



## AN INSIDER'S PERSPECTIVE

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# Are We Partial to Airblast Peening?

**THE OBVIOUSITY OF THIS QUESTION IS STRIKING.** For those of you who wish to check the existence of this unique word, "obviousity," do not bother, I admit that it is a non-standard word, much like the sources of most useful data in our industry! My introduction to this word was through my good friend, colleague, and guide to the nuances of wheelblast machines, Ron Barrier. Ron used to manage the demo facility at Wheelabrator in LaGrange, GA, where I first met him. 'Interesting' would be an understatement to describe every interaction I have had with him; he was a wealth of knowledge seldom found in published literature. Ron was once deputed to investigate a 'browning' issue faced by a large aerospace prime when peening their aluminum structural members. Ron called me from the site and said, "I inspected everything in the machine and could not find a \*\*\*n thing wrong with it. I then quizzed the operator on the time duration of this issue when the obviousity struck me like a lightning bolt". The customer had mothballed the process for several months but failed to empty the shot from the machine. The shot had rusted and started discoloring the parts upon impact. The simple act of descaling the shot by running the machine without parts took care of the problem. What obviousity!

Among other things, Ron had practical demonstrations on double-knee saturation (a classic media contamination issue where the process ends up with two saturation points/intensities, one for each size of shot). Ron worked with demo machines all day and had to constantly switch between shot sizes. Ron's demo lab had a large machine appropriately named 'Big Bertha' that could simulate about twenty different machines by varying process parameters and part handling. It was in this machine that Ron had conducted his famous ladder test to demonstrate the loss of velocity (and intensity) at increasing stand-off distances. Wheelabrator Engineering used this data when positioning blast wheels in complicated shot peening and blast cleaning machines.

As I was getting ready for another day of training at the recent shot peening workshop (Oct 27-29, 2025), I learnt that Ron had passed away on Oct 26th. Ron was one of those unsung

heroes in our industry, and I owe my blast machine education to this unconventional yet well-informed repository of knowledge. Ron's informal contributions to this industry continue to be valuable. You will be missed by many, my friend!

### AN INDUSTRY-DRIVEN COMPARISON

I was explaining to the students in one of my recent classes that the power ratio between wheel and airblast is 1:24. Consider a 3/8" nozzle flowing about 20 lbs per minute at 80 PSI. A single 20/25 HP blast wheel could easily flow 500 lbs per minute (x25 of the nozzle) of the same blast media. Therefore, there is a compelling argument to use a wheel unless your application requires peening with glass bead (referred to as 'foo-foo dust' by Ron B.) or similar media with low bulk density. Is the substitution that simple? Unfortunately, not. Several equipment manufacturers have attempted to design blast wheels that can efficiently propel non-metallic media but were met with limited practical success. Media breakdown, lodging between rotating members fitted with close clearance, and lack of sufficient mass to create an impact are some of the concerns. Others have attempted to assist propulsion with the infusion of compressed air, but the practice was not widely accepted. I took the opportunity to audit the progress in our industry in both machine types, with specific reference to shot peening applications within a time reference of the last three decades.

Wheelblast	Airblast
Direct drives (some with inverters)	Unlimited articulation (with robots)
Materials with increased wear-resistance	Active velocity measurement (closed loop)
Ease of maintenance	Integration with handling equipment such as tables, conveyors
Limited wheel articulation (wheel/mounting panel)	Visual monitoring of the process (cameras and sensors in the blast zone)

Unlike airblast machines, wheelblast will rely on the cleaning market to direct it to the next stage in evolution. For our discussions, I will include those wheel peening machines used in the automotive industry for suspension, transmission, and power train components. Though I am certain that this industry sector is equally interested in repeatable and accurate peening results, their primary goal remains increased throughput. Therefore, unless any of the above attributes listed under 'airblast' leads to increased throughput, it is difficult for an equipment manufacturer to focus research efforts in that direction. To top that are the financial pressures that automotive OEMs and tiers constantly battle with. As a result, though opportunities exist to embrace some of the emerging technologies of airblast peening machines, wheelblast technology continues grow at a slower pace. Afterall, transmission failure in an automobile does not share the same criticality as fatigue fracture in an aircraft engine blade.

### CONVERTING FROM WHEELBLAST

I recently learnt that a large landing gear OEM has made it mandatory to switch all its wheelblast peening equipment to airblast for this application. Supported by reasoning that I am not privy to, combined by the convincing ability of some of my industry colleagues, this switch could be influenced by several factors such as (a) perception of wasted blast pattern (most of these machines are fitted with 6-8 wheels, each powered by 20 HP motors), (b) the need for better control of the pattern in defined areas on the gear, (c) physical size of the machines (wheelblast machines of this kind are generally installed in a deep pit, combined with significant elevation above floor level – about 24'), and possibly (d) the relatively greater sophistication of airblast machines over wheelblast.

A non-aerospace application where I notice an increasing popularity of airblast is peening transmission components such as pinions and ring gears. This switch could be due to the need for higher velocity (and intensity) for newer styles of gears. Older wheelblast machines, peening with 14" diameter (assumption) wheels turning at 3600 RPM generated a velocity of 280 feet per second, whereas a 3/8" diameter nozzle at 90 PSI could generate a velocity that is much higher. If your temptation is to select a wheel size and speed to generate an equal velocity as the nozzle, you will also end up propelling x20 or greater quantity of shot, all of which will be at the high velocity. Needless to mention, this extra amount of shot might 'flood' the gear tooth or impact areas of the blast cabinet that hardly need peening! Flooding will create coverage issues in the critical root areas of the gear and impacting the cabinet will accelerate wear in an already high-velocity impact process.

Some non-aerospace applications that continue to be addressed by wheelblast machines are: shot peening of railway wheels to high intensity values, upwards of 0.010C, shot peening of leaf and coil springs in an inline arrangement with multiple, cabinet roof-mounted blast wheels, auto connecting rods, where the entire rod is to be peened instead of just the neck region, and OD areas of large mining bits (ID and small bits are peened in airblast machines).

### THE CASE FOR HYBRID MACHINES

The advantages of high media flow, along with the surgical targeting of blast nozzles can be achieved with a hybrid machine. It is worth mentioning that the cost of those expensive electrical components is shared between the two systems. Though a bit more elaborate, such a machine shares other machine features such as the blast cabinet, reclaim system and dust collector. Finally, the need for certifying two machines is eliminated. A single audit and certification take care of that challenging activity. I can see hybrid machines offering a suitable peening solution for complex parts such as aircraft structures. Fixed blast wheels located in a symmetric pattern within a blast cabinet could provide uniform blast from both sides of the part while pre-determined areas with difficult features and geometry could be processed downstream using a robot or nozzle carriage mounted blast nozzle(s).

### APPLICATION-BASED DECISIONS

Practically, all peening solutions are applications-based. The obvious ones are those that require the use of non-metallic media (airblast only), peening inside holes, slots and tight areas (airblast), low intensity values (airblast, possibly suction/syphon). The ones that could be processed with wheels or nozzles were listed and discussed earlier. Other aspects of a project that sometimes influence choice of media propulsion (when either will work) include commonality among existing machines in the plant, availability of power and/or compressed air, space, skilled workforce, end-user preference, and fixture design to list a few.

Though wheelblast machines are common for cleaning applications, apart from sophisticated users, many shot peeners are unfamiliar with the process. For such users, the list below should help with comparable process parameters:

Parameter	Wheelblast	Airblast
Velocity	Wheel speed and diameter	Air pressure
Flow rate	Motor HP	Nozzle size
Coverage control	Masking	Masking and nozzle articulation
Size classification	Continuous sampling through classifier	100% Classifier
Removal of non-rounds	Spiral separator (sample)	Spiral separator (sample)
Calibration – velocity	VFDs or inverters for blast wheel	PID loop for air pressure
Calibration – exposure	Wheels are fixed	Nozzle movement can be calibrated for speed and position
Accuracy and repeatability	Requires regular monitoring of wear of wheel parts and replacement	Nozzle blast patterns are smaller with anomaly easily noticed on the part

## CONCLUSION

Industries that manufacture mission-critical components are aware of the risks associated with not monitoring a process. Changing a well-established airblast technique with a wheelblast or other non-conventional peening tools needs to be accompanied by solid justification of the benefits. Except for a few aerospace applications, production rate is seldom discussed in terms of hundreds of parts per hour. This industry is obviously partial to airblast for their peening needs. Wheelblast machines are not as prolific in the medical implant industry either. They would certainly be well-advised to mimic aerospace practices and apply the technological breakthroughs achieved for their own unique applications.

So, where does this leave wheelblast machines? How would a company that focuses on wheelblast machines as their portfolio make their mark and dedicate their R&D investment dollars?

- Material technology – wheelblast machines are known to be louder (than airblast). Though mitigated by larger (and longer) cabinets, more work can be done in better materials to muffle the noise including the base metal and sound insulation techniques. Additionally, given the volume of media flow, better sealing techniques

will mitigate some of the stigma attached to using such machines.

- Maintenance – High rate of media flow = increased wear and maintenance needs. Focus on common maintenance aspects such as conveyor bearings, buckets in the elevator, access to upper reclaim parts such as rotary screens, airwash separators and simple implements such as media sample collecting stations at accessible elevations.
- Maintenance predictability (this seems to be the single largest attribute that AI could bring to our industry) – with the volume of parts in a wheelblast machine that require maintenance, controls could be geared to get us closer to the goal of a machine that defines its own maintenance protocols predicted well in advance.
- Active shot velocity measurement tools – such as the ones available with airblast machines (nozzle sensors and others)
- Less maintenance prone and cost-effective means of articulating blast wheels

The wish-list could be endless with the appreciation that not all of them could have commercial appeal or reasonable returns. I realize that this list needs to be qualified and validated through the lens of commercial viability. However, when you consider the volume of automotive parts that are processed in wheelblast peening machines, wheelblast machines could be made as appealing as their airblast counterparts! ●

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