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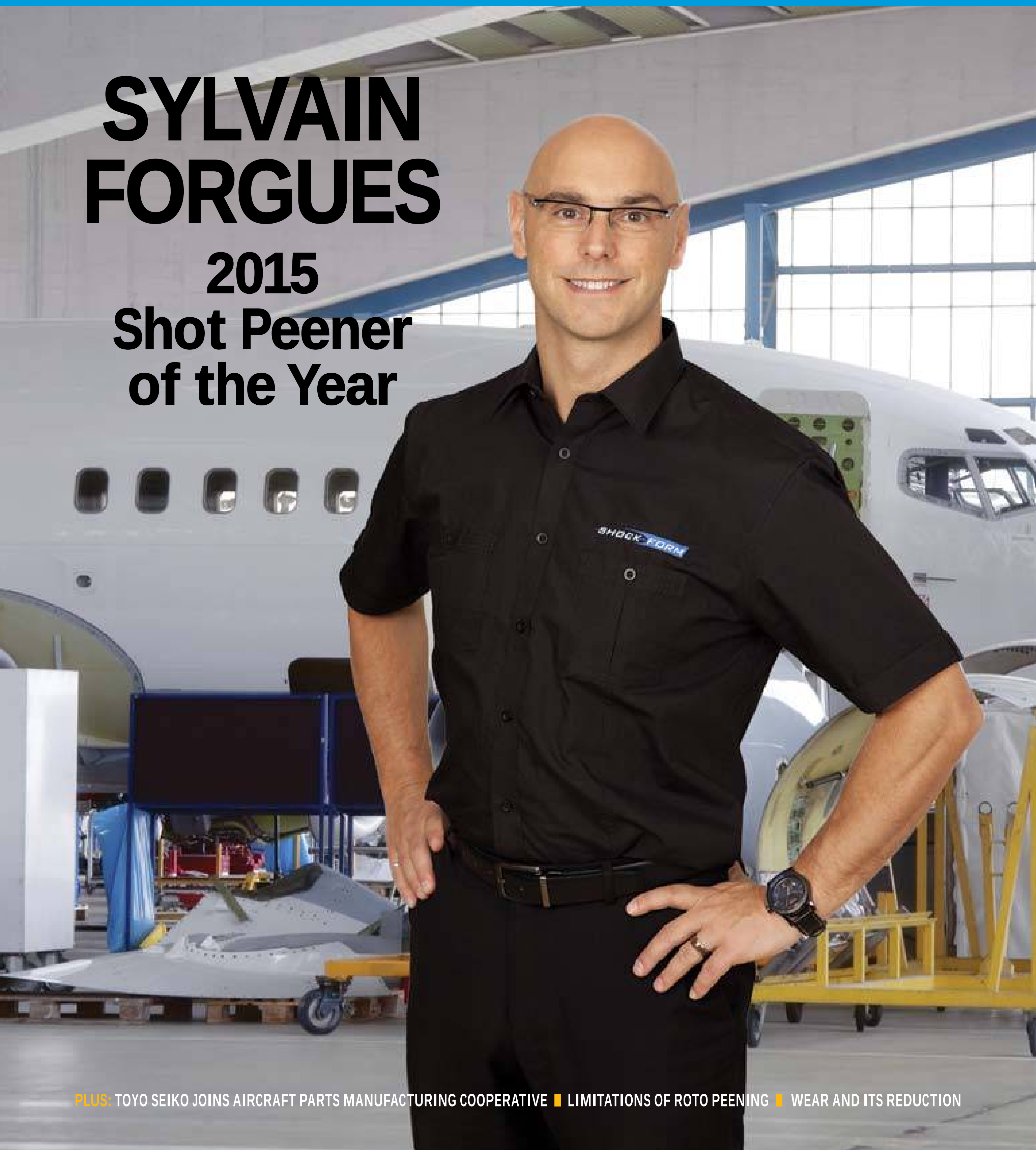
The Shot Peener

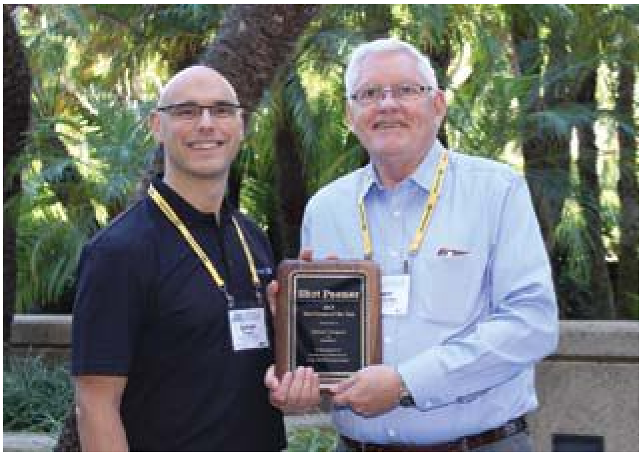
Sharing Information and Expanding Global Markets for Shot Peening and Blast Cleaning Industries



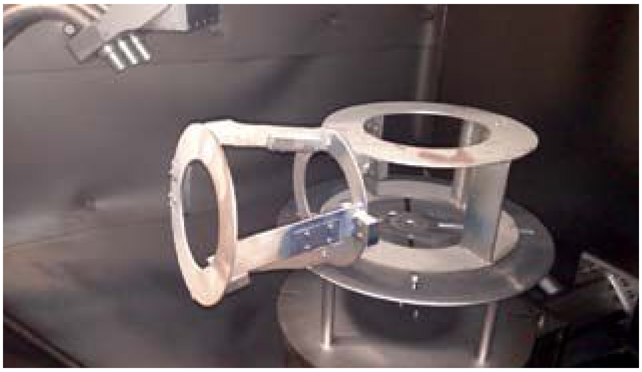
SYLVAIN FORGUES

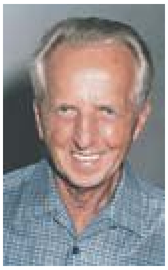
2015 Shot Peener of the Year

PLUS: TOYO SEIKO JOINS AIRCRAFT PARTS MANUFACTURING COOPERATIVE | LIMITATIONS OF ROTO PEENING | WEAR AND ITS REDUCTION



Sylvain Forgues, Founder and President of Shockform, receives the 2015 ***Shot Peener of the Year*** *award from Jack Champaigne, Editor of* ***The Shot Peener*** *magazine*





THE SHOT PEENER

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

The Best of 2015 and Looking Ahead to 2016

THE 2015 ANNUAL WORKSHOP in California was successful for many reasons and perhaps its most gratifying aspect was the acceptance speech by Sylvain Forgues for the 2015 **Shot Peener of the Year** award. His story about attending the International Conference on Shot Peening in San Francisco in 1996 and how he became interested in the shot peening process was very interesting.

JACK CHAMPAIGNE

He shared his memories on attending a dinner party during the conference and making new friends in the shot peening community. His continued studies and applications has led him to many innovations including the FlapSpeed® PRO. Sylvain joins a long list of important contributors to the shot peening industry. Read more about Sylvain on page six.

2016 will mark the 25th anniversary of the US Shot Peening Workshop. Has it really been that long? The 2016 workshop in Indianapolis is going to be a great event—watch for more information in future issues of *The Shot Peener*.

I was pleased that Dr. Kirk wrote an article on a problem that besets shot peeners: Wear. In "Wear and Its Reduction" on page 26, Dr. Kirk reviews how material selection and component design can reduce wear rates. He even offers a suggested modification of blast wheel design. He says it's a "purely an academic exercise" and it's very interesting how he approaches product re-design.

I've already reviewed Dr. Kirk's article for the spring magazine where he reveals often overlooked concepts on shot peening coverage. Stay tuned.

The Purdue Center for Surface Engineering and Enhancement (C-SEE) reports that several companies have indicated interest in their program. The treatment of welds for structural integrity is already being studied by the Civil Engineering School at Purdue and additional research may be sought from the C-SEE. One application receiving early interest is the performance of nozzles for increased efficiency. This could lead to the understanding of boundary conditions of media flow rate and air pressure ranges. And another prospective project is the investigation of technologies for inspecting and grading media sizes using both sieve analysis and computer-aided image analysis. If you would like more information on C-SEE, please contact:

David Bahr
Materials Engineering
Purdue University
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Email: dfbahr@purdue.edu

In closing, I hope 2016 is off to a great start for all of you. Best wishes for happy, healthy and prosperous year.

THE SHOT PEENER

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Kathy Levy | Associate Editor | __e Shot Peener

A Stellar Career in Aviation and Aerospace

Sylvain Forgues, our 2015 Shot Peener of the Year, with Shockform's FlapSpeed® Pro.

SYLVAIN FORGUES is a dynamic contributor to the advancement of shot peening in aerospace and aviation. He is the founder and President of Shockform Aeronautique Inc. in Boisbriand, QC, Canada, where he is responsible for Research and Development, Strategic Orientation, Business Development and Product Development. Shockform has launched many innovative products since the company's inception in 2006, including intelligent tools for repair peening, surface inspection devices and customized robotic shot peening systems. Shockform's popular FlapSpeed® PRO for rotary-flap peening is widely used by aircraft maintenance, repair and overhaul facilities, airlines, original equipment manufacturers and the United States military. "Although peening is a mature market, it offers many opportunities for innovative products. We have a great team at Shockform and we are working on many exciting projects that will significantly improve the peening experience," said Sylvain.

Sylvain's ability to oversee the introduction of successful products for the aerospace industry is based on an impressive career path. He started his career in 1993 at Bombardier Aerospace where he worked on the Aircraft Structural Integrity Program of the CF-18 fighter program. His work included Stress and Fatigue Analysis and R&D on Probabilistic Crack Growth, Cold Working and Shot Peening.

After five years, he transferred to the commercial division of Bombardier where he was in charge of structural in-service issues for the fuselage of the CRJ-200 fleet.

In 2002, he became Section Chief of the R&D, Robotics and Software department at L-3 MAS, one of Canada's leading providers of maintenance, repair and overhaul services for military and commercial aircraft. At L-3 MAS, his team developed and marketed a novel robotic shot peening system to reshape and peen critical internal structures directly on the CF-18 and Bombardier CRJ-700 with minimal disassembly.

Sylvain received his degree in Mechanical Engineering from the University of Ottawa in 1990 followed by a Master's degree in Applied Mechanics from the Ecole Polytechnique in Montreal. For his Master's degree, he studied the beneficial effects of hole cold expansion through 3D non-linear finite element analysis, residual stress measurement by x-ray diffraction and experimental fatigue testing.

Sylvain has applied his impressive academic background and work experience to authoring more than 15 papers and articles on shot peening and fatigue life improvements. "I first met Sylvain in 2005 at the Ninth International Conference on Shot Peening in France where he presented his paper titled *Evolution of Shot Peening On the CF-18—From OEM to Robotic*," said Tom Brickley, Vice President of Electronics Inc. "I was impressed that he took a difficult problem and developed a solution that benefited a real-life commercial process. He was very good at explaining complex theories so a layman could understand. It's no wonder his ideas work on the shop floor," he added.

Sylvain is an active member of the Society of Automotive Engineers Surface Enhancement Committee where he has introduced new specifications for processes such as needle peening for aero engine repairs. He is also a Lead Trainer for the Electronics Inc. Shot Peening Training division. Over the last five years, he has provided on-site rotary flapper peening training in French and English to more than 350 students in Canada, USA, Brazil, Dubai, Germany and France. For the last 10 years, he has taught specialized classes at the Electronics Inc. USA shot peening workshops.

The Shot Peener staff is pleased to give the 2015 ***Shot Peener of the Year*** award to Sylvain and we look forward to further accomplishments from this energetic and innovative industry leader.

Visit www.theshotpeenermagazine.com/shot-peener-of-the-year for a complete list of past Shot Peener of the Year award recipients.

TOYO SEIKO Joins Aircraft Parts Manufacturing Cooperative

TOYO SEIKO CO., LTD has joined the Aircraft Parts Manufacturing Cooperative (APM) and Mitsubishi Heavy Industries (MHI) in a plant location agreement with Matsusaka City in Mie Prefecture, Japan. With these agreements, the framework has been laid to establish an industrial cluster centered on the Matsusaka Plant for the integrated production lines of small parts for commercial aircraft, and vertical and horizontal tails for the Mitsubishi Regional Jet (MRJ), a next-generation regional jet.

TOYO SEIKO will provide shot peening for all integrated parts requiring the metal surface treatment produced in the Matsusaka Plant. In order to process such a large volume of parts per month, TOYO SEIKO will install several shot peening machines in the facility. The machines will be operated by TOYO SEIKO's shot peening technicians.

The shot peening job shop services provided by TOYO SEIKO are Nadcap accredited and the company is seeking AS9100 certification as well. In addition to their job peening services, TOYO SEIKO is well known for their Conditioned Cut Wire for Aerospace, High-Hardness Cut Wire, the Coverage Checker, Residual Stress Measurement Services, Ultrasonic Shot Peening Services and the distribution of shot peening-related products.

APM plans to establish a "Smart Cluster" at the site that will enable the effective and flexible integrated production of small parts for commercial aircraft, including the MRJ and airplanes manufactured by The Boeing Company. In their quest to achieve this goal and compete more aggressively in the global market, APM will blend the highly efficient manufacturing methods used in the automobile parts industry into a aircraft parts production system in order to create a sophisticated, self-sustaining parts production system. Going forward, the participating companies aim to begin full-fledged operations in the latter half of fiscal 2016.

MHI plans to make the Matsusaka Plant a key manufacturing base for MRJ in Japan, and is preparing to begin production of vertical and horizontal tail sections by the end of March 2017.

Matsusaka City is located in the Tokai region, which is home to many aircraft-related businesses. The Japanese government has designated it as a "Special Zone to Create Asia No.1 Aerospace Industrial Cluster" in an effort to promote the development of Japan's aircraft industries. Located in the Matsusaka Core Industrial Complex, the Matsusaka Plant is also a part of this special district.

The Mitsubishi Regional Jet, currently under development, is a family of 70-to-90 seat next-generation aircraft. The MRJ drastically reduces fuel consumption, noise and emissions while offering a more spacious and comfortable cabin than existing regional jets.

With the plant location agreements as a basis for further development, MHI will strive to make the MRJ project a success, and contribute to the creation of a Japanese aircraft industry that is a highly competitive power in the global market.

"We are very pleased to have secured a shot peening contract with MHI at the Matsusaka Plant. As shot peening professionals, we are looking forward to working with them on the new Mitsubishi Regional Jet," said Yoshihiro Watanabe, President and CEO of TOYO SEIKO.


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AN INSIDER'S PERSPECTIVE

Kumar Balan | Engineer | Empire Abrasive Equipment

Visions of the Future

Part one of a two-part series on the past, present and future of shot peening and blast cleaning from industry leaders, including Michael Brauss, Dominic Cimino, Jim Harrison, Scott Nangle, Alain Portebois, Jim Whalen and Ron Wright

IN A WORLD littered with terms such as "the internet of things," "big data", and "industrial internet," one often wonders about the position of our relatively small surface preparation world. What revolutionary changes in the past 20 years impacted it? What is its future? Unless retirement is imminent, what should we anticipate and prepare for? The 2015 USA Shot Peening Workshop provided an ideal opportunity to speak with some of the industry influencers about their thoughts on the shot peening and blast cleaning industry. I spoke with Jim Whalen of Progressive Surface, Ron Wright and Alain Portebois of Wheelabrator, Michael Brauss of Proto Manufacturing, Jim Harrison and Dominic Cimino of Curtiss-Wright/Metal Improvement Company and Scott Nangle of Empire Abrasive Equipment Company. This is a compilation of their assessment of its current state and vision for the future.

Evolutionary Milestones in the Past 20 Years

Peening equipment has truly evolved in the past 20 years: the sophistication of controls, prominence of specifications, new industry entrants and variety of applications have made the last two decades more dynamic than ever before. Our group was unanimous that computer controlled/monitored peening was the most significant milestone in the last 20 years. Each of them had their own valuable addition to this common opinion.

"Our business has seen closed-loop process controls and intuitive HMIs develop in conjunction with computer controls. Customers are also interested in a direct approach to velocity scanning with our ShotMeter G3 Particle Velocity Sensor," said Jim Whalen of Progressive Surface. Listing ergonomics (cleaner and quieter equipment) and a smaller footprint as other aspects, Jim sees peening evolving as part of a larger lean-manufacturing set-up.

Wheelabrator is a manufacturer of wheel- and air-type cleaning and peening systems. Ron Wright, their Northern America Air and Wheelblast Peening Manager, said, "We have seen greater development in air over wheel-type equipment in the past few years, but that's not the whole story. In addition to hybrid machines (air and wheel in one cabinet), we are re-designing popular wheel machines for traditional peening applications with sophisticated controls, automation and material technology. This of course speaks to the needs of our customer base that is demanding this change in order to stay competitive with a repeatable process."

Alain Portebois echoed Jim Whalen's observation that velocity measurement and control are becoming more important to customers.

Scott Nangle, who describes Empire's identity as "everything airblast," commented, "Our engineers identify accuracy, precision, automation and controls as evolutionary milestones both in cleaning and peening equipment. We are also experiencing greater customer involvement in validating peening and grit blasting applications before and after a sale. There is no doubt that computer controls and process engineering have become as important as the actual equipment itself."

"Validation essentially is a means by which multiple customer facilities stay uniform with expected results, cycle after cycle. It also removes the ambiguity from those applications the customer has not worked with in the past," added Nangle. This is a sentiment that also forms the basis of specification conformance in our industry.

Michael Brauss of Proto Manufacturing builds X-ray Diffraction (XRD) equipment and provides in-house XRD services. "More and more customers from North America and overseas are sending their parts to our labs to measure residual stress. XRD is certainly catching on as a critical, additional step for customers that validate their peening results," said Brauss. "Computer-monitored peening and robotics have changed the level of sophistication in the peening world, and XRD measurements are downstream of this value chain," he added.

Jim Harrison and Dominic Cimino of Curtiss Wright/ Metal Improvement Company are experts in providing shot peening and laser peening services to many industry sectors. According to Harrison, "We provide our services to a wide

variety of industries including sophisticated markets such as Aerospace and Defense. Being a service provider, our equipment has to be flexible enough to handle part variety while at the same time conforming to specification and audit requirements." Dominic Cimino, who is in charge of multiple facilities in the northeastern United States, said, "Specification conformance and process control are the two main evolutionary milestones our business has seen over the past few years. Our customers, particularly in Aerospace, have led our business into this progression over the years."

New Adopters?

"Aerospace and Automotive are the traditional users of peening equipment with Medical joining in the recent past, and we don't see new users that could match this growth for our industry," said Jim Whalen. He was quick to add, "That said, current users are expanding the limits of their existing machines and applications by adding new components to the process."

Commenting on new adopters, Ron Wright said, "Our cleaning equipment continues to bring new industries into our database of users. Also, grit blasting equipment has grown in control sophistication, particularly in Aerospace."

"Empire continues to see new industries adopting blast cleaning equipment, and the oil and gas industry are shot peening more components. Additionally, traditional industries are converting from manual to automated cleaning equipment," said Scott Nangle.

Jim Harrison and Dominic Cimino feel a mix of industries have used their shot peening job shop services over the years. "New industries haven't approached us with significant volumes of parts to be peened," explained Cimino.

Michael Brauss said, "We provide XRD services to industries that don't use shot peening. In terms of post-peening XRD, we have seen an increase in users from outside the traditional industries of automotive, aerospace and medical, such as power generation, structural (bridges and buildings) and the resource-based industries."

What's Next?

It was interesting to get perspectives from equipment manufacturers and service providers. No discussion about the future can commence without appreciating where we came from and this discussion was an attempt at exactly that. Our journey thus far has brought us to the present with these questions: Where is this industry headed? What features are users going to seek in their equipment? Are our Industry Influencers concerned about the future? With the high level of equipment sophistication that ensures conformance, are specifications going to be relaxed? Will alternate materials eliminate the need for shot peening, at least for some components? Will alternate techniques displace shot peening?

Follow on to part two of this discussion, in the spring edition of *The Shot Peener*, to read what these industry stakeholders had to say about such profound issues.

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Roto Peening Has Its Limitations!

ROTO PEENING (RP) was developed and is still used today mainly in aerospace maintenance, repair and overhaul (MRO) facilities for on-site-repairs of aircraft and helicopters. Over the last decades, RP found entrance in the specifications and service bulletins of most aircraft manufacturers and, in 2010, the AMS2590 specification became available.

Basically RP is a subtype version of conventional Shot Peening (SP) with the major difference being a defined number of contained shot in a polymeric flap accelerated by the rotation of a supporting mandrel (Figure 1).

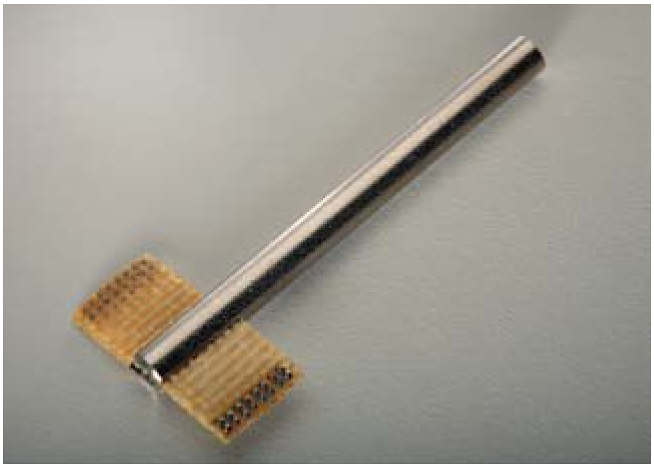


Figure 1. Roto peening flap in mandrel

This smart technical design results in the following major differences between RP and SP in terms of shot and intensity.

	Roto Peening	Shot Peening
Shot Size	Fixed: 0.033 inch (0.84 mm)	Flexible: 0.002 - 0.24 inch (50µm - 6 mm)
Shot Material	Fixed: Tungsten Carbide	Flexible: Cast/Stainless Steel, Glass, Ceramic
Shot Hardness	Fixed: Tungsten Carbide	Flexible: 45 to >70HRC
Intensity Range	Almen N, A	Almen N, A, C

RP and SP—the latter using a large number of independent particles in a shot stream—follow mainly the same technical targets: Controlled creation of a compressive surface residual stress layer to overcome metal fatigue-related failures during the use of critical components. As RP is primarily used in the on-site repair of damage-weakened aerospace components, it is even more important to focus on the appropriate use of this manual-driven repair technology.

In conventional SP, one of the first lessons you learn when you establish a call out for a component is to be aware of the dimensions, especially the smallest radii to be peened. The reason is these radii are where the largest stress causing fatigue problems occur during load (Figure 2).

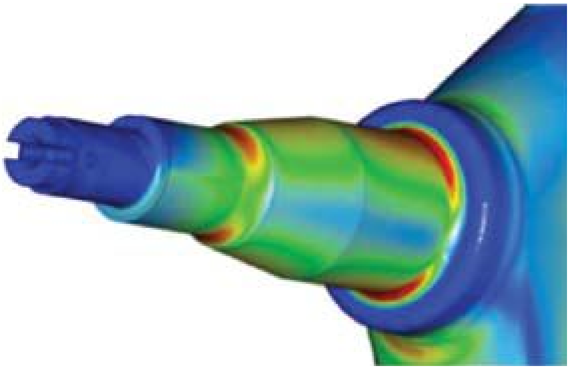
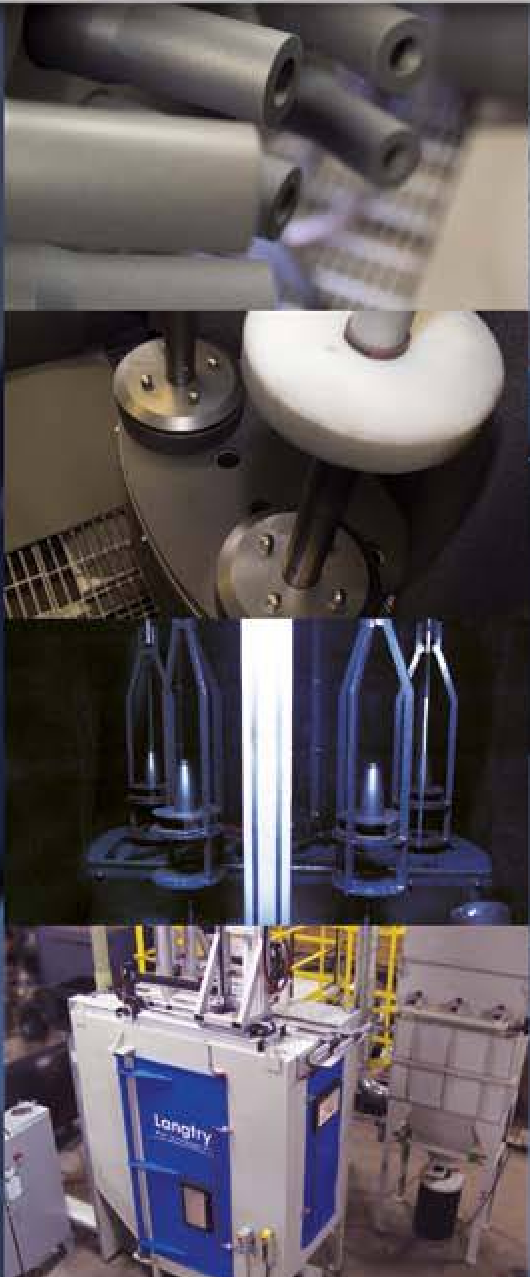


Figure 2. Red colour represents highest stress levels in the radii areas under load

In comparison to SP, the material/hardness (tungsten carbide) and size (S330) of the shot in the RP technique is limited to only one choice. Based on this fact, the use of RP is technically already limited regarding a smallest radius which can be peened. In conventional SP, the AMS2430 declares that the diameter of shot to be used must not be greater than one-half of the smallest fillet radii. In RP, the only size available and bonded to the flap is 0.033 inch (0.84 mm). This rule could be misinterpreted that the smallest radii that can be treated is 0.066 inch (1.68 mm) which, in fact, is wrong!

The reason for this is the embedded shot position in the polymeric strip used in RP technology. First, the position of the embedded shot cannot cover the end of this strip (see Figure 1 and 3). Secondly, the stiffness of the strip limits its


POWER ON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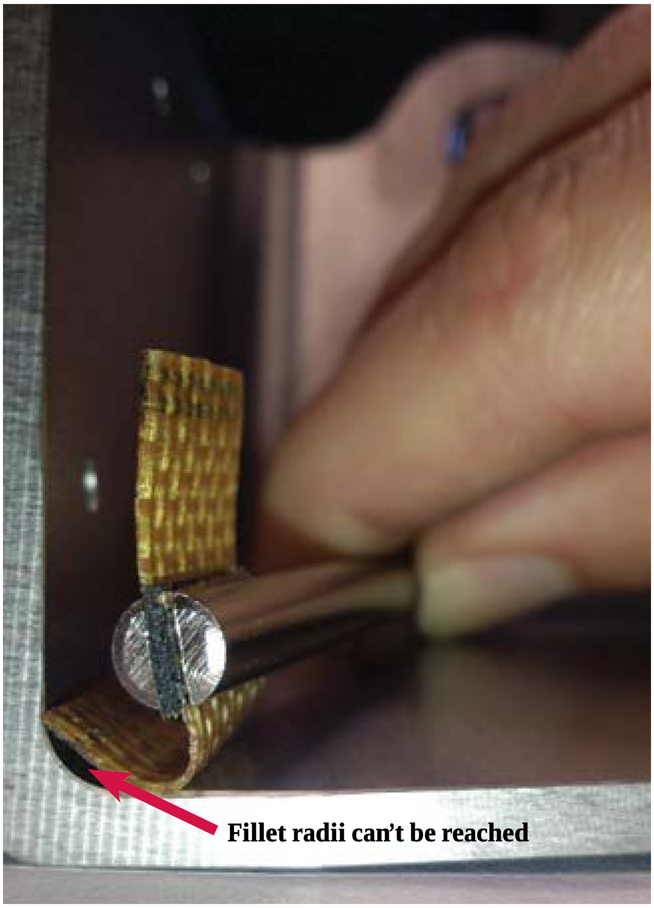

Figure 3. Example of a radius (0.3 inch/8 mm) that is too small for roto peening

ability to peen small radii (see Figure 3). These two facts lead to the result that the smallest radius possible to peen is by far larger than just the double of the used shot size.

This observation already includes the possibility of adjusting the flap to the required surfaces by cutting it down. Even the theoretically smallest single-shot flap is limited by the shot position and strip inflexibility.

An investigation of different specifications and service bulletins has revealed that, in some cases, the above mentioned incorrect radius of 0.0625 inch (1.587 5 mm) has been pointed out. Whereas, in most specifications and service bulletins, no real values or pre-preparation guidance concerning the radius are given. In other cases, including the AMS2590, it is at least mentioned that during the part preparation process "all fillets shall be properly formed."

In a few exceptions, the repair manual offers a detailed and realistic "minimum fillet radii that can be peened" for the three different available RP flap sizes. See the following table as an example.

Flap Size		Minimum Fillet Radii
Length	**Width**	
2.00 inch (50.8 mm)	1.00 inch (25.4 mm)	1.25 inch (31.75 mm)
1.25 inch (31.8 mm)	0.56 inch (14.3 mm)	0.75 inch (19.05 mm)
0.98 inch (25 mm)	0.56 inch (14.3 mm)	0.61 inch (15.6 mm)

Example of minimum fillet radii from an aerospace bulletin

The above values clearly demonstrate that within the available documentation, the smallest possible radii to treat by RP can and should—in the author's opinion—be a minimum of 19 times larger than with conventional SP using the same (S330) shot size.

Summarizing the findings above, they make it clear that the use of RP in terms of peening of stressed radii should be urgently re-evaluated and limited to a minimum radius of >0.6 inch (15.2 mm) for the smallest flap size.

Reflecting upon experience and knowledge, the author furthermore recommends re-thinking the present repair manuals and also AMS2590 in terms of peening holes by RP. Today this kind of peening is allowed down to 0.5 inch (12.7 mm) diameter equal to a radius of 0.25 inch (6.4 mm).

Figure 4. Mid-size roto peen flap (1.25 x 0.56 inch / 31.8 mm x 14.3 mm) in a 0.75 inch (19.1 mm) hole

Figure 4 shows, as an example, a mid-size flap in a 0.75 inch (19.1 mm) hole that is reaming rather than peening. It underlines the concern that holes smaller than 0.75 inch (19.1 mm) cannot be peened correctly with this flap size.

Given this information, it is understandable that major OEMs explicitly recommend using conventional SP instead RP (BOEING Field Service, BAB-LUT-99-00006H, 20 Sep 99) in critical areas.


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Hydro Honing Labs Receives Patent on 3D Modeling Process

HYDRO HONING LABORATORIES, the parent company of Peening Technologies, has patented a process for producing Almen strip fixtures utilizing 3D modeling called "Apparatus and Method for Quantifying Metal Surface Treatment" (Patent Number US 9,063,049 B2). The process was developed by Thomas Beach and Walter Beach of Peening Technologies and is already in use at Peening Technologies' two shot peening job shops in Connecticut and Georgia.

The job shops service aerospace, automotive, and power generation industries. Peening Technologies specializes in work for the demanding aerospace industry and was the first shot peening company to receive Nadcap accreditation. (Peening Technologies is Nadcap accredited in Surface Enhancement and Nondestructive Testing - Liquid Penetrant, Magnetic Particle.) A third company, Peening Technologies Equipment, designs, builds and sells custom shot peening equipment to a variety of markets.

"We were looking for ways to make Almen fixtures quickly, efficiently, and at a lower price point. Typical Almen fixtures—at least, accurate ones—often require a lot of expensive machining along with long lead times. Scrap parts make nice Almen fixtures but are not often available and they can be expensive to convert," said Walter Beach, Vice President of Peening Technologies.

Most specifications require Almen strips to be placed in locations representing the surfaces requiring intensity verification. However, these specifications offer very little guidance on how to obtain accurate verification data. As a result, Almen fixtures can often be no more than rough representations of the part being peened. "Our method allows us to make our fixtures very accurate without pricing ourselves out of business," said Walter.

The first step in Peening Technologies process is to create a computer-generated 3D part model that identifies the location(s) where intensity should be verified. With this information, Almen strip holding blocks are positioned on the model in the 3D computer program and a support structure is designed. This structure is then typically laser cut into a collection of parts. These parts, along with the Almen strip holders, are welded together to create a customized unit.

Peening Technologies developed this process soon after their investment in a Trumpf Model 1030 laser cutter several years ago. OEM customers began saying they had never seen fixtures like this and several said, "you should patent that!" Encouraged by their customers' response, Thomas and Walter began writing their first patent.

The 3D modeling method has become Peening Technologies' primary tool for fixture fabrication. With the company's in-house laser cutter, they can easily save the test fixture's digital files for easy storage and retrieval. "This method greatly accelerates the development of a new shot peening process. What used to take days or weeks now can be done in only a few hours. In the world of aerospace manufacturing, time is in short supply, so being able to react quickly and deliver parts quickly is key to our success," said Walter.

UNITED STATES PATENT:
Apparatus and Method for Quantifying Metal Surface Treatment

Patent Number:
US 9,063,049 B2

Applicant:
Hydro Honing Laboratories Inc.

Inventors:
Thomas A. Beach, Walter A. Beach

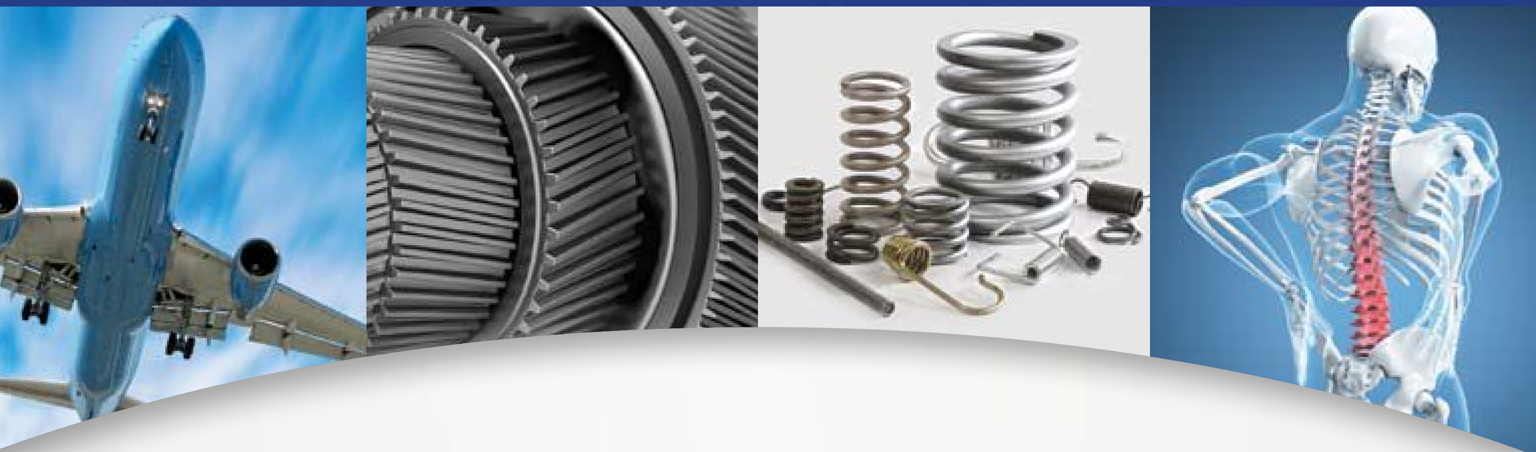
The following fixtures were created with Hydro Honing Laboratories' patented process

PREMIER

PREMIER SHOT COMPANY

1666 Enterprise Parkway *Twinsburg, OH 44087*

A Cut Above



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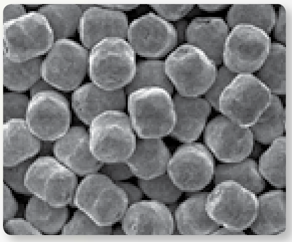
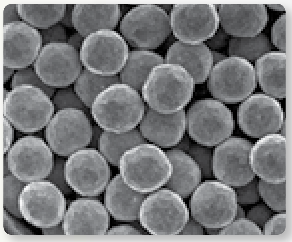
- **Substantial Cost Savings** The increase in useful life of Premier Cut Wire Shot results in savings in media consumption and reclamation, dust removal and containment, surface contamination and equipment maintenance.

As Cut



Normal Conditioning



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Metal Enhances Healthcare Technologies

The following article originally appeared in Medical Design Technology. It is part of Medical Design Technology's Roundtable series where they invite experts to comment on topics of interest to their industry.

WITH THE USE of plastics exploding in the component fabrication world for medical devices, it would seem the use of metal would dwindle away. But that's not happening anytime soon as metal components still offer an array of advantages over their molded or 3D printed counterparts that keep them as the ideal option for a number of applications. And this isn't just in the orthopedic space as the material of choice for implants. Rather, metal components are being indicated for use in a number of different types of devices, from surgical tools to implantable technologies to portable solutions.

Advantages

Speaking about machining in this month's roundtable, Judy Carmein, CNC machining product manager at Proto Labs, shared some comments on why machining was still quite the viable option for medical device OEMs. "End-of-arm tooling (e.g., robotic surgical tools) require high strength and intricate geometry that usually cannot be obtained with injection-molded plastics. The same is true for surgical tools. In addition, many materials that can be machined are also easy to sterilize, which is important in most medical applications. And the low upfront tooling costs allow for customization of individual parts."

Adding his own thoughts on why metal and machining are still being used in the medtech space over plastic components, Ken Altman, director of advanced manufacturing, machining division, at Orchid Orthopedic Solutions said, "Machined metal or titanium medical devices can be finished to very tight tolerances and sometimes, competitively priced to plastic components for smaller runs."

Challenges

So with metal (and machining more specifically) still providing great value as a component fabrication option to medical device designers, it's important to be mindful of what other designers are doing that create problems for them later in the production process. Both Roundtable participants shared a number of challenges they observe in the medical device development space.

"Designers need to think about the machining process while designing their parts. Certain part features can add significant cost and should be included only if necessary to the design," says Carmein. "Tight inside radiuses, and tiny features all add to the cost of machining the part. These features require very small end mills for cutting. In general, the smaller the end mill tool that is required, the longer it takes to machine the part — this drives up costs. Smaller tools also tend to deflect, so small, deep features can be especially problematic."

"Generally most OEMs have great designs but occasionally small details are overlooked, often geometric dimensioning and tolerancing requirements make manufacturing difficult and end parts expensive. "This is where DFM [design for manufacturability] reviews with your contractor create a big benefit," adds Altman. He goes on to say that, "Sharp corner radiuses are often specified for no apparent reason; adding a small fillet radius adds design strength and may reduce your final product cost. The sharp corners create a challenge for machining due to tool corner breakdown during machining."

3D Printing

As 3D printing continues to "invade" as a disruptive technology across so many industries, it was interesting to hear the Roundtable participants speak to how it was creating an impact in the machining space.

"3D printing is a disruptive technology for the manufacturing industry, and especially for machining. But this disruption is driving innovation within traditional machining applications. A near net shape, non-manufacturable part can be built in direct metal laser sintering (DMLS) and then can be selectively machined for increased precision. It's an instance of multiple processes working together," offers Carmein. She continues, mirroring a point made previously by Altman, "There are, however, some unintended design challenges that 3D printing has created for machined components in the medical device space. For example, if parts are taken from concept through development with only printed samples, when it comes time to manufacture production parts in the desired machining setting, issues can arise. So manufacturability should be considered at every stage if the part will eventually move from prototype to production."

Altman shares Carmein's mostly positive outlook of 3D printing saying, "3D printing has been a great complement to machining. In some cases, it's difficult to determine how internal features will be machined. Orchid owns several 3D printers, making it easy to print parts if needed before

production, making process development easier while eliminating errors and improving final product acceptance."

Outlook

Looking ahead at machining's future in the medical device space will sure to continue to bring challenges to the experts who offer the service, but it will undoubtedly continue to help bring about fantastic innovations in the healthcare technology space.

Carmein predicts, "There will most likely be an even closer customization of product design with patient. Soon it will be common to scan a joint to be replaced, build a CAD file from the scan, and then manufacture the new joint as the procedure is in process. You can also expect an increased focus on very small devices, whether implantable or end-of-arm robots to conduct the actual surgery."

"I'd predict components will continue to get smaller and machining will rely more on micro-sized tools and additive manufacturing to produce these small components. In five to ten years, there could be more cloud-based applications for CAD/CAM systems and improved remote access for machine attendance. Collaborative robots could continue to evolve and may replace much of the human-machine intervention," concludes Altman.

Vapormatt Employee Celebrates 50 Years in Blasting

PHIL DAWES has celebrated an incredible 50 years in the blasting sector and 20 years as an employee at Vapormatt in December. Vapormatt specializes in wet blasting for surface preparation and finishing.

Phil began his journey in the blasting industry in 1965 as an apprentice at Abrasive Developments, which coincidently was also owned by the family that founded and continue to operate Vapormatt today, the Ashworths. He rose through the company to a sales engineering role and after knowledge-boosting stints elsewhere in the blasting industry, he joined Vapormatt in the autumn of 1995—bringing with him 30 years of valuable experience.

During his time at Vapormatt, Phil has spearheaded the development of the company's composites business and played a key role in the growth of its aerospace offering, among other valuable contributions. Despite his anniversary landmarks, he has no plans to retire just yet and will continue to pass on his extensive experience to his Vapormatt colleagues.

"I've greatly enjoyed my half-century in the blasting sector and more recently at Vapormatt, playing my part in growing both industry knowledge and the use of wet blasting over the past 20 years," said Phil Dawes, Sales Engineer at Vapormatt. "I'm now looking forward to what is in store for Vapormatt and the wet blasting process in the future."

Commenting on the Phil's anniversary, Robin Ashworth, Managing Director at Vapormatt, said, "Phil has been a wonderful member of the Vapormatt team throughout the time he has been here. He has an excellent grounding in all things wet blasting and is a fountain of knowledge for the rest of the team, especially for his young colleagues who are able to further develop their own skills thanks to his advice and knowledge. His reliability, dedication, loyalty and willingness to share his knowledge over the past two decades has been and continues to be truly appreciated by all here at Vapormatt."

2015 marked the 60th anniversary in the blasting industry for Phil Dawes. Mr. Dawes is a Sales Engineer at Vapormatt.

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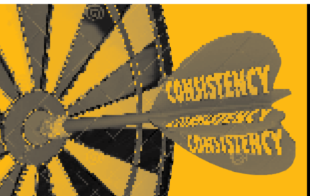

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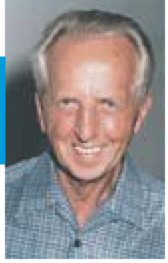

ACADEMIC STUDY

Dr. David Kirk | Coventry University

Wear and Its Reduction

INTRODUCTION

Shot peeners are beset with wear problems. Every piece of shot and all peening equipment are subject to wear to a greater or lesser extent. A universal example is the wear endured by shot particles on impact with components. As another example: the late Jack Plaster aptly said that "A centrifugal blast machine is probably the most self-destructive of all modern mechanical machines." Enormous numbers of hard particles are pressed against unlubricated rotating surfaces, hence generating fiendish wear problems. To some extent a centrifugal wheel-blast machine acts as a giant pepper mill—with shot particles playing the role of peppercorns!

This article uses impacting shot and the blast wheel to illustrate the types of wear mechanisms most commonly encountered by shot peeners. These mechanisms are called "Adhesive wear" and "Abrasive wear". For both mechanisms we have either "two body" or "three body" situations. These alternatives are illustrated in fig.1.

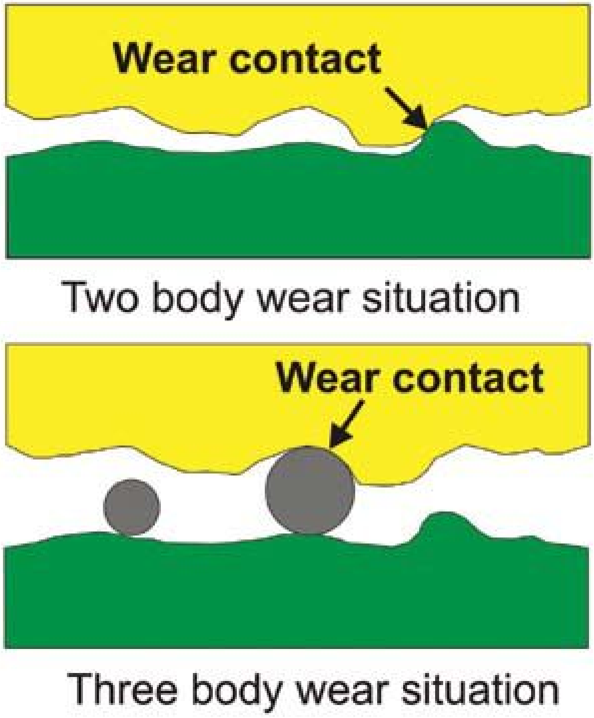

Fig.1. Two and Three Body wear situations.

The article also indicates how material selection and component design can reduce wear rates. An attempt to improve on blast wheel design is included as an illustration.

For every shot peening component the following adage is appropriate: "*If a man can make a better mouse trap, the world will make a beaten path to his door.*"

Wear only occurs if two surfaces are in contact and are moving relative to one another. The resulting rate of wear is governed by both pressure and speed.

The effects of pressure and speed can be visualized by a simple example. Think of rubbing an old, rusty Almen strip using emery paper. We all know that the greater the applied pressure the higher will be the polishing rate. Less obvious is the effect of speed of rubbing. The faster the rate of rubbing the more material is removed per stroke! Think of why two sticks have to be rubbed quickly against one another if there is to be any hope of generating a flame. Classic survival techniques include pressing a pointed stick into a block and rotating it with a bow's string—hence generating both high pressures and high speeds.

ADHESIVE WEAR

As the name implies, adhesive wear occurs when two surfaces physically adhere to one another. This type of wear is often called "galling." Adhesion takes the form of micro-welds formed between the two surfaces. Two nascent metal surfaces pressed together will micro-weld to one another at points of contact. "Nascent" means newborn and implies a surface completely free from oxide protection. Relative movement of the two surfaces breaks apart the tiny points of adhesion, causing wear. Fig.2 on page 28 illustrates the formation of a single micro-weld with subsequent tearing apart.

This section uses the formation of a dent to illustrate how nascent surfaces are generated, leading to adhesive wear.

Dent Formation

All non-noble metallic components form a protective oxide layer when exposed to air. If this layer is broken, oxygen in the atmosphere will, normally, rapidly repair it. The oxide layer is, however, extremely brittle. When a shot particle hits a component the shot particle deforms elastically. This elastic deformation is sufficient to shatter the particle's oxide layer. As a dent is being produced, the dent surface itself is stretched

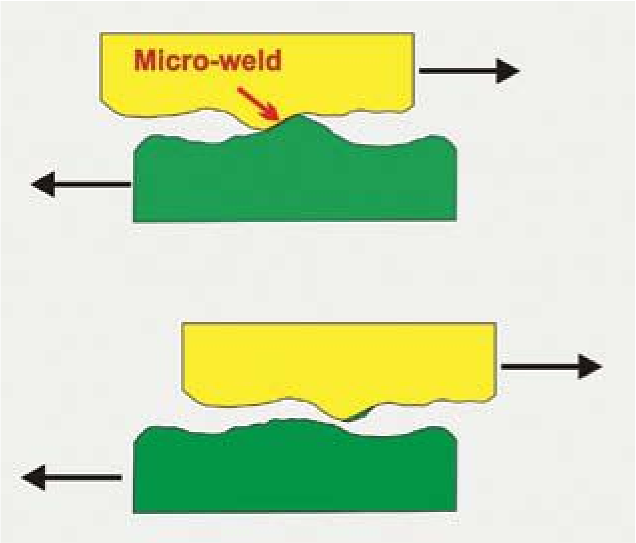

Fig.2. Micro-weld formation and subsequent tearing apart.

both plastically and elastically. This stretching fractures the component's oxide layer. For a typical dent whose diameter is ten times its depth the stretching is about 3%. This vastly exceeds the ductility of any oxide coating. Fig.3 illustrates the stretching that is involved. The arc ABC is 3% longer than the original surface length AC.

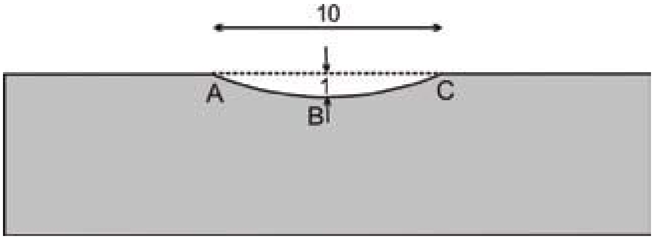

Fig.3. Typical dent geometry.

No oxygen can get to the interface between the impacting shot particle and the dent's surface. Hence we have two nascent surfaces being pressed together and also moving relative to one another. Huge numbers of microscopic auto-welds are therefore formed and then broken apart. As a consequence, adhesive wear must occur. The microscopic scale of the adhesion process promotes the observed polished appearance of dents.

Susceptibility to Adhesive Wear

A good indication of adhesive wear susceptibility is the thickness of the oxide coating on a metal's surface. Noble metals such as gold have the thinnest of oxide layers—a monolayer—but are rarely shot peened. Metals such as aluminum and chromium have very thin oxide layers—so thin as to be translucent. Aluminum alloys and stainless steels also have very thin oxide layers. It is well-established that aluminum, stainless steels and gold are very susceptible to adhesive wear. Gold foil has been used for thousands of years based on the "cold-welding" that occurs when it is hammered into place.

ABRASIVE WEAR

Abrasive wear mainly occurs when a harder material rubs against a softer material. Emery paper contains particles that are harder than metals—hence its usefulness for rust removal. That is an example of two-body wear. Metallurgists use diamond-impregnated polishing wheels to produce ultra-smooth surfaces. That is three-body wear. Both two- and three-body wear occurs in shot peening situations.

Abrasive wear characteristically occurs when an asperity on the harder surface strikes an asperity of the softer surface. This is illustrated in fig.4. As an asperity on the harder surface strikes an asperity on the softer surface something has to give! In this case it is the asperity on the softer surface which is work-hardened until it fractures.

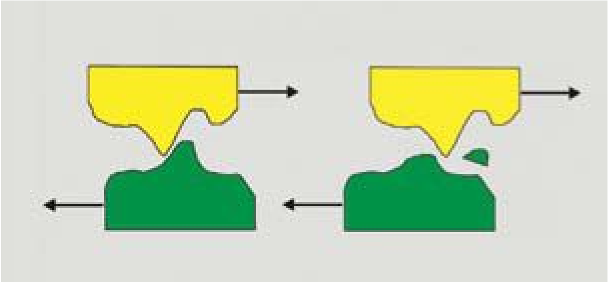

Fig.4. Two-body abrasive wear.

WEAR REDUCTION

Material selection and component design are the two major factors in wear reduction.

Material Selection

Material selection has benefited from the enormous advances made in developing wear-resistant materials. The choice is now so large that it is easy to over-simplify selection. Consider, for example, using just hardness as a wear-resistance criterion. The assumption then is that the higher the hardness the greater will be the wear resistance. This assumption is only valid when comparing materials that have similar microstructures.

Fig.5, on page 30, illustrates schematically two types of wear-resistant alloys having the same measured hardness but with quite different microstructures. Each grain of the single-phase material has a similar hardness. For the two-phase material very hard particles are imbedded in a softer matrix. A macro-hardness indenter can only measure average hardness. Hence both types of material may have identical measured values of hardness. A common example


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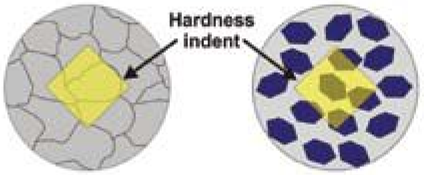
of a two-phase wear-resistant material has tungsten carbide particles imbedded in cobalt. This has a much higher wear-resistance than a single-phase steel of the same measured macro-hardness. Micro-hardness indenters are, however, capable of differentiating the hardness of individual particles.

Material selection based on macro-hardness values alone is not recommended. Attention must also be paid to the type of micro-structure. If, however, two materials have similar micro-structures then it is highly probable that the harder material will be more wear-resistant.



(a) Single-phase (b) Two-phase

Fig.5. Single-phase versus two-phase structures.

Component Design

All components that are in a wear environment must be designed to withstand wear to a specified extent. Commercial considerations are of paramount importance for both supplier and user. A balance has to be obtained between cost and useful life. If, for example, it was possible to design a component that had an infinite life then suppliers would soon go out of business. On the other hand if a component had to be replaced frequently then users would be prepared to pay a premium. A universal example is that of light bulbs. The classic shot peening design problem is that of blast wheels whose performance is adversely affected by substantial wear.

Wear reduction for shot particles and blast wheels are considered in the next two sections of this article.

SHOT PARTICLE WEAR

Shot particles are, of course, central to the process of shot peening. All available types of shot wear away during use but at different rates. They can therefore be classed as an essential consumable. The most obvious effect of wear is a progressive reduction in the average diameter of the shot particles. This is illustrated schematically in fig.6.

Without any correction, wear would eventually cause the average shot diameter to fall below its specification. Correction procedures, which can be on-line or intermittent, include sieving and replenishment. The effect of intermittent correction is illustrated in fig.6.

Shot wear mechanisms are based on oxide layer breakdown and adhesive interaction with components. Oxide layer breakdown also contributes to the accumulation of dust which has to be removed. Adhesive interaction depends primarily on the relative chemical compositions of shot and component. The greater the wear rate for the shot the greater

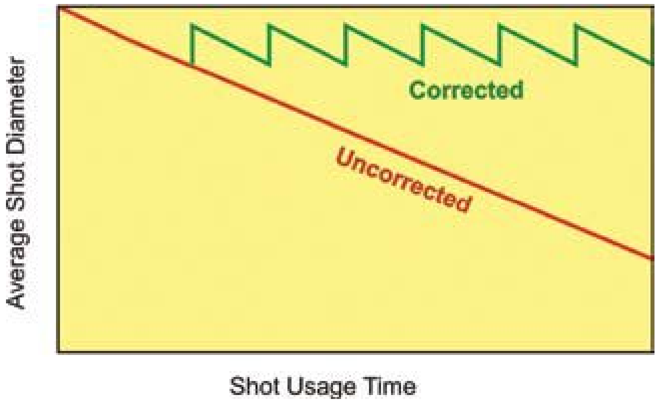


Fig.6. Effects of wear on shot diameter and intermittent correction.

is the frequency of associated corrective treatments. It follows that a low shot wear rate is greatly advantageous.

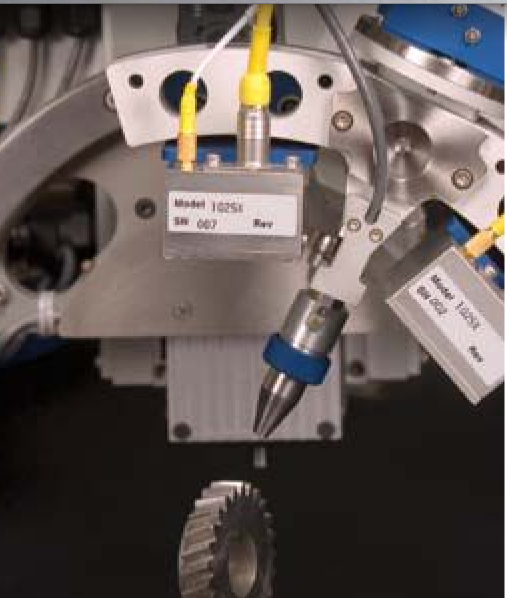
Wear resistance is just one of the several factors that influence shot selection. Several types of carbon steel shot are available including cast, cut wire and carburized. Alloy steels include stainless and high-manganese varieties. High-manganese steels are famous for their wear resistance.

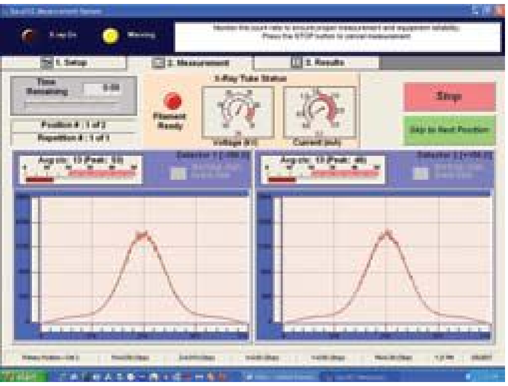
Shot wear can be defined as the gradual reduction of average shot particle mass during use. This reduction of mass corresponds to a progressive reduction in shot particle volume and hence shot particle diameter. There are no standard tests or specifications that relate directly to shot wear.

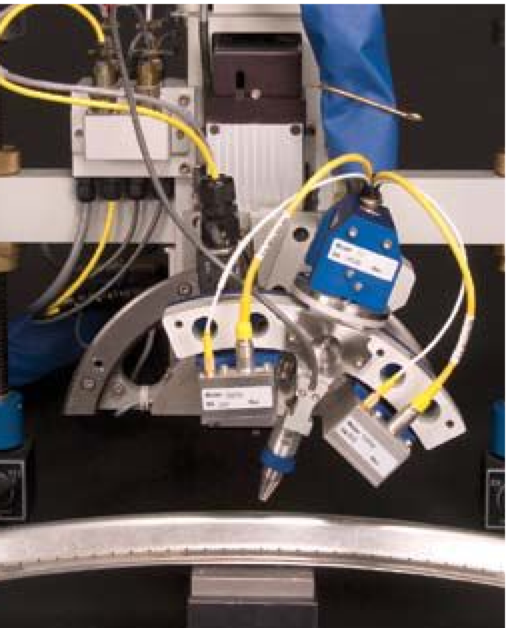
One specification, J445 Metallic Shot and Grit Mechanical Testing, is commonly used in conjunction with an Ervin Tester to estimate the durability of shot samples. It has the considerable advantage of only requiring about 100 g of shot. It does not, however, measure wear rate directly.

J445 includes three different procedures that can be used to assess shot durability. The first of these involves taking a 100 g sample of shot and subjecting it to batches of peening cycles. After each batch of, for example, 500 cycles, the sample is removed and re-weighed with some mass having been ejected through a nominated control screen. Screen-retained sample mass is then plotted against the number of cycles. Cycling is ended when more than 95% of the original 100 g sample has been lost through the control screen. Fig.7 on page 32 shows the corresponding graph (Fig.1 in J445).

The area under the plotted curve, colored green in fig.6, is determined using the prescribed trapezoidal method. This area, 160,500 % cycles for fig.6, is then divided by 100% to give a value of 1605 cycles. A rectangle, ABCD, has been included in fig.7 that has exactly the same area as the trapezoidal area. Division by 100% gives the horizontal side, CB, of the rectangle—1605 cycles for this example. This number of cumulative cycles is designated as the durability parameter in J445—the larger the number the greater the durability.







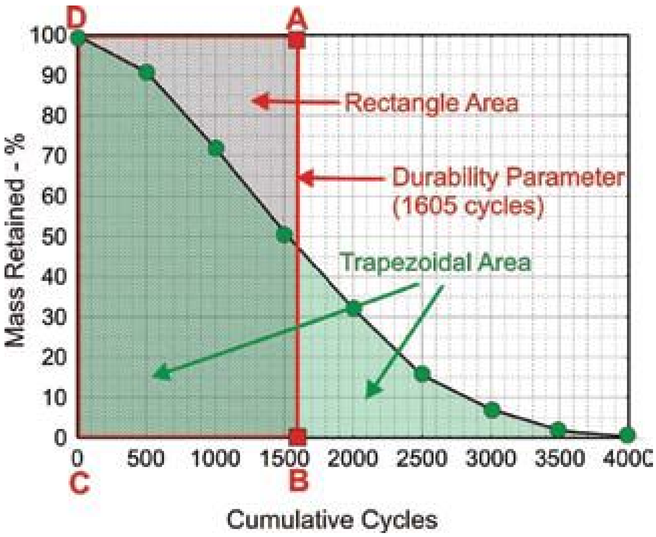


Fig.7. Modified version of J445's fig.1.

The J445 durability test can be modified to give a direct indication of shot wear rate. Fig.8 shows the same SAE data points as are included in fig.6. At a 50% mass loss it can be assumed that the screen-retained sample still has the same number of particles as it had originally. A 50% mass loss corresponds to a loss of only 20% diameter for spherical particles. Assuming that the original average diameter of the S660 particles was 0.066 inch this would therefore have been reduced by 0.0132 inch at 1500 cycles. Dividing diameter reduction by the number of cycles gives us a direct wear rate parameter. For this example the wear rate value is therefore 8.8 x 10^{-6} inch per cycle (224 x 10^{-6} mm per cycle) being 0.0132 inch divided by 1500 cycles.

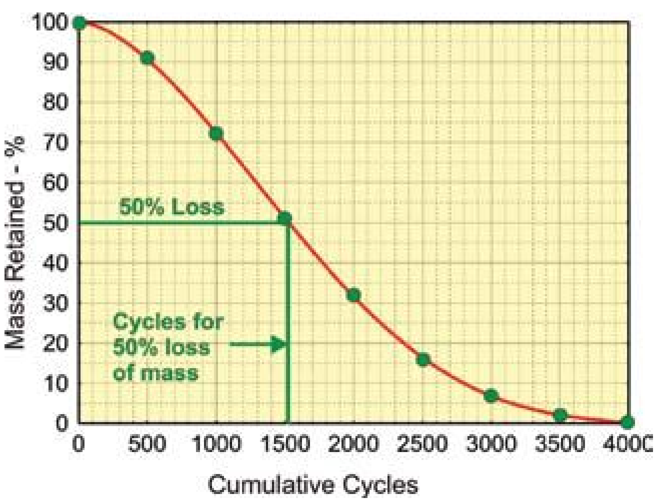


Fig.8. J445's fig.1 data used to estimate cycles for a 50% mass loss.

COMPONENT DESIGN

This section is an exercise in the thought processes that could be involved in reducing wear by modifying component design. It uses the wear-prone blast wheel as an example. Fig.9 shows the components of a conventional type of blast wheel.

With a blast-wheel we have both high pressures and high speeds. Both accelerator and throwing blades normally rotate at the same angular velocity. If, for example, the blade tips sweep a circumference of 1.0 m at 60 r.p.s. then the thrown shot will have a velocity of at least $60ms^{-1}$. If, for the same example, the accelerator has a circumference of ⅓m (radius 53mm) then shot is scouring the control cage at a sliding speed of $20ms^{-1}$. This shot is also being pressed into the accelerator/control cage interface with an acceleration of some 770 times that of gravity! That figure comes from dividing the square of the circumferential velocity by the radius of rotation $[(20ms^{-1})^2/0.053m = 7540m.s^{-2} = 770g$, where $g = 9.8m.s^{-2}]$.

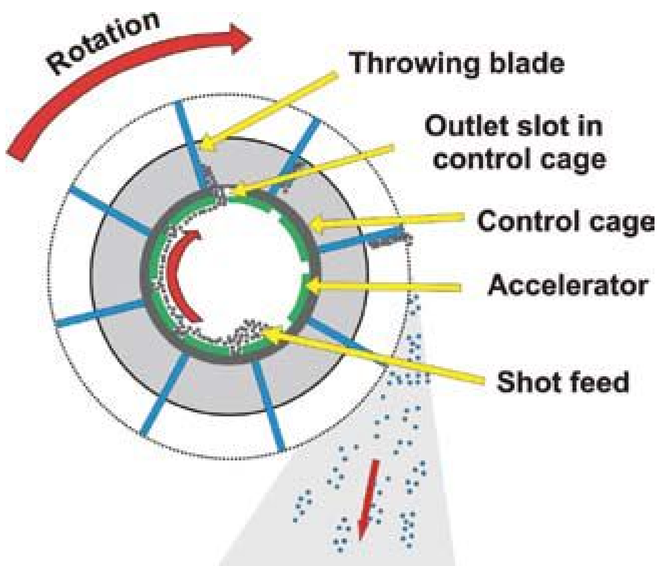


Fig.9. Schematic representation of a typical centrifugal blast wheel.

Two-body wear of a blast wheel will occur when shot particles are moving along the blades—shot as one body and the blade as the second body. Another example is when shot particles strike a component's surface to produce a dent. Three-body wear will occur, for example, when shot particles are trapped between the accelerator and the control cage as in fig.9.

Wear rate increases with both force and sliding speed. One way to reduce the wear rate would be to reduce the diameter of the accelerator—hence reducing both sliding speed and centrifugal force. That approach, however, induces several problems. One is that the throwing blade length must then be a large fraction of the wheel radius. Long blades generate a relatively-large spread angle for the thrown shot stream. Another problem is that exiting the shot through the control cage opening becomes more difficult because the centrifugal force on the shot—pushing it out of the control

cage—is lower and also because the outlet slot has to occupy a greater angular proportion of the control cage. The maximum number of throwing blades that can be accommodated without interfering with the shot stream also decreases with increase in blade length.

Wear reduction might, however, be effected by component design modification. Such a modification would need to reduce the sliding speed without reducing the accelerator diameter. A modification is presented here which could offer substantial advantages in terms of wear reduction, increased shot stream concentration and reduction of component number.

Possible Modification

This modification involves:

(a) Not having a separate, static, control cage. Instead every throwing blade has an outlet slot,

(b) Having one fewer slot in the accelerator than there are blade outlet slots (and hence blades) and

(c) Rotating the accelerator at a specified faster rate than the throwing wheel. This rate synchronizes the accelerator and outlet slots - so that they always coincide at only one point on the circumference.

Fig.10 illustrates the mechanical arrangement for the suggested modification.

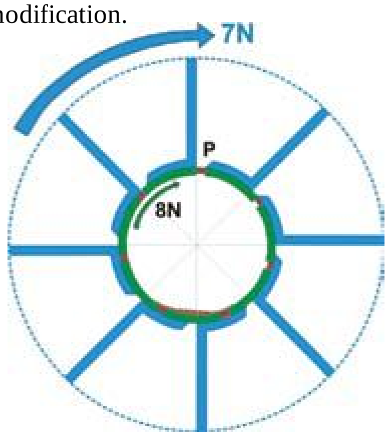


Fig.10. Modified system for eight-bladed wheel.

The accelerator's angular rotation rate has to be faster than that of the throwing blade wheel by the ratio of the number of throwing blades to the number of accelerator slots. In fig.10 there are eight throwing blades and seven accelerator slots. Hence the accelerator rotation rate has to be 8/7 times that of the throwing blade wheel. The reason for the matched, but different, rotation speeds is that an accelerator slot and a blade slot must only coincide at the same, fixed, angular position – such as P in fig.10. Coincidence is achieved when the product of angular rotation speed and number of slots is the same for both accelerator and blade wheel.

There are several advantages that can be attributed to the suggested system. The most important advantage is that the relative surface speeds between the moving parts are greatly reduced for given diameters of accelerator and blade wheel. For example, a relative surface speed of 35 $m.s^{-1}$ for an eight-bladed wheel would be reduced to 5 $m.s^{-1}$. This would lead to reduced shot breakage and wear, together with reduced accelerator cage and blade wheel wear. A second advantage is the number of basic components is reduced from three to two—from accelerator, control cage and blade wheel to simply accelerator and blade wheel. That means that there are now only two major sources of wear and breakage. With the reduced overall wear it is possible to increase the wheel blade and accelerator diameters so as to accommodate a greater number of blades on a given wheel. That, in turn, leads to a more concentrated thrown shot stream.

Mechanics of Control Cage Shot Transfer

Conventional blast wheels have two stages of shot transfer: (i) shot has to emerge from a slot and cross over the static slot and (ii) be collected by a moving blade. With the suggested system, shot transfers directly onto a moving blade. The differences in the respective movements are illustrated in figs.11 and 12 on page 36. Shot transfer from the slot involves a combination of "hammer throwing" and "burst pipe" mechanics. Neither of these is very effective in moving shot at 900 to the tangential direction of the accelerator.

The exit slot for a conventional wheel has to be several times the width of the cage slot. That is to allow time for the surface layers of the shot in the accelerator slot to be transferred to the exit slot. Once in the exit slot the shot is travelling across a "no man's land" until it crosses into the path of the moving blade. The forward face of the exit slot may be sharply angled to bounce shot into the path of the blade. Once shot is collected by the blade it is propelled outwards by centrifugal force until it reaches the blade tip.

With the suggested modification, shot is transferred directly to the root of a moving blade as soon as the accelerator slot starts to coincide with an exit slot. It is important to note that the relative speed of the slots is much less than that for a conventional wheel. For an "8/7" modified wheel, the relative motion is seven times slower than that for a conventional wheel. That means that the exit slot does not need to be much wider than the accelerator slot – there is seven times as much time for exiting of shot per degree of wheel rotation. Shot transfer, being direct to the blade, is much more orderly than that with a conventional wheel.

DISCUSSION

Wear between unlubricated moving parts can never be eliminated. At best it can be reduced by attention to both materials and component design. Numerous studies have

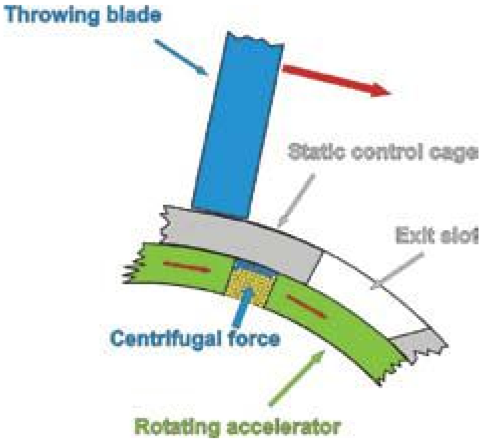


Fig.11. Conventional Exit Slot arrangement.

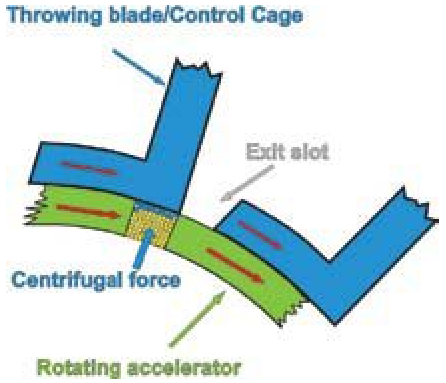


Fig.12. Modified Wheel Exit Slot arrangement.

indicated that there is an almost linear relationship between contact speed and wear rate for a given contact stress and contacting materials. Consideration of changes in any piece of peening equipment is improved by having at least a basic understanding of wear mechanisms.

Quantification of shot wear rate is difficult in the absence of a directly-related specification. Modification of the J445 shot durability specification can, however, yield wear rates directly. Shot selection for optimum wear rate is complicated by the additional factors that have to be considered. Hardness is not the sole factor affecting wear rate. As always, the maxim "caveat emptor" (let the buyer beware) prevails.

The suggested modification of blast wheel design is purely an academic exercise designed to illustrate the types of thought processes and calculations that might be encountered in product re-design. Additional examples of relevant calculations are available from the author on request at Prof.David.Kirk@btinternet.com.

Improvement of wear performance is a constant factor for equipment manufacturers. A balance has to be struck between cost and longevity. Simply buying the cheapest shot, for example, is poor economics. At the other extreme, a manufacturer selling shot that lasted forever would soon go out of business.

Huntsville Company Saves Millions for Taxpayers with Process of Repairing Damaged Helicopter Blades

The shot peening services of Avion Solutions, located in Huntsville, Alabama, were recently featured in a news story by their local television station. The following is the online print version of the television feature.

YOUR AVERAGE BLACK HAWK helicopter costs about $16 million. One rotor blade carries a price tag of $220,000. Obviously, if you can repair a damaged blade rather than replace it, you can save big money. That's where shot peening comes in.

First used on automobiles back in the 1940s to increase the strength of valve springs, it's actually pretty simple. The surface of a metal part is hammered, or impacted, to compress the surface layer. It makes the surface tougher, and less likely to crack.

"It's a little counterintuitive, because you think you're damaging the material by creating dents, but you are creating a stronger surface that's actually resistant to cracks," says Kelly McClurg of Huntsville's Avion Solutions. The company has developed equipment to ultrasonically shot peen damaged rotor cuffs on Black Hawk helicopters. The peening takes place as small beads of material are literally bounced against the parts' surface. What was smooth is made rough, and much tougher.

Glen Soule, a longtime helicopter repairman at Avion Solutions, says the damaged parts would have had a different fate 20 years ago. "We would have replaced the rotor blade and that cost a lot of money," says Soule. Once again, the equipment and process developed by Avion Solutions means quick repairs, and so far some $60 million in savings.

"I mean it's obviously a good news story for our company, but being able to save that kind of money for the Army, and knowing that money goes back into other things to support the war fighter, it's just fantastic," says Avion's Jeff Blackmon.

Once again, shot peening is a technique that essentially hammers the surface of a metal part. The hammered portion is covered with small dents, but those dents make it a tougher surface. Using it on Black Hawk helicopters has saved tens of millions of taxpayer dollars.

Avion makes repairs on rotor blade cuffs at the Meridianville Airport in Madison County. The Army has two of the shot peening machines at the Corpus Christi Army Depot. The company's goal is to eventually deploy the equipment to forward areas, for on-the-spot repair.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Five Ways Nadcap Has Improved Aerospace

SINCE NADCAP was launched in July 1990, it has steadily grown to become the premier cooperative industry program for improving aerospace manufacturing processes around the world. To mark the occasion, the Performance Review Institute* has compiled data that highlights five ways that the program has benefited the industry participants.

1. Nadcap has created a collaborative environment where aerospace OEMs and Suppliers come together to develop consensus process control criteria and requirements.

The number of subscribing OEMs has increased from 1 when the program started in 1990 to 53 in 2015. The number of active accreditations now exceeds 6900 from suppliers located in 50 countries. The program has grown to include active participation from companies in North America, Europe, Asia, South America, Africa, and Australia.

2. Nadcap provides a range of tangible and intangible benefits to OEM subscribers as well as accredited suppliers. Eighty-six percent of over 2,800 respondents to the supplier survey recognize that Nadcap has improved quality in the aerospace industry. Additional identified benefits were improved process efficiency, reduced escapes to customers, reduced defect rate, improved first time yield, increased revenue, and improved customer satisfaction.

OEM subscribers to Nadcap benefit through access to eAuditNet, a global comprehensive database of all supplier audit performance information. In-depth process capability assessments, conducted by subject matter experts selected by industry, enable OEM subscribers to effectively and efficiently manage their supply chain.

3. The Nadcap Program captures multiple subscribers' requirements in a single audit. Nadcap reduces redundancy for all, through the industry working together to create harmonized audit criteria, based on industry and OEM subscriber requirements. Audit criteria are developed in 19 different technologies such as Heat Treating, Non-Destructive Testing, Composites and Surface Enhancement.

4. Nadcap audits improve consistency across industry and across the supply chain.

According to a survey conducted in 2015 by the Nadcap Management Council (NMC), 93% of Nadcap subscribers reported that Nadcap audits improve consistency across industry and across the supply chain.

5. Nadcap augments OEM subscriber resources in overseeing the special process supply chain. In the 2015 NMC survey, 92% of subscribers stated that Nadcap augments their company resources in terms of managing special process suppliers. Feedback included "The data from Nadcap oversight is used readily when determining how often to engage with accredited suppliers" and "Allows us minimize number of on-site visits."

Free Training for Nadcap Meeting Attendees

Nadcap meetings take place three times per year in locations around the world, optimizing opportunity for attendance by the global supply chain. Since 2010, the Performance Review Institute* has offered free training to attendees at Nadcap meetings.

In the past five years, 2,182 aerospace industry professionals have benefited from improving their knowledge via these complimentary training sessions, saving the industry almost $600,000 in training costs. Topics include subjects as varied as Nadcap Audit Preparation, Root Cause Corrective Action and Introduction to Pyrometry, some of which have been taught in different languages.

Joe Pinto, Executive Vice President and Chief Operating Officer of PRI, explains "PRI's goal is to be a global provider of customer-focused solutions designed to improve process and product quality and promote collaboration among stakeholders in industries where safety and quality are shared goals. "Professional development opportunities such as free training at Nadcap meetings is a key part of meeting our organizational objective. I am committed to continuing to listen to our customers and providing training on relevant topics to support continual improvement and knowledge transfer in the aerospace industry."

* The Performance Review Institute (PRI) is the not-for-profit organization that administers Nadcap.

A New Study: "Shot Blasting and Sand Blasting in Sub-Saharan Africa"

Sub-Saharan Africa enjoys the highest growth rate in the world. A group of countries (Nigeria, Gabon, Angola, Ghana, Ivory Coast, Cameroon, and Kenya) are on the same path as Southeast Asia in the 80s. Their growth will unfold even faster, driven by lavish Oil and Gas production and considerable mining operations. Less known are 40 vehicle assembly plants in 10 of these countries, 30+ foundries and forges, a dozen of significant shipyards, gas bottle reconditioning, corrosion protection and structural steel processing.

The 200+ page "Shot Blasting and Sand Blasting in Sub-Saharan Africa Study," prepared by Erwan Henry and published by IRIS International, covers 46 countries (not including the well-chartered Republic or South Africa) and provides contact details of 250+ companies engaged in shot blasting and sand blasting, and of 200+ companies soon to be setting up blasting operations.

The current ASU (Apparent Steel Usage) in this region, however, represents the one of France or Poland! The Shot Blasting and Sand Blasting in Sub Saharan Africa Study is a business development tools for blasting equipment and media suppliers looking for sources of growth.

A 16-page sample of the study is available on request at shotblasting.study@gmail.com.


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Langtry Blast Technologies

Expansion and Relocation Increases Room for Success

THE TEAM at Langtry Blast Technologies Inc. (Langtry) has now completed their relocation and facility expansion. After many interior renovations and changes, they have settled into their new location and continue to be a world leader in the design and manufacturing of custom surface preparation equipment. They continue to experience a large amount of growth in both domestic and international markets and hope that this positive change will trend future growth globally within the industry.

To accommodate this growth, a new, larger and more advanced facility was needed to better meet the increased demands and expanded product lines. Burlington, Ontario remains the company's home city and the new facility is located at 5390 Munro Court; just a few kilometers east of the previous one. This new location keeps Langtry centrally located to many of its customers and suppliers, while maintaining ease of access to all the major highways connecting Langtry to the various parts of the Greater Toronto Area. This allows Langtry to continue to offer quick response times to local service calls. At the same time, by remaining in Burlington, they are also able to maintain level parts pricing.

This expansion more than doubles their manufacturing capability and will allow Langtry to better support their customer's needs and accommodate their growing list of orders for new equipment, parts and service. With more office space and a much larger production area, Langtry has a vision to continue to expand its customer service, engineering, electrical and application capabilities. By expanding these departments, they will be able to provide the quality service and solutions that their customers have come to expect from them.

The new facility is equipped with multiple shipping doors, an overhead crane and multiple service outlets. These new features increase Langtry's ability to work on larger equipment with ease while refining manufacturing processes. Each department is larger and has more room to perform the tasks required to produce quality equipment and offer high quality services. This increase in space opens the doors for new opportunities, refinement of operations and better quality control.

"I look forward to seeing how expanding our facilities here in Burlington will enable and enhance our business opportunities", commented Michael Langtry, President and Owner. "Working in our previous location became quite a challenge in regards to space. In the past three years, we have seen a significant growth in sales, due in part to our partnerships with Shockform Aeronautique in the Montreal area and our Asian sales team overseas. These partnerships have opened new markets for our equipment around the world, and we acknowledge the growth that these partnerships bring. We have worked hard to exceed our customer's expectations and have continued to develop our products, solutions and services. We grew out of our space in our previous manufacturing facility which made it challenging to keep up with customer and industry demands. To accommodate this growth, we needed to expand to a larger facility to continue offering world-wide service and support to all of our customers. After looking at many locations ranging throughout the Niagara area, this location offered the best of everything that we needed. Burlington remains the best location for Langtry as it is central to many industrial business areas including Toronto, Mississauga, Oakville, Hamilton and the Niagara Region."

Langtry Blast Technologies Inc. will be able to better accommodate its growing list of customers and all of their needs. This expansion will also allow Langtry to expand its services to ensure Langtry stays current and cutting edge with the extensive range of services it offers to both new and existing customers.

Langtry designs and manufactures custom equipment for a host of different industries and applications including;

- Shot Peening
- Blast Cleaning
- Double Peening
- Blast/Paint Rooms
- Roughness
- Surface Preparation
- Dust Collectors
- Deburring
- Etching
- Peen Forming
- Etching

Langtry offers a 24/7 maintenance and service department to support customers on multiple shifts whenever they need support the most. The preventative maintenance

programs are custom designed to each customer's specific needs, ensuring that essential components of the equipment are inspected and monitored on a regular basis. Service and support is offered worldwide both on equipment that has been manufactured by Langtry Blast Technologies Inc. and also on other brands of equipment. Calibration services are offered to ensure their customer's equipment is functioning within the required specifications and documentation is supplied for both auditing and tracking purposes, ensuring seamless support for their customers own specific reporting purposes.

The parts department has always been a principal department for the business. With the new larger facility and increase in warehouse space, Langtry has been working towards being able to stock a larger selection of after-market parts. This increased inventory will allow them a decrease in the turn-around time on parts orders and ensure their customer's needs are met in an expedited manner. ISO 9001 procedures ensure that third party products are competitively priced and that manufactured and assembled parts pass rigorous quality assurance standards.

With 25 years of experience in quality design, manufacturing and maintenance programs, Langtry Blast Technologies meet standards such as ISO 9001:2008, CWB (W47.1-09 & W59-03), AMS2430, AMS2432 and Controlled Goods of Canada.

The team at Langtry Blast Technologies Inc. has embraced the opportunities and positive effect this exciting relocation has provided to the them. "The relocation has been a time for the Langtry team to stand back and acknowledge their success and commitment of a very cohesive, highly organized group of individuals who bring a magnitude of expertise, new ideas and energy to this growing organization every day", stated Michael Langtry, President.

Langtry Blast Technologies Inc. is proud of its new expanded facility and looks forward to serving even more customers with its high quality equipment, services and attention to detail.

Pangborn Group Announces New Partnership

The Pangborn Group, a global leader in surface preparation solutions, is pleased to announce new ownership by United Generations, LLC (UG). Led by owner Doug Basler and headquartered in Waukegan, Illinoise USA, UG is a well-established, family-owned group of companies specializing in engineering, manufacturing and after sales parts and service support. Doug Basler, Chairman of UG LLC, says: "We believe that bringing the Pangborn Group into the United Generations family is the next step in continuing to build upon the success which Pangborn Group is recognized for in the marketplace. We are enthusiastic to offer blast solution equipment, replacement parts and exceptional service for the long term needs of our customers."

"This is a major milestone in the continued development of Pangborn Group as a world leader in surface preparation equipment", says Joe Camerata, the newly promoted CEO of Pangborn Group and member of the Pangborn Executive Leadership Team since joining the group in 2007.

The Pangborn Group will continue operating from its headquarters in Fairburn, GA (Atlanta metro area) and at our other locations in Germany, the UK, Italy and China.

New Product from Airblast AFC

Airblast AFC is proud to introduce the AbVac Grit Recovery Unit, a portable abrasive recovery unit capable of removing anything from dust up to 2" debris. Available with a wide range of flexible hoses, tools and extensions this powerful suction unit allows operators to recover spilled abrasive quickly and efficiently without the back-break of manual recovery. This helps to improve health and safety and reduce labor costs.

The recovered abrasive is automatically collected into a Big Bag ready for disposal. Alternatively, the unit can be combined with an abrasive storage hopper to allow recovered abrasive to be fed back into the blast machine and reused. Silos are available in several sizes to feed up to four blast machines.

The AbVac unit offers a range of features including automatic Big Bag filling, 25 & 40 HP power alternatives, a filter system for dry or moist material, automatic ATM filter cleaning system without compressed air, complete start-stop control system and various options of safety filters.

The AbVac is specifically designed to offer maximum transportability with its compact design, retractable legs and forklift sleeves that allow it to be picked up and moved easily. This makes the unit ideal for mobile use as well as fixed installations as it is able to access most areas where cleaning needs to be carried out, increasing media recovery rates usually limited by long runs of hose.

For more information, please contact Airblast AFC at (800) 331-7744 or visit www.airblastafc.com.


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