarse. An "on the fly" shot screen analysis will mitigate a lot of these issues." In extremely busy foundries such as Grede, re-work adds significantly to cleaning and handling costs and they keep strict tabs to minimize such occurrences.

Handling is a large part of any blast operation, and simply put, re-handling is wasted money. Bob added, "Blast equipment manufacturers should start thinking of a bypass at the exit end that would return product requiring re-blast to the infeed side. In most continuous machines, re-blasting tends to be dedicated cycle—the re-blast parts are sorted and stored separately to be re-introduced as a separate cycle often in a dedicated shift."

Jim VanCoulter, the Mill Room Supervisor at the same foundry, points out to another interesting benchmark for operating economics—abrasive durability. This is something we do not assign much importance to in the shot peening world. In foundries that operate multiple blast cleaning machines that are fitted with high HP wheels, every particle of shot better do all the work it is intended to do. More details on the measure of durability can be found in our discussions in Fall 2017[5]. Foundries often use pounds of shot consumed per ton of castings cleaned as their indicator of durability and cost of operation. Very often, anomalies in this pre-registered target value indicate issues with the machine or even abrasive quality, both of which could have a cascading effect on cleaning room efficiency. Such numbers are usually manually tabulated based on production data (tons of castings cleaned and drums of shot consumed). The summary of my discussions with my foundry colleagues led me to thoughts of automating these mundane yet critical processes that have significant bearing on whether an operation is profitable or not.

PRESCRIPTIVE MAINTENANCE

Everything we have discussed here are "wishes" expressed by industry professionals. Some exist to a certain degree, while others are still "pies in the sky," but none are out of line in expectation. I would like to conclude our discussion with an interesting thought from a book I read recently by Thomas Friedman[6]. He differentiates between Conditional Maintenance (if it looks dirty, wash it), Preventive Maintenance (change the oil every six thousand miles), and Prescriptive Maintenance. This last maintenance technique relies on sensing mild patterns (aka machine operating data) and uses the immense processing power available today to predict failures well in advance. To quote from this book, "with a much finer grain of fidelity, we can make finding the needle in the haystack the norm—not the exception."

Our industry relies on conditional and preventive maintenance techniques. Imagine if data collection advanced to the extent described in this book where a simple change in sound that is undistinguishable to the operator's ear could actually predict a future unclean part, or the possibility of less than 100% coverage on a mission-critical aerospace component, or the possibility of a door leak leading to operator slippage?

All of these speak to the future of our industry. I am excited, as should you be! I look forward to reporting with more on this.

[5] "*The Critical Role of Shot in Achieving Consistent Shot Peening Results*", *The Shot Peener, Fall 2017*

[6] "*Thank You for Being Late, An Optimist's Guide to Thriving in an Age of Accelerations*" by Thomas Friedman

Media Flow Detectors for Non-Ferrous Media
for economic and efficient media control

• Requires little maintenance due to no moving parts • Operates from 24 Vdc
• Relay contact output • Push-button setup
• LED indicators • CE compliant • For non-ferrous media only

The sensors use a charge-coupled amplifier that is connected to a sensing pin (MFD-4 and MFD-250) or a sensing ring (MFD-P1). The pin or ring is inserted into the flow path of the abrasive blasting media. Each particle passing the pin or ring shares a minute charge with the pin or ring. This charge is converted to a voltage that is used to activate an output relay contact.

MFD-4
Media Flow Detector for Suction-Type Abrasive Blasting Machines

The MFD-4 is enclosed in a rugged aluminum housing. It can be attached to the media blast hose at any location and in any orientation via a sensing pin that protrudes from the bottom of the mounting base. A sensing pin is included with the MFD-4. Replacement pins are available from Electronics Inc.

MFD-250
Media Flow Detector for Suction-Type Abrasive Blasting Machines

The MFD-250 is enclosed in a 3.6" x 1.5" x 1.5" aluminum housing and is attached to a sensing pin in its mounting base. Its 6-pin plug allows for easy connection of the sensor to the power supply and machine controls.

The sensor is placed in the blast hose near the mixing chamber. LEDs on the top of sensor indicate green for "Flow OK" or red for "No Flow". The internal relay is activated during green "Flow OK".

MFD-P1
Media Flow Detector for Pressure-Type Abrasive Blasting Machines

The MFD-P1 is enclosed in a 3.6"x 1.5" x 1.5" aluminum housing and is attached to a sensing ring in its mounting base. The mounting base is available in various sizes to fit most abrasive blast machine configurations. Its 6-pin plug allows for easy connection of the sensor to the power supply and machine controls. LEDs on the top of sensor indicate green for "Flow OK" or red for "No Flow". The internal relay is activated during green "Flow OK".

Setup is simple for these sensors. The zero and span functions are automatic—pushing the "zero" button acquires zero for the no-flow condition and pushing the "flow" button sets the sensor gain and activates the relay. The relay contact will transfer whenever the flow is 50-100% of the programmed setting.

1-800-832-5653 or 1-574-256-5001
www.electronics-inc.com

Electronics Inc.
Shot Peening Control

ICSP14

4 - 7 Sept. 2022, Milan

14th International Conference on Shot Peening

Politecnico di Milano, Milan - Italy

THREE DAYS OF FULL IMMERSION IN PROGRESS, CHALLENGES AND OPPORTUNITIES FOR PEENING TREATMENTS

After having been postponed two years later, the 14th International Conference on Shot Peening is finally planned in presence at Politecnico Milano, Sept.4-7, 2022.
ICSP14 is one of the calendar's most important events on the science, technology and applications of mechanical surface treatments. It offers a unique forum for scientists and engineers to deepen and update their knowledge on all aspects of mechanical surface treatments. International representatives from academia and industry will come together to present and discuss the latest developments in shot peening and related subjects. International well known leaders in surface treatments have already confirmed their exciting plenary lectures. In the case the COVID pandemic is still limiting mobility, it will be considered to move on virtual or on mixed-mode conference.

WHY

The conference is a unique opportunity for researchers and industry representatives to present their scientific and technological developments on shot peening and surface treatments.

WHAT

Shot peening and allied treatments offer unique opportunities and are even more attractive when applied to additive manufactured parts.

HOW

Submit your abstract and papers to
submit@icsp14.org
For further info visit:
www.icsp14.org

IMPORTANT DATES

Submission of abstracts	**February 15th, 2022** ~~March 7th, 2022~~
Notification of acceptance	**March 15th, 2022**
Submission of papers	**April 30th, 2022**
Notification of paper acceptance	**May 30th, 2022**
Conference ICSP14	**September 4-7th, 2022**

PARTNERS

POLITECNICO MILANO 1863 · Peen Service · Electronics Inc. Shot Peening Control · MFN Metal Finishing News International · peeningaccessories.com · The Shot Peener

ICSP14 Chairman, Prof. Mario Guagliano
Department of Mechanical Engineering Politecnico di Milano
Campus Bovisa Sud via La Masa 1, 20156 Milano, Italy
www.icsp14.org

ICSP14

2022
Shot Peening Training

Improve your skills,
reach your professional goals

Learn from expert instructors
on relevant topics

FAA-accepted courses,
Nadcap Partner in Education

Datteln, Germany.....*May 3 -5*
Seminar and Workshop

Toronto, Canada..... *May 12 - 13*
Seminar

Czech Republic (City to be announced)..... *September 13 - 14*
Seminar

Mashantucket, Connecticut, USA.....*October 24 - 26*
Seminar and Workshop

Datteln, Germany..... *November 8 - 10*
Seminar and Workshop

Additional events may be added throughout the year.
Visit www.shotpeeningtraining.com for locations and dates.

Receive certification for achieving a higher level of shot peening education.
Seminar, workshop and on-site training attendees are eligible to take our FAA-accepted shot peening and rotary-flap peening achievement exams.

On-site training programs are also available

Train on your equipment • Can be customized • Includes facility and equipment review
Training can be held any time of year • Ideal for five or more employees

Shot Peening Training

www.shotpeeningtraining.com
(574) 256-5001 or 1-800-832-5653

Engineered Abrasives®

Manufacturers of the Finest Blast Finishing and Shot Peening Systems

(708) 389-9700 or (773) 468-0440

Email: mwern@engineeredabrasives.com Web: www.engineeredabrasives.com

IATF 16949
ISO 14001
FORD Q1
Certified
Job Services

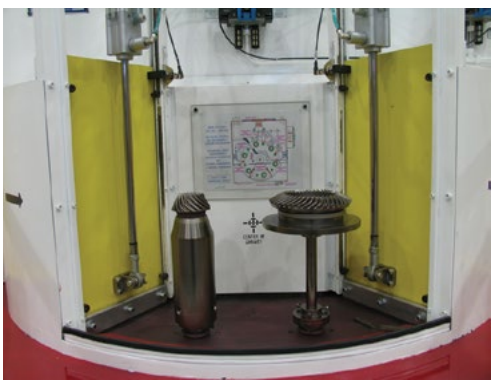
All Engineered Abrasives® systems are available with the EA® Knowledge System®. The EA® Knowledge System® features computer animation on machine operation and maintenance, including how to do Almen Strips.

Engineered Abrasives® High-Volume Index Unit with complete Material Handling and Robotic System

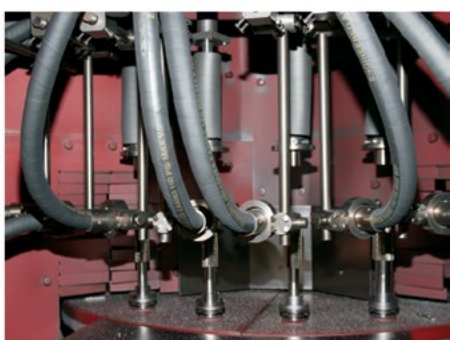
60" Index Unit Ring and Pinion Gears for High Volume

8 Pressure Nozzles with MagnaValves®, Buck Elevator, Sweco and Dust Collector

CONTROL by MagnaValve®



All Tooling and Fixtures Tool Steel hardened to 62 RC



Engineered Abrasives® index units are the most durable machines on the market today with all our special features

Patented 72" Index Unit with Shot Flow Controls, Sweco, Bucket Elevator, 8 Nozzles and 16 Spindles. Designed for high-volume shot peening.

Look for RED components and surfaces to be sure you get Engineered Abrasives® quality equipment and OEM parts.

High-volume automotive systems for ring and pinion axle gears

Designed and built by EA®

Two (2) Index Units with complete load and unload Fanuc Robots and Conveyor System

Both machines built and tested on EA® floor

EA® 72" Flex Peener™
4 stations with 4 spindles at each station. Can do different gears on each spindle or all the same for higher volume.

Single Cell Unit, 5 Pressure Nozzles

◀ Bucket Elevator Sweco System

◀ MagnaValves®

◀ Dual Swing Doors for higher volume

Special safety platforms for easier maintenance ▶

EA® 72" Index Unit

ACADEMIC STUDY
Dr. David Kirk | Coventry University

Back to Basics

Accuracy of Shot Peening Measurements

INTRODUCTION

Accuracy of shot peening measurements is a very basic requirement. Three factors comprise a reasoned approach to accuracy. These are:

1. Assumption
2. Precision
3. Bias

Consider, as an example, an analogue wristwatch. It is a fair **assumption** that it will be reasonably accurate because watchmaking is so very well-established. The **precision** will largely depend on whether or not it has a seconds hand. A large **bias** will occur if we travel between time zones without correction. Over time, a small bias will develop—assuming the watch is not radio-controlled. Usually, the more expensive the watch the slower will be the rate of this "creeping bias".

This article considers the implication of the three factors—assumption, precision and bias—on the accuracy of shot peening measurements. Every shot peening measurement has an element of variability. We cannot, however, estimate the variability of measurements unless we have adequate information, aka data. Whole industries rely upon data that they garner meticulously. It was a surprise, when attending an Electronics Inc. Shot Peening Workshop, to discover that most of the students did not retain peening data after they had used it just once. Shot peening data is so easily stored in a data bank such as the ones incorporated into Excel.

Given an adequate number of measurements for a specific aspect of shot peening, we can estimate variability using readily available, simple techniques. Such a technique is called a "Normal Distribution". This technique is applicable to most shot peening measurements. Fig.1 illustrates important features of the technique.

An important feature of Normal Distributions is its sharpness. This is indicated by the Width at Half Height, **WHH** in fig.1. The smaller the value of **WHH** the sharper is the curve. A parameter, **σ**, defines the sharpness. **σ** is called the "Standard Deviation" and it corresponds to the value of **WHH** divided by 2.355. Variance of measurements is defined as being the square of the standard deviation. For fig.1, the mass for each strip in boxfuls of nominally identical Almen strips was obtained using a highly precise balance. Having these multiple values allowed the blue curve to be drawn. This type of curve is sometimes said to be "bell-shaped".

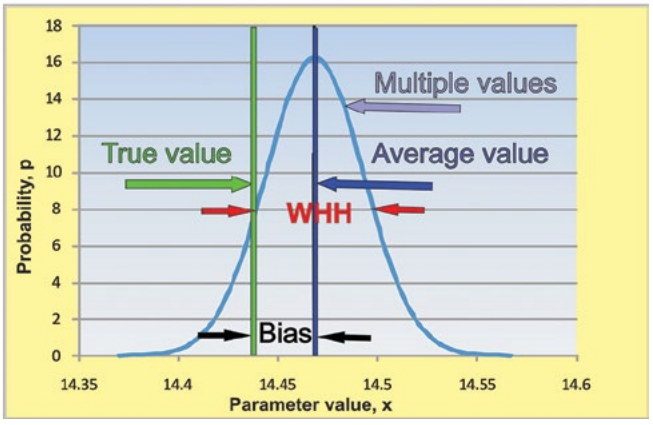


Fig.1. Parameters of a Normal Distribution.

The observed tiny variation of mass could only have been detected by having used a very precise device. The average of the observed multiple values divides the curve into halves.

CALCULATING STANDARD DEVIATION

Knowing the standard deviation of a group of measurements can be very useful. Fortunately, the computerized calculation of standard deviation is simple although tedious if a very large number of measurements is involved. Table 1 shows how Excel facilitates calculation because it includes built-in standard deviation functions. Try it for oneself! In column A of an Excel spreadsheet enter the measurements that require standard deviation calculation—seven for this example. At **8**—below the last entered measurement—type "=STDEV.S(A1:A7)". Press "Enter" and the value of the standard deviation for the measurements appears. Simple!

Table 1. Example of Excel Entries to calculate Standard Deviation.

	Column A
1	14.39
2	14.43
3	14.51
4	14.51
5	14.47
6	14.42
7	14.39
8	**0.051594**

24 Vdc MagnaValves for air-blast machines

24 Vdc MagnaValves for wheel-blast machines

MagnaValve®

Media valves for air-blast and wheel-blast machines

Reduces labor, media and energy costs while adding control and reliability to shot peening and blast cleaning processes

The non-ferrous media MagnaValve for air-blast machines

You can depend on it

The unique design of the MagnaValve makes it one of the most reliable and hard-working media valves on the market today. Other benefits include:

- **Flows most ferrous media and the 700-24 flows non-ferrous media**
- **MagnaValves have companion controllers for accurate and dependable media flow control**
- **Compliance to specifications is readily attainable**
- **Available in 24 Vdc and 120 Vac**
- **Trusted by OEMs and end-users worldwide**

1-800-832-5653 or 1-574-256-5001
www.electronics-inc.com

Electronics Inc.
Shot Peening Control

USEFULNESS OF STANDARD DEVIATION VALUE

The value of the standard deviation for a particular variable quantifies the variability. A useful application is to estimate the probability of the parameter satisfying a specified requirement. For any normally distributed variable there is what is called the "68-95-99.7% RULE". This rule is an aid to memory, signifying that 68% of random measurements of the same variable will lie between ±1 standard deviation of the average value, 95% between ±2 standard deviations of the average value, and 99.7% between ±3 standard deviations of the average value. This important concept is illustrated by fig.2.

99.7% Probability

For quality control purposes, the 99.7% probability is particularly important. Consider the following example, which uses simple values for ease of mental arithmetic. Imagine that we have tested a representative sample from a large batch and found that it had an average value of 10 and a standard deviation of 1. We can be 99.7% sure that any other specimen from the same large batch will have a value that lies between 7 and 13—average 10±3. For most shot peening operations, the standard deviation would be much smaller than 1. For a standard deviation of say, 0.1, our 99.7% certainty is that any other specimen will have a value between 9.7 and 10.3.

Variance

The variability of one particular property is called its "Variance". Variance is defined as being the square of its standard deviation. As examples, standard deviation of 2 converts to a variance of 4 and a standard deviation of 0.1 converts to 0.01.

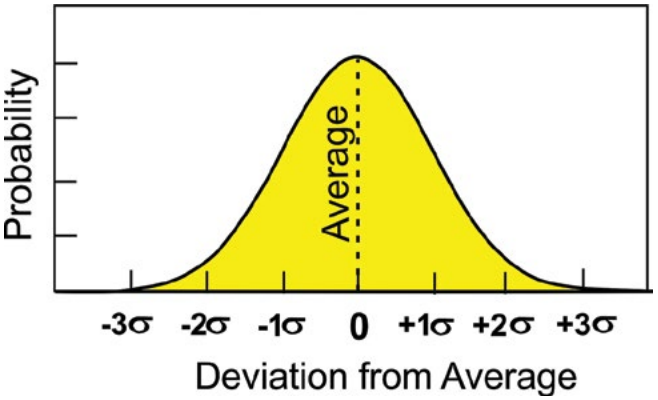


Fig.2. Probability versus Deviation from Average.

VARIABILITY

Variance, **V**, is the square of the measured standard deviation, **σ**, of a set of measurements. Hence:

Variance, $V = \sigma^2$

The key to understanding and using variances is to appreciate three of its features:

1 - **Constituent variances are additive,**
2 - **Contributing variances must be identified** and
3 - **Contributing variances with small standard deviations can be ignored.**

1 - Constituent variances are additive. Assume, for example, that single measurements of mass made on each of 50 Almen A strips indicated an interstrip variance of 11 (in arbitrary units). Fifty repeat measurements made on just one of the 50 strips indicated a measurement variance of 1. The interstrip variance is 11 and the measurement variance is 1. Now:

Interstrip variance = Measurement variance + Mass variance

so that, for this example:

11 = 1 + Mass variance

Hence, we can deduce that the mass variance, for this example, is **10** (11 – 1).

2 - Contributing variances should be identified. For example: the variances that contribute to the mass (weight) of an Almen strip can be identified as being length, width, thickness and steel density. No other properties of an Almen strip (such as hardness) contribute to its mass. If, for example, it was established that the variances of length, width and steel density for the strips were all equivalent to 1 then for a mass variance of 10 we have that:

10 = 1 + 1 + 1 + Thickness variance

from which we can deduce that the thickness variance must be **7** (10 - 1 -1 -1).

3 - Contributing variances with small standard deviations can be ignored. This is a very important practical point that is rarely highlighted. Imagine that a particular set of measurements gave a standard deviation of 11 that was contributed by 4 factors having standard deviations of 10, 4, 2 and 1 respectively. This means that:

$$11^2 = 10^2 + 4^2 + 2^2 + 1^2 \text{ or}$$
$$121 = 100 + 16 + 4 + 1$$

Ignoring the contributions of 16, 4 and 1 only makes a small change in the estimated variability. The practical importance is that we should concentrate on trying to reduce any factor that has a much larger variance than any of the other factors. As another example, imagine that the observed standard deviations for length, width and steel density for a given batch of Almen strips all had a magnitude of 1 and that the observed standard deviation for mass was 10. Converting these into variances gives that:

100 = 1 + 1 + 1 + 97 (thickness variation)

That means that 97% of the observed variability can be attributed to thickness variation so that variations of length, width and steel density can effectively be ignored (as being insignificant).

Measurement Variance

Measurement variance arises when an instrument indicates different values for repeat measurements made on the same specimen. For example, a high-precision Almen gage may well indicate slightly different values for arc height when the same peened strip is measured several times. The causes of measurement variance are normally identifiable and involve a combination of operator and instrument factors. Reputable instrument manufacturers usually try to offset measurement variance. Every case, however, is different making it difficult to generalize.

The standard method for countering measurement variance is to take the average of repeat measurements on the same specimen. If two successive measurements are identical then it is generally assumed that there is no significant variance and the average is self-calculated. If, on the other hand, two successive measurements are different then further action is necessary. If the difference is only one instrument unit one can either take the average or take a third measurement. For three measurements with two the same and one differing by only one measurable digit then the value of the two identical measurements is generally accepted.

Parameter Variance

Every shot peening parameter varies. For example, Fig.3 illustrates the variability of indent size. Different parameters vary, however, in different ways. For example the variability of cut wire shot diameter is quite different from that of cast steel shot. Fig.4 shows, schematically, the size distribution of a cast steel shot sample. Cut wire shot shows a Normal Distribution of size.

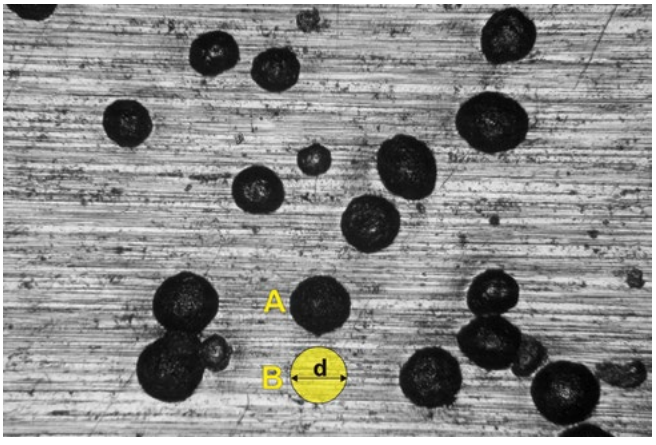


Fig.3 Variability of indent size.

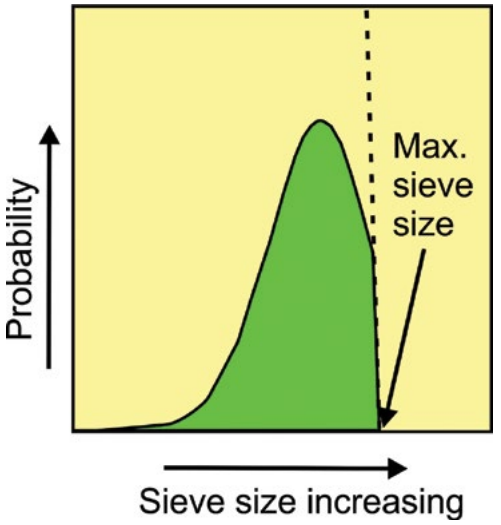


Fig.4. Cast steel shot sieved size distribution.

APPLICATION OF VARIANCE TECHNIQUES

Management and control of variability requires that it can be measured quantitatively. Standard deviation and variance can then be calculated automatically, for example by using an Excel program.

Studies of parameter variability involve several other defined terms. These include:

Population – this is the total number of identifiable objects that could be measured. A 50 kg bag of 110 size steel shot will contain about two hundred and fifty million particles. The population size would therefore be two hundred and fifty million. Taking ten seconds per particle to measure just one parameter would take eighty years to measure the whole population. This leads to the need for selecting a truly representative sample!

Sample Size – this is the number of identifiable objects properly selected as being adequately representative of the whole population. An "adequate number" will depend on the variability of the object and the ease of making individual measurements. The greater the variability the greater is the sample size needed to be representative.

Parameter Distribution – the measured parameter values for a particular sample may have different "distributions". A frequently encountered distribution is the "Normal Distribution" which has a bell shape and would be appropriate for cut-wire shot. As-cast shot, on the other hand, has a different size distribution with zero probability above a certain sieve size but tailing off to very, very fine particles that have passed through the smallest sieve.

Range and Average – range is the difference between the largest and smallest measurements made on a sample. Average (or Mean) is the total of the measurements divided by the number of measurements.

ANALYZING ACCURACY VARIABILTY

Three variability factors determine the accuracy of any individual measurement. These are:

1. Parameter Variability,
2. Instrument Variability and
3. Technique Variability.

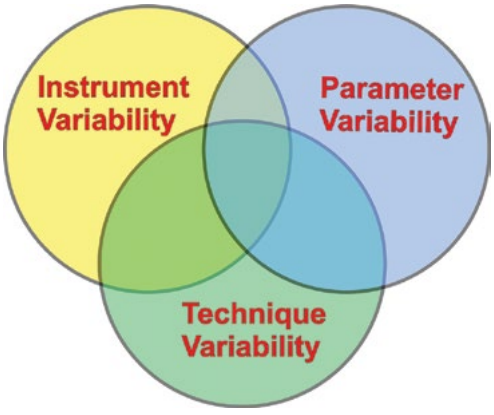


Fig.5. Factors affecting accuracy.

Parameter Variability

Every shot peening parameter has variability. For example, Fig.3 illustrated the variability of indent size. Different parameters vary, however, in different ways. For example, the variability of cut wire shot diameter is quite different from that of cast steel shot. The type of variation affects how it can be measured and controlled together with its significance.

Instrument Variability

Instrument variability is when an instrument indicates different values for repeat measurements made on the same specimen. For example, a high-precision Almen gage may well indicate slightly different values for arc height when the same peened strip is measured several times. The causes of measurement variance are normally identifiable and involve a combination of operator and instrument factors. Reputable instrument manufacturers usually try to offset measurement variance. Every case, however, is different making it difficult to generalize.

The standard method for countering measurement variance is to take the average of repeat measurements on the same specimen. If two successive measurements are identical then it is generally assumed that there is no significant variance and the average is self-calculated. If, on the other hand, two successive measurements are different then further action is necessary. If the difference is only one instrument unit one can either take the average or take a third measurement. For three measurements with two the same and one differing by only one measurable digit then the value of the two identical measurements is generally accepted.

Technique Variability

Errors arise when a measurement technique has an element of subjectivity. A classic shot peening example is the measurement of arc height using an Almen gage. Workshops include training in how to minimize variability of measurement.

IMPLIED PRECISION AND ACCURACY

We must beware of dubious implied claims for precision and accuracy. For example: A manufacturer may display that a coverage measurement of 36.8279634% has been made on a particular sample using their equipment. This cannot be taken to mean that the true coverage has precisely that value. It actually reflects the method that has been employed—such as counting the pixels of an area that has been scanned and allocating them on a yes-or-no basis as to whether or not they correspond to dents. The importance of measurement technique can be illustrated by considering the following: Imagine the lengths of two objects were measured, using an office ruler, to the nearest millimeter. The objective being to obtain the ratio of their lengths. If the two lengths were measured to be 4.7 and 7.1 mm what should be expressed as the ratio? Microsoft Calculator returned a value of 0.661971 830985915492957746478873 24. Implying such precision and accuracy is clearly erroneous. We can only properly include one digit more than those of the measurements themselves. Hence 0.662 is far more appropriate (4.7 and 7.1 having two digits).

GRAPHING ACCURACY

Graphs are a splendid way of illustrating trends but only if they are a reasonably accurate utilization of the data involved. The shape of a fitted curve can also reveal useful information.

All shot peeners are familiar with so-called "Saturation Curves". Appropriate equations are fitted to test data of deflections measured on a set of at least four peened Almen strips. Fig.6 illustrates the benefits of employing more than four. The proper shape of a saturation curve is well-established so that using six peened strips reveals any significant deviation.

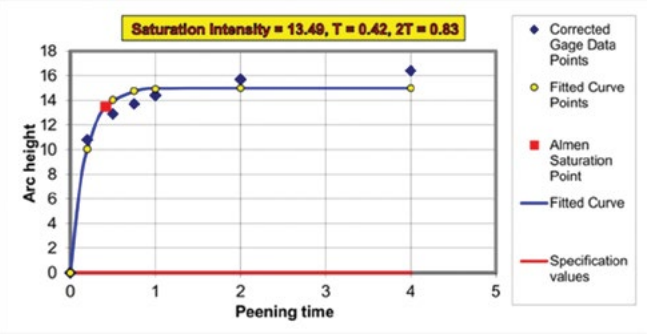


Fig.6. Saturation curve revealing significant deviation.

ALL THINGS CONSIDERED

In order to accurately interpret shot peening graphs it is

important to consider all of the things that might have affected the data. The deflection of peened Almen strips depends, for example, upon the elastic modulus of the strips. Equation (1) is a simplified form of the equation (5) that appears in *The Shot Peener* Fall 2009 edition.

$$\mathbf{h = K/E} \quad (1)$$

where **h** is Almen arc height, **K** is a constant and **E** is the strip's elastic modulus. Hence the lower the strip's elastic modulus the greater will be the arc height induced by a given shot peening treatment. Elastic modulus can be affected in several ways mainly by preferred orientation of the steel's grains. A factor commonly overlooked is the testing temperature because it has only a small effect on measured arc height of a given peened strip. Fig.7 shows how the elastic modulus of an Almen strip is affected by room temperature.

Reading from fig.7, the elastic modulus at 28˚C is 2GPa lower than it is at 16˚C. 2GPa is about 1% of the elastic modulus. Hence, the measured arc height on a given peened strip will be some 1% greater at 28˚C than if measured at 16˚C.

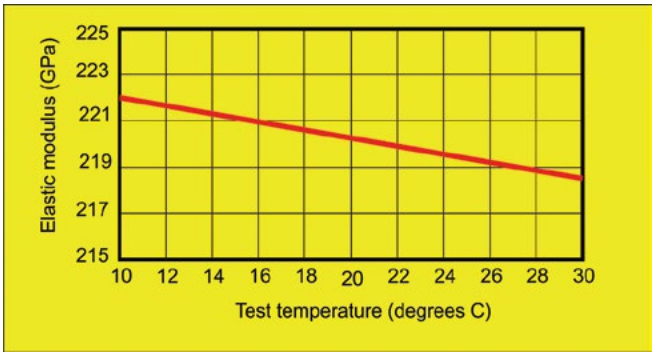


Fig.7. Effect of temperature on the elastic modulus, E, of Almen strips.

DISCUSSION

This article has attempted to highlight the problems associated with achieving accuracy of shot peening measurements. Most of the problems are familiar to shot peeners. Navigating through the various problems is, however, like crossing a minefield. Constant vigilance is required.

Storing data is of vital importance and is not difficult to achieve. Trends can be detected to show what changes are taking place over time. Correction can then be applied where necessary. Measuring equipment must be maintained and routinely calibrated.

Not all the problems affecting accuracy are governed by specifications. A prime example is that of the elastic modulus of Almen strips which can vary significantly.

Hitoshi Soyama | Tohoku University

Cavitating Jet: A Review

The following paper can be downloaded in its entirety at www.shotpeener.com

Hitoshi Soyama
Department of Finemechanics, Tohoku University, Sendai 980-8579, Japan; soyama@mm.mech.tohoku.ac.jp;
Tel.: +81-22-795-6891; Fax: +81-22-795-3758

Featured Application: Cavitation peening, Cleaning, Drilling

Abstract: When a high-speed water jet is injected into water through a nozzle, cavitation is generated in the nozzle and/or shear layer around the jet. A jet with cavitation is called a "cavitating jet". When the cavitating jet is injected into a surface, cavitation is collapsed, producing impacts. Although cavitation impacts are harmful to hydraulic machinery, impacts produced by cavitating jets are utilized for cleaning, drilling and cavitation peening, which is a mechanical surface treatment to improve the fatigue strength of metallic materials in the same way as shot peening. When a cavitating jet is optimized, the peening intensity of the cavitating jet is larger than that of water jet peening, in which water column impacts are used. In order to optimize the cavitating jet, an understanding of the instabilities of the cavitating jet is required. In the present review, the unsteady behavior of vortex cavitation is visualized, and key parameters such as injection pressure, cavitation number and sound velocity in cavitating flow field are discussed, then the estimation methods of the aggressive intensity of the jet are summarized.

1. Introduction

Cavitation is a harmful phenomenon for hydraulic machineries such as pumps, as severe impacts are produced at bubble collapse [1,2]. However, cavitation impacts are utilized for mechanical surface treatment in the same way as shot peening, and this is named "cavitation peening" [3,4]. The great advantage of cavitation peening is that shots are not used in the peening process, as cavitation impacts are used in cavitation peening [5]. Thus, the cavitation-peened surface is less rough compared with the shot-peened surface, and the fatigue strength of cavitation peening is better than that of shot-peening [6]. In conventional cavitation peening, cavitation is generated by injecting high-speed water jet into water [3,4], and a submerged water jet with cavitation is called a "cavitating jet". The cavitation peening is utilized for the impacts of cavitation collapses, and it is different from water jet peening, in which water column impacts are used. To use the cavitating jet for peening, it is worth understanding the mechanism of the cavitating jet.

Volker Schneidau | sentenso | www.sentenso.com

Shot Peening Workshops with Additional Focus on Practical Training

sentenso's Workshop and Training Concepts in Europe

EI SHOT PEENING TRAINING (SPT) has been spreading all over the world, following the demands of aerospace and automotive industries in key regions. When providing training outside the United States, EI SPT links with regional industry experts with shot peening expertise that will adapt to language and cultural specialties, to support the training itself, and to improve sustainability of training's benefits with the customers. Local training partners keep contact with the students and their companies, follow-up on questions, give advice for process and equipment, or even supply equipment and services.

sentenso in Datteln, Germany is one of these strong EI SPT partners that covers shot peening training in Germany and several other countries in North, South and Mid Europe. Built on the shot peening expertise of its training managers, Volker Schneidau and Wolfgang Hennig, the company has vastly extended its activities over the years. This goes back to the first European Shot Peening Workshop held in 2008 in Sinsheim, Germany that was powered by strahlportal—Volker Schneidau's engineering firm. Since then sentenso and strahlportal have trained close to 300 students from a long list of European countries and industries with almost 400 FAA course certificates being issued. About 40% of all students have been trained in the last two years alone.

sentenso today provides both Shot Peening Workshops and on-site training. The Shot Peening Workshops are held twice each year in the German and English language. On-site trainings can be booked individually.

The Practical Approach

The unique feature of the in-house Workshops in sentenso's Technical Center is that it is a dedicated combination of theoretical and practical elements in one training event. The regular two days of training for Level 1 and 2 are extended by a third day in order to have time for practical work on real shot peening machines, covering the core topics of media, intensity and coverage. This training is not simply an optional add-on after the seminar but it is closely woven into the agenda to directly link theory and practice and allow students to keep track of the purpose of the information.

Hands-on work supports the retention of training materials

Volker's goal when implementing training at sentenso was exactly that idea of sustainability. Hands-on work improves the retention of the learned material, providing several benefits:

- Hands-on experience helps students overcome insecurities
- Interaction with the trainers helps find and avoid typical mistakes
- Interaction with peers allows for better understanding and mutual support

Also for the new Shot Peening Workshop in the Czech Republic in September, sentenso will add value to this event by implementing practical training content (see related article on page 40).

sentenso has been successfully following this training concept for more than 10 years. Since 2012, students have enjoyed the hospitality and engagement of the sentenso team as they provide a comfortable learning environment. They are impressed by the equipment used in the shot peening process and quality management. Above all, students are convinced of the competence of the trainer team, consisting of experienced sentenso staff members. Jan Claes from ZF Wind Power Antwerpen said, "The practical training at sentenso about XRD and compressive stresses related to peening gave me a lot of insights and knowledge about the process and measurement techniques which removed my personal stress and gives me good confidence to be process owner in our factory."

Training Competence from Level 1 to 3

The trainer competence was strengthened when Wolfgang Hennig from Rolls-Royce Germany joined the team in 2019. Wolfgang has brought his considerable experience and know-how of jet engine applications to sentenso. His ongoing training engagement has encouraged several aircraft MRO companies to extend training provisions to their staff, either in sentenso Workshops or at their own sites.

SHOT PEENING TRAINING
Continued

When it comes to discussion of residual stresses, the engineer Jörg Behler conveys background knowledge and practical exercises with sentenso's X-ray stress analyzer.

Even Level 3 candidates in the Workshops take three days of training, repeating essential Level 2 contents, performing practical exercises, and then deepening their knowledge in intensive discussions with the trainers to prepare for the Level 3 exam. The exam itself is very demanding due to its open questions and the time pressure. Volker and Wolfgang stress the importance of quality thereby maintaining a high level of education and thus the value of the Level 3 training. Nadine Goertz from MTU Maintenance Berlin-Brandenburg confirms, "sentenso has a great experienced team in automotive as well as in aerospace applications. Especially for Level 3 education they found a new challenging way to train the shot peening community!"

Customized On-Site Trainings

Apart from the Workshops with the included practical training, the on-site training concept provides a number of benefits to the company such as:

- Reduced travel time and expenses
- Protection of confidential information when required
- Specialized training contents for the real process and job

More than 100 students have completed such customized trainings in various branches like aerospace, automotive, medical, and other specialized industries such as spring or machine manufacturing.

Despite these excellent reasons for on-site training, students who are trained at their own companies are missing networking opportunities with peers from other companies who often have similar challenges in their shot peening activities. Therefore, Wolfgang and Volker recommend an appropriate mixture of Workshops and on-site training, depending on the tasks students must accomplish. While networking and exchanging experiences in the Workshops, they gain specific training in process and quality management at their own facilities.

Training is provided in shot peening's critical fundamentals

SPECIFICATIONS
Dave Barkley | Director of Training | Electronics Inc.

The New Four-Four-Two

AS THE SPONSOR of the May 2022 publication of J442, I've asked *The Shot Peener* magazine to allow me to highlight its major changes.

A goal of the SAE Surface Enhancement Committee (SEC) is to remove redundant and conflicting information among specifications thus making them easier to understand. This was the main reason for a new J442.

The current two grades of strips used in the peening industry were defined in different specifications: J442 for standard grade strips and AMS2432 for high grade strips. AMS2432 notes all test strips must conform to J442 but adds tightened thickness, flatness (pre-bow) and hardness requirements.

The main problem with this is the specifications use of different measurement units and tolerance methods. As an example, J442 dimensioned strip thickness using minimum and maximum limits as a tolerance. AMS2432 uses a plus/minus method to tolerance strip thickness. Those unfamiliar with proper dimensioning practices could be confused on how to relate the plus/minus tolerances of AMS2432 to the limit style dimensions of J442. Errors are compounded when different rounding methods are used for converting between metric and imperial units.

This issue has been corrected with the new J442 defining both standard and high-grade Almen test strips: Grade 1 and Grade 1S. Grade 1 test strips have the same requirements as previous J442 versions and Grade 1S adds the tightened thickness, flatness, and hardness requirements from AMS2432. The names "1" and "1S" were chosen due to multiple organizations already using these terms to designate the two grades of test strips.

AMS2432 is currently being revised to simply reference the J442 Grade 1S test strip instead of outlining the tighter tolerance requirements. A provision in both specifications is added to allow a test strip manufacturer 18 months after the new AMS2432 is published to sell existing stock of incorrectly manufactured test strips.

Another change to J442 is the once optional end stops on Almen gages are now required. This, along with centering the test strip on a slightly longer holder, ensure the areas of the test strip shaded by the fastening screws will not corrupt arc height measurements. Again, redundant text concerning this will be removed in the updated AMS2432.

Finally, it's worth noting the new J442 has all new drawings and tables. This was done to correct a couple small errors and make requirements easier to find. Imperial measurements are added throughout the metric specification for reference.

Visit www.sae.org/standards for a copy of the latest SAE specifications.

Volker Schneidau | sentenso | www.sentenso.com

The 2022 Mid European Shot Peening Workshop

Sponsored by EI Shot Peening Training, KrampeHarex, sentenso and Wista

ANNOUNCING the first shot peening training seminar and workshop to be held in the Czech Republic. The 2021 training event had to be cancelled due to the pandemic. Electronics Inc. Shot Peening Training (SPT) and its local partners are back in 2022 with a two-day training event on the 13th and 14th in September.

The training 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 by professional instructors.

As the Workshop will be held in the facilities of WISTA, a local machine manufacturer, it will incorporate practical exercises to manage the process and its settings correctly, and how to perform proper quality inspections. The instructors will cover a real-life application in air shot peening practices.

TRAINING TOPICS

The following topics will be covered in the training event. These shot peening topics are part of the FAA training program of Level 1 and 2 developed by Electronics Inc. SPT.

- Shot Peening Introduction
- Peening Media Basics, Inspection and Maintenance
- Particle Size and Shape Analysis (shop)
- Peening Intensity Basics and Advanced
- Saturation Curve Generation (shop)
- Peening Coverage Basics and Advanced
- Coverage Development (shop)
- Shot Peening Applications
- Process Parameters and Control
- Rotary-Flap Peening Introduction (optional on day 3)
- Rotary-Flap Peening Certification (optional on day 3)

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. 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.

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.

Hennig, Wolfgang. Mr. Hennig 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.

SPONSORS

Electronics Inc. founded shot peening education in 1991 and continues to lead the way in high-quality shot peening training.

KrampeHarex is a specialised manufacturer of blast and peening media with operations all over the world. The company's product quality is compliant with international standards and is routinely checked and documented in its own QM laboratory.

WISTA has been a leading supplier of comprehensive solutions for surface finishing since 1994. WISTA offers an extensive training programme and demonstrations of technologies for operators and service personnel.

sentenso has been delivering services and innovative equipment for process and quality management in shot blasting and shot peening since 2009. Since then, sentenso has been carrying out shot peening training both as part of Workshops and training at its own technical center and at companies on site. The training focuses on applications in the aerospace, automotive, and other demanding industries.

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.

Get Up To Speed On Rotary Flap Peening

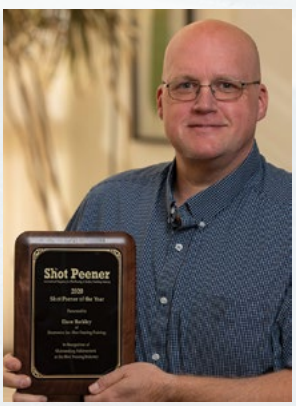
Rotary flap peening is one of the quickest-growing shot peening methods—it's effective, economical and fast. EI Shot Peening Training offers one-day on-site training programs for companies and military bases that want to expand their rotary flap peening skills.

Our rotary flap peening training will:

- **Help you achieve a controllable process**
- **Increase your operators' skill**
- **Demonstrate how to achieve compliance to specifications and standard practices, including AMS2590**
- **Expand your use of this productive process**

Our training program is beneficial to operators, supervisors, inspectors and application engineers.

FAA mechanics are eligible for training credit. Ask us for more information.



Dave Barkley is the Director of EI Shot Peening Training and one of EI's rotary flap peening instructors. Mr. Barkley was the author/sponsor of AMS 2590 "Rotary Flap Peening of Metal Parts." He is also the recipient of the 2020 Shot Peener of the Year award.

Shot Peening Training

www.shotpeeningtraining.com

(574)256-5001 or 1-800-832-5653

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

Clemco Donates the "Ferrari of Blast Cabinets" to a Texas High School's Welding Program

Highlights

Clemco Industries donated a new Pulsar Plus 55-Suction Blast Cabinet to the welding program at Samuel V. Champion High School in Boerne, Texas. The welding students at the award-winning welding program have built:

- Hunting blinds for disabled veterans
- A cattle dipping vat for the U.S. Department of Agriculture
- A metal shooting target for YouTube influencer Matt Carriker's *Demolition Ranch* and *Off the Ranch* channels
- A metal firepit as a gift for a retired Texas fire chief
- A metal shooting target for World Wresting Entertainment superstar Goldberg
- Careers for themselves

"That's Smart Engineering"

"It's the Ferrari of blast cabinets," Dorman Vick says of the Pulsar Plus 55-Suction Blast Cabinet that Clemco donated to the Welding Pathway at Samuel V. Champion High School. Vick launched Champion High's Welding Pathway in 2004 and has been running it since.

"I've used wonky cabinets before," Vick says, "and I can tell you that the cabinet Clemco gave us is quality. It's so comfortable and easy to use. If a 14-year-old high school freshman can operate it with no problems, anyone can. That's smart engineering."

Champion High, which has its share of 14-year-old freshman, is located in Boerne, Texas, a city of just under 20,000 residents situated about a 45-minute drive northwest of San Antonio. But other than the age of its students, the Welding Pathway is not a typical high school welding program.

Vick Had an Idea

In the fall of 2020, Vick had the idea that he could help his students more quickly earn their industry-level welding certifications if they didn't have to spend so much time removing mill scale off their test weld coupons and other projects by using grinders or less efficient hand tools. Vick wanted to free up the students' time to work on more complex and creative projects. What they needed, he thought, was a blast cabinet.

"I did my research," Vick explains, "and everybody in the industry I talked to said the quality of Clemco equipment sets

Dorman Vick (kneeling, right) with his 2020-21 first and second period students.

it apart in the sandblasting business and the world. So I called Clemco and asked if they had a cabinet they would be willing to donate. They were the only manufacturer I called."

Bad News and Good News

Vick spoke with Kurtis Ohse, Clemco Director of Marketing. "Vick asked if Clemco could donate a base-model cabinet," Kurtis remembers. "I got back to him a couple months later with bad news and good news. We couldn't donate a base model. But we could donate a cabinet from our new line of Pulsar Plus Cabinets."

Pulsar Plus Cabinets are Clemco's newest line of blasting cabinets. Clemco manufactures Pulsar Plus Cabinets in six models: two pressure-blast and four suction-blast, all equipped with 17 ergonomic and state-of-the art features.

"Like Going From the Flintstones to the Penthouse"

Vick and his students received their new Pulsar Plus 55-Suction Cabinet in February 2021.

"We got the cabinet set up on day one," Vick recalls. "That day the students went to work blasting mill scale off their welds with No. 8 glass bead. It was like going from the Flintstones to the penthouse. Not only does the cabinet make the work go about 80% faster, but it is far safer than hand grinding and produces fantastic finish on the metal."

What the Students Think

Ryan Myers, Senior

"I had a summer job at a firearms manufacturer where I used a cabinet. But the cabinet from Clemco is a million times better. It can get right inside creases and tight corners. I'm getting knowledge and experience that will give me a head start when I job hunt."

Caleb Roberts, Junior

"I can't tell you how much the cabinet has helped us. Right now we're getting our welding certifications. With the cabinet we can sandblast mill scale and beads off our test plates and get them as clean as possible. We couldn't do that before with grinders, and now I can finish five welds in the time that before I could only finish one. We really appreciate the donation."

Nathan Young, Senior

"The cabinet is so easy and convenient to use. To sandblast without it would require a body suit and a lot more space. I only have to put the part in the cabinet, my hands in the gloves, and then I'm ready to go. We mainly use the cabinet to clean up our welds and to prep parts for painting. It saves us so much time."

"We're Building Strong Young Men and Women"

Vick's students learn much more than technical welding and fabricating skills in his program—they also learn to believe in themselves and in others.

"To see kids come into our shop that maybe the system has deemed cannot go to college," Vick explains, "and then to watch them shine and become superstars, build anything they put their minds to, that's what it's about. What we're doing is more than helping young people build careers. We're building strong young men and women. They leave here knowing they can come up with an idea and make it a reality."

"I also see the change in my students when they give back to heroes and the community," Vick continues. "No textbook can teach somebody that giving is better than receiving, that freedom isn't free. They now know what it feels like to change somebody's life. That's so cool."

"From Welding Under the Hood" to Teaching High School Students

Vick, who is 44-years-old and says he has been "welding under the hood for a paycheck" since he was 14, continued to weld part-time while he studied animal science in college, and welded and pipe-fitted full-time for years after he graduated.

Then in 2003, Vick went to a church event where country singer George Strait's father, a lifelong high-school teacher, spoke about the merits of teaching. That talk, and nudging from a friend who was retiring from teaching welding classes at Clark High School in San Antonio, convinced Vick to go back to college and earn his teaching degree. His first year teaching was at Clark High, but the next year the Boerne Independent School District hired Vick to start up Boerne High School's Welding Pathway from scratch.

"We Built the Program Up From Just About Nothing"

Vick says that when he started the Welding Pathway 17 years ago, he was given an empty building with worn-out tools. "We threw all of that old equipment away," he recalls. "With help from many hard-working kids, we built the program up from just about nothing to where it is today."

After three years at Boerne High, the pathway moved to the newly opened Samuel V. Champion High School, where for years it served both of the Boerne Independent School District's high schools. Boerne High eventually opened its own Welding/Agricultural Mechanics Program; however, Vick has remained at Champion High to continue running its Welding Pathway.

"Skilled Trades Are the Backbone of This Nation"

"I've continued to weld part time on weekends and during summer break when I can, especially when Texas oil fields were booming," Vick says. "It helps me bring fresh, real-world content to the students. Many students have incorrectly been told that the trades are a second-tier career choice. Nothing could be further from the truth. Skilled trades are the backbone of this nation. There's no shame in coming home dirty after a day's work.

"It's awesome to know that Clemco understands this and is investing in our youth to help bring back American trades."

Anja Črtalič | Marketing Manager | FerroCrtalic International | ferroecoblast.com

SHOT PEENING AUTOMATION

SHOT PEENING is a process that requires a high level of control to achieve work process repeatability. The main reason for that is one cannot check the peening effect on actual material without destructive testing, so it is crucial to control all parameters that affect intensity in order to ensure that the shot peening process is done according to requirements. Today's machines are equipped with PLC and HMI control; therefore, almost everything can be controlled and stored in case reverse checking is needed. For controlling their shot peening machines, FerroECOBlast uses their own platform called FerroSmartPanel, which can be set up on any HMI or PLC brand. It has been designed in-house based on our extensive know-how and experience in surface treatment gained since 1964.

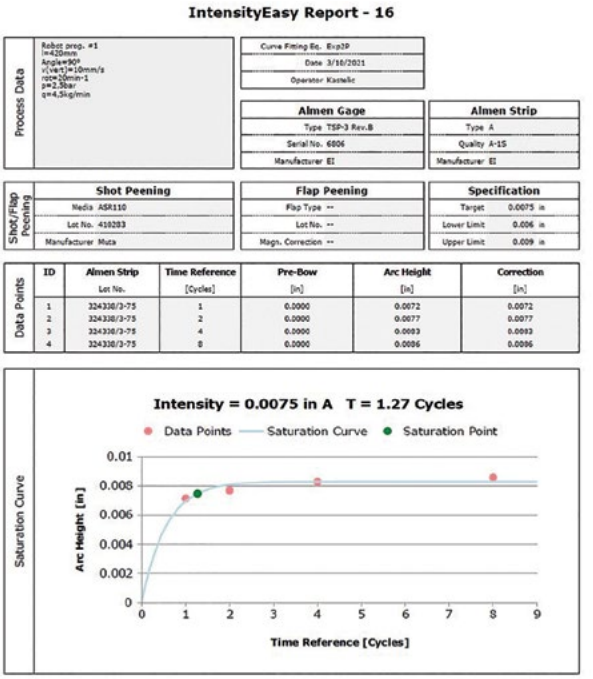
Sample screen from FerroSmartPanel

At the heart of such a system lies not only control of machines, like manipulators or robots, and turning on and off of electrical components, but also control over the complete process—together with checking and storing all data on a hard disk so that the history can be downloaded if necessary.

Let's take a look at what needs to be controlled in shot peening: first, the media flow, which needs to have a closed-loop system that alerts you if the flow is out of the tolerance range and brings the process to a halt—and the same applies to operating air pressure. Once this is set up, the second thing that affects intensity and the shot peening process is the distance and angle of the nozzle relative to the workpiece. This is controlled by a robot or gantry manipulator which usually operates within very tight tolerances. Once we have this set up, we need to check if the shots used for shot peening are OK, so the recycling system needs to be engaged to continuously separate broken particles and maintain the operation mix at the same level all the time.

All right, we have set up the parameters and have established control. Now, is there anything else that needs to be done? Well, to do a proper shot peening job, this is actually enough; however, we have upgraded our system with various features that allow the operator to easily calibrate the media flow valves and to set up the saturation curve on the machine itself without using an additional program. The FerroSmartPanel interface includes a saturation curve solver that allows the operator to connect an Almen gage via USB and import all measurements taken during the Almen testing and to plot a saturation curve. The saturation curve is stored with all the necessary information. This is usually done with separate programs where arc heights need to be entered manually, which is unfortunately very time-consuming.

Every facility that uses a shot peening machine knows that media flow valves need to be calibrated periodically or every time material size is changed. The valves are most commonly sent to their manufacturer for calibration, and it could take days or even weeks to get them back before



Saturation curve report displayed on HMI

putting the machine back into operation. This causes production downtime; something everyone wants to avoid. This nightmare is gone with our system since our machines come complete with a calibration station and program that allow media flow valves to be calibrated by the operators themselves. This eliminates weeks of production delays and helps ensure that your equipment is ready and set for work.

As almost everything these days, this too is under ongoing development and is improving on a daily basis. Our R&D crew are constantly looking for improvements to reduce production time and cost and to increase the quality of the shot peening process.

Integrated shot flow calibration system

ARSP 1000 DUAL shot peening machine

The 14th International Conference on Shot Peening
September 4-7, 2022
Politecnico Milano
Milan, Italy

Early registration begins July 15th, 2022

ICSP-14 is the calendar's most important event on Shot Peening. This three-day event is a must for scientists and engineers working in mechanical surface treatments. Discover the state-of-the-art in the science, technology and applications of mechanical surface treatments.

What will you learn?

Today's global society faces many urgent challenges. The focus is on saving energy and reducing emissions. Shot peening can create stronger, lighter and smaller metal components. Shot peening's benefits and applications are the key to satisfying sustainable requirements in high-tech fields.

Discover new applications and new markets for shot peening.

Hear the latest developments on how shot peening and related mechanical surface treatments can enhance the resistance of load-bearing components.

Attend presentations on combatting fatigue and fracture, modelling and simulation, and related and alternative surface treatments.

Who is it for?

Academia

ICSP-14 offers a unique forum for scientists to deepen and update their knowledge on all aspects of mechanical surface treatments, and present the state-of-the-art in the research world.

Industry

International representatives from academia and industry will come together to present and discuss the latest developments in shot peening and related subjects.

The ICSP-14 Scientific Committee

Our Scientific Committee members come from academic institutions and industrial organizations as part of our commitment to promoting multidisciplinary cooperation and exchange.

Topics

- Processes for Fatigue Enhancement
- Experimental Methods for Material Characterization
- Surface Finishing
- Laser-Based Processes
- Industry 4.0

Registration

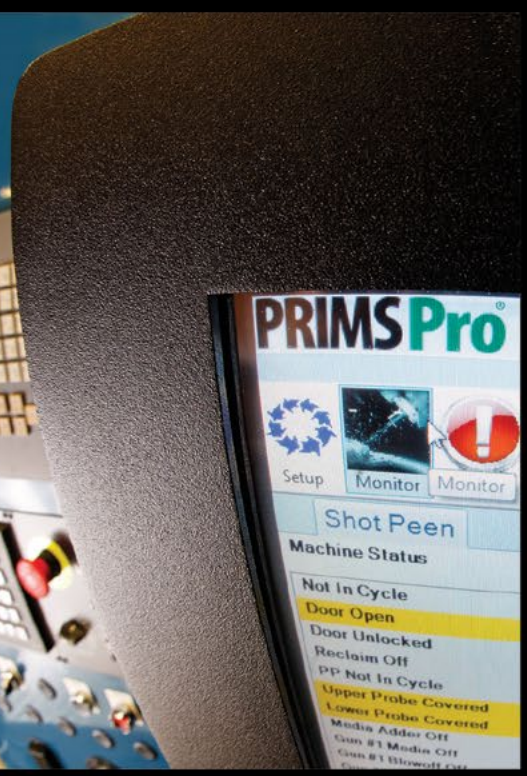
Visit www.icsp14.org for more information and to register.

Progressive® SURFACE

PRIMS Pro®

More efficient parts processing? **Procisely!**® **PRIMS Pro®** gives engineers and operators the **most advanced** and **flexible** process controller ever.

PRIMS Pro® is Windows-based and **procisely** customized for your shot peening operations.



Part & program manager

- ***Queue*** *parts before processing, or while others process*
- ***Search*** *by easily sorting through large quantities of parts*
- ***Select*** *and define multiple motion control or surface functions*
- ***Modify*** *or review part programs*

Preventive maintenance

- ***Auto-sort*** *based on next item required*
- ***All-in-one*** *maintenance scheduler, historian, and advisor*

Multi-level security system

- ***Customize*** *permission levels by user log-in*
- ***Control*** *modifications to process parameters and part data*
- ***Limit*** *who can reset PM items or run alarms*

PRIMS Pro automates process control, monitoring, and data-logging for key parameters. It's the ideal monitoring software for production, overhaul and repair, and R&D.

Learn more at:

progressivesurface.com

RESIDUAL STRESS MEASUREMENT

X-Ray Diffraction Systems & Laboratory Services

TECHNOLOGY THAT DELIVERS ACCURATE RESULTS

Safety. Quality. Performance.

1-734-946-0974 info@protoxrd.com ISO/IEC 17025 Accredited

X-RAY DIFFRACTION SYSTEMS & SERVICES

PROTO

www.protoxrd.com