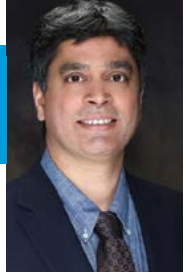

AN INSIDER'S PERSPECTIVE
Kumar Balan | Blast Cleaning and Shot Peening Specialist

Tribal Knowledge in the Blast Industry Part Five

KEEPING THE MOMENTUM

Producing discussion topics for *The Shot Peener* is no easy task. Physics does not change often, and our industry seldom experiences dramatic breakthroughs! Our cognizant readers and users of cleaning and peening equipment demand that the subject hold universal interest, be globally appealing, and enhance their knowledge banks. To reach the newcomers in our industry, this quote from Albert Einstein, "If you can't explain it simply, you don't understand it well enough," acts as a constant reminder and judge of the author's cognizance and writing abilities! Fortunately, for me, I have always found inspiration from the people I have worked with, currently and in the past. Among those have been industry peers; diverse groups such as Primes, MROs, different tiers in automotive; and service providers (also known as job shops or metal laundries by some).

Part Five of "Tribal Knowledge" is a result of my recent discussions and discoveries at service provider facilities in Canada and the United States. At one end of the spectrum, these shops could be manually cleaning steel fabrications, preparing them for a downstream coating. On the other end of the sophistication scale, a peening job shop could be peening complex aircraft engine parts and other mission critical components. Silently working away, these industry partners are unsung heroes that experience a rich variety of applications and cater to multiple specifications and special user requirements.

MACHINE VERSATILITY

My journey starts at VibraFinish in Mississauga, Ontario. Brian McGillivray, the President of VibraFinish, is an active proponent of Vibratory Peening, a technology that has been highlighted and discussed in the past issues of *The Shot Peener*. VibraFinish caters to its automotive clientele in Ontario, Canada and the US with blast cleaning and shot peening services. I met with Clive Graham, their Plant Manager, who brought great clarity to the use of certain equipment types for parts that have conventionally been understood as needing to be cleaned or peened in a machine with a different type of handling system. Clive explained, "A job shop environment faces demands from multiple customers with different part types. As a service provider, we expected to process any part type presented to them with minor adjustments to tooling. An inline versus batch-type spinner arrangement is the most common example. These two machines are generally interchangeable." I will summarize my learnings from Clive as below:

- Parts in the neighborhood of 3' to 5' in length (such as torsion bars) are shot peened in a spinner hanger-type machine where they are held in a birdcage-type fixture within a work envelope that can be physically located inside the blast cabinet. "Though an ideal situation dictates that individual parts be peened by spinning about their own axis, allowing sufficient gaps in between the parts in this birdcage will ensure media penetration/reach and coverage to the inside of the spinning birdcage fixture when it is away from the blast wheel." This was Clive's response to my concern about variable distance of the part from the blast wheel as the fixture spins in the blast stream.
- As we have discussed several times in our previous articles, the capabilities of airblast and wheelblast are distinctly different with the latter commonly used in high-production environments. Clive works with wheel as well as air-type machines. He confirmed that distance has a relatively greater impact on peening results with air-type machines as compared to wheels. "We have seen that intensity varies very slightly between a 12" to 60" stand-off distance with at least two 15" diameter blast wheels. The resultant blast patterns and control cage settings help achieve uniform arc height

A birdcage-style fixture with multiple long parts fixtured to peen simultaneously

values along the entire part length. We use this style of fixturing in several spinner hanger machines to process long parts."

- Clive added, "We are not strangers to complicated parts that get sent to us for processing. For such parts, we adopt two tricks of the trade: (a) split the cycle by spinning the fixture clockwise and then counter-clockwise and, if available, (b) use the three-position indexer arrangement that automatically re-positions the fixture in three positions within the blast stream, spinning it in all three positions. A combination of all these techniques allows sufficient peening coverage on all types of part geometries."

I too have experience with projects that substituted inline machines with spinner hangers for specific applications. I have to point out to our readers that this is only prevalent in the wheelblast world. There are distinct advantages with each type of work handling, and I will elaborate on those in the table in the next column.

PRE- AND POST-PROCESSING

Peening Technologies is a shot peening service provider with two plants in East Hartford, Connecticut and a third in Austell, Georgia. During a recent visit to their Connecticut facility, Walter Beach, their Vice President, educated me on their experience with pre-cleaning aerospace parts. Walter Beach is also an active member of the SAE and AMEC committees for Surface Enhancement. "Though our focus is steadfast in conforming our peening process to AMS 2430, 2432 or any other OEM specification, we also carefully consider pre- and post-processing of such parts. AMS 2430 (3.4.3.2), for instance, requires parts to be visually clean prior to peening. It states that if clean parts are not supplied to the processor, either a cleaning method should be specified, or the processor should use a method that is acceptable to the OEM. Some insights into pre-cleaning:

- Adopt a standardized cleaning process with the clear understanding that this may not satisfy the requirement for all parts. This will help standardize the pre-cleaning process. Cleaning should be performed based on the contaminant. Examples include alkaline method (soap solution), isopropyl alcohol, acetone, mineral spirits, or an aqueous-based cleaning solution. A well-documented procedure will provide the framework when a new procedure requiring the use of other chemicals needs to be drafted, and for an audit.
- Nitric acid is often used for post-peen cleaning for Titanium and Aluminum parts, particularly when working with airframes, to remove ferrous contamination. Ensure that the temperature of the acid is specified in your customer's documentation.

Inline Machine	Spinner Hanger
• Commonly a wire mesh belt, rubber belt, roller conveyor or hanger hooks, with the first two being endless versions. • Takes up greater floor space than batch-type spinners. • Parts are placed on the belt, typically conveyed without the need for fixturing. Hangers may require fixturing. • Parts placed on a mesh belt acquire the shadow generated by the belt strands. Blasting between parallel rollers in a roller conveyor can mitigate this. • Though wheels are located on both sides (or top and bottom) of the cabinet, a symmetric set of wheels (typically lower set) can be disabled for parts requiring a single side blast. • Blast pattern generated by four or eight wheels (symmetric pattern of wheel layout) offer compound angles of impact that help with coverage.	• Batch-type spinners provide excellent coverage in a smaller footprint. • Multiple parts can be processed simultaneously and benefit from ricochet blasting in addition to direct impact. • Spinner hangers require special fixtures for parts. Such fixtures could also be loaded/unloaded offline during the blast cycle (in a Y-track style arrangement). • Exposure for certain part styles can be enhanced by several techniques of part presentation discussed above, and also by increasing the exposure time in the blast. • Floor space requirement is a fraction of that required for pass-through machines. • Batch-type spinners minimize the amount of media leakage as compared to pass-through designs that require longer vestibules, curtains, etc., to contain the airborne media particles.

- Enquire with your customer on the concentration of acid, cleaning time, temperature and all such critical parameters before embarking on a project.
- During post-processing of parts, it is important to know whether the protection needs to be long or short term. In other words, knowing the destination of the part after peening will help you determine the type of oil coating to be applied on the part.

RE-CALIBRATION OF MAGNAVALVES

Peening Technologies uses cast steel shot as well as cut wire shot as required by their customer specifications. Walter explains the need for re-calibration, "If you are faced with a need to change media suppliers, whether it be between cast shot or cut wire shot suppliers or within each type, it is imperative that you re-calibrate your MagnaValves as part of the change. Even though both media samples might conform to the same AMS requirement, the chemistry and hardness could be ever so different within the allowable range, eliciting a different response from the valve."

On a similar note, I recall a past experience with a customer in Aerospace that could not repeat results within

the required range tolerance after switching media suppliers. They then had to re-plot saturation curves with slightly different process parameters to achieve their target.

INFORMATION FROM CUSTOMER (OR LACK THEREOF)

When contrasting blast cleaning with shot peening during a class that I was instructing at the recent shot peening workshop, I inferred a distinct likeness for peening. My reasoning is that peening has tangible goals, and defined results. On the other hand, the results of blast cleaning are generally subjective. Excessive cleaning creates a dent on the operating cost, and not as damaging as excess shot peening. Please note that the final result in shot peening still depends on the quality of information provided to the shot peener. Not all peening customers are as sophisticated and meticulous as those in Aerospace. This sometimes creates gaps in information that impacts the service provider. Walter Beach lists a few of these gaps with suggestions to fill them.

Intensity verification locations: Walter explains, "A common phrase one hears in this industry is 'it's in the specification.' "I have often explained that the specification is a process document—it is not drafted to discuss your specific part, the tensile stresses involved, and identify potential points of failure. One can expect such information in the drawing, with which we can design a PVT (Part Verification Tool) to mimic the actual part and install Almen blocks with strips to verify arc height in required areas. Without this information, you are literally shooting in the dark." Easier said than done as not all drawings contain this information. Walter suggests that, in such situations, the service provider should draw up the part, and identify areas based on past experience where blocks should be installed. This drawing should then be verified and approved by the end-user before proceeding with fabrication of the PVT and subsequent peening of actual parts. Walter's term for this is "Opinion Based Quality Control"!

During his session on "Best Practices for Shot Peen Process Development," at the recent EI Shot Peening Training Workshop, Walter Beach had several valuable insights that I will list here with relevant explanations:

1. When receiving a Purchase Order (PO) for peening services, ensure that the PO is for your organization, and that the PO reflects the revision level of the engineering drawing. Any mismatch will lead to non-conformance and other complications in the field.
2. When reviewing the engineering drawing, does it state all the required peening process data such as intensity (absolute number or range), coverage percentage, and shot size? This is the bare minimum. Other data that will be useful to have include shot hardness, areas requiring peening, and those that are optional and/or prohibited.
3. Almen strip tolerance (use the correct tolerance range) and whether pre-bow compensation is required (to be recorded) or not permitted.
4. SAE ARP 7488 – review and have a copy of this document. Though not a specification, it has useful data that will help with developing your peening practice.
5. Select a vendor for Almen strips and stay with them. A mixture of strips from different vendors will lead to non-repeatable results. If you base your purchasing decisions for peening supplies on cost alone, it will cost more later!
6. It is important to know the procedure to plot a saturation curve and to interpret it. However, during production runs, make use of a Curve Solver software program.
7. When operating multiple machines and processes, document data on the intensity achievable with combinations of nozzle size, standoff distance, impingement angle, air pressure, media flow rate and media types. This data will be valuable for future projects.
8. When inspecting peened parts, check for coverage and appearance including possible rolled edges. Inspecting inside cavities can be challenging. FOD (foreign object damage) is inspected using mirrors or a borescope. A pin gage (0.025" diameter Flat nose) can be slid down the barrel of the hole to check for rolled edges, with proper care to not score the wall.

SUMMARY

The feedback from readers on our "Tribal Knowledge" series has been very encouraging. However, information to create individual discussions comes in metered doses! As we continue along this path, it is apparent that there is a thirst and need for this type of previously undocumented information. Our goal should be to collect, preserve and when possible, grow this abundance of knowledge that is currently spread out among a wide human database.

Blast cleaning applications are greater in number than shot peening. Also, the process tends to be more forgiving than peening. Therefore, the tribal knowledge available for cleaning applications surpass that in shot peening. The good news is that the working concepts of the machines remain similar and interchangeable. Most of my respondents for this series have been veterans in the blast cleaning industry.

With the introduction of Walter Beach, a current user of shot peening equipment in this series, it is heartening to note that information is being shared to benefit the broader sector of peening equipment users. I look forward to more feedback from you, the user of this process and equipment, so that together we can learn, thrive, and grow this industry.