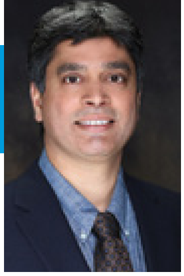

## AN INSIDER'S PERSPECTIVE

*Kumar Balan | Blast Cleaning and Shot Peening Specialist*

# Tribal Knowledge in the Blast Industry

**Part One of Two Parts**

### INTRODUCTION

The online Business Dictionary defines Tribal Knowledge as "A set of unwritten rules or information known by a group of individuals within an organization, but not common to others, that often contributes significantly to overall quality." Sound familiar? How often have you remarked, "it makes no sense, it defies all laws of physics, but it seems to work?!" That was one of the effects of tribal knowledge being applied. I distinctly remember my introduction to this phenomenon about three decades ago during my first job as a Trainee Engineer at Wheelabrator in India. Within the first few hours of staring blankly at a drawing board (yes, machines were designed even before ACAD and Inventor), I realized that there was more I had to learn from experienced draftsmen than accumulated through four years of university education!

The journey since then has been remarkably interesting. I have had the fortune of working with some of the best designers, sales and applications professionals in the blast industry, all of whom are difficult to come by now. These fine folks gave me the opportunity to learn what I know today. More importantly, this type of information could never have been found in any relevant technical publication, other than possibly company-specific engineering handbooks. Though I doubt that ours is the only industry with this unique feature, I suspect and hope the lack of replenishment is not as endemic in others. Retirements, retrenchment, and unfortunate demises too have affected this knowledge bank in our industry. It is also not reasonable to expect new talent to come up to speed and catch up on a technical level, assuming this talent chooses to show interest and sustenance in the product and process.

I can hardly expect to capture this tribal knowledge within the word count restrictions of this article, but I do hope to give you a flavor of what is involved. In this journey, I spoke to four of my colleagues, all of whom are retired from the industry, to gather information for this article. Interestingly, I found their eager responses to not just fill the gap about tribal knowledge, but also to provide insights into the origin of some established practices in the industry. The first and foremost topic that came up in all four discussions was pertaining to media velocity. Let us start with that.

**240 Feet Per second**

Jay Benito and I worked together at Pangborn and Wheelabrator, from where he retired almost a decade ago. During one of my customer visits with Jay, he was effortlessly bombarding wheel velocity values at the customer while dazzling him and puzzling me with the delivery! Jay explained, "Velocity keeps our spare parts and shot business going." He taught me an easy-to-remember approximation to calculate velocity in feet per second as diameter of wheel in inches x speed in rpm/180. His favorite calculation phrase involved an 18" diameter wheel that when spinning at 3000 RPM will generate a velocity of 300 feet per second, to which he added, "This is about 60 feet per second more than anyone ever needs!"

Bill Rhodaberger retired from Ervin Industries as their VP Sales & Marketing. With Bill's assistance, I first experienced the fascinating science and technology that underlines shot manufacture. He invited me to Ervin's shot plant in Adrian, Michigan where I witnessed their 40T furnace pouring molten metal and multiple nozzles spraying cold water to atomize the metal into shot particles. Bill said, "Good quality shot is like fuel for your car—the best of blast machines will suffer in performance with bad shot." To emphasize the importance of velocity in the process, Bill took me to the Ervin labs in Adrian and Tecumseh, Michigan to demonstrate the Ervin Test Machine—an industry standard in testing media durability. This machine propels shot in a controlled atmosphere with the flexibility of varying shot velocity to study durability under such conditions. He explained that velocity had a direct bearing on media durability, and exacerbated if media chemistry and physical characteristics fail to meet SAE J827 requirements.

*So, what is the magic behind 240 feet per second?*

Bill Raby and I also worked together at Pangborn and Wheelabrator. A well-respected authority in foundry applications, Bill spent over 40 years in the industry prior to his retirement last year. He noted, "The one big difference in the industry now versus when I started is the blast velocity. Standard blast wheels had V-belt drives, and in North America, most blast wheel motors were 1800 rpm. Wheel diameters were 18", 19.5" or 21" and the required velocity was achieved by selecting the proper sheave diameters for motor shaft and blast wheel spindle assembly (unit bearing). For example, a 19.5" diameter wheel would have a sheave ratio that raised the speed from 1800 rpm at the motor to about

2250 rpm at the blast wheel. Operating a 19.5" wheel at 2250 rpm produced a shot velocity of about 240 fps which was satisfactory for most scale and sand removal requirements."

It seems like things simply fell into place with this magic value of 240. Availability of wheel diameter, sheaves and motor ratings all played a role in arriving at this velocity figure. To top that, the suitability of this velocity for most applications made it the standard. Who can argue with that? We can, we will, and we did!

Ron Barrier and I worked together at Wheelabrator until his retirement a few years ago. In Ron's role as the Demonstration Manager, he has helped customers over multiple decades by simulating their processes with test machines in LaGrange, Georgia. Ron used to live and breathe blast machines and was known to regularly set off metal detectors at Atlanta's Hartsfield International Airport due to the presence of fugitive shot in his hair when he took a plane right after a customer demo! "Everything since 1974 has been about shot velocity and blast wheels—240 to 250 feet per second was good for everyone, until someone decided that high-speed wheels were needed to address demands of high production," he said.

Let us pause for a second here to evaluate Ron's statement. Does high velocity necessarily translate to increased (faster) production? Like Ron, most of us will beg to differ. Though increased ***shot flow*** will lead to higher production rates, even that is not always true, particularly when working with parts that have intricate geometries, holes, cavities, etc. There are applications that benefit from high velocities, but those are exceptions.

Ron continues, "High shot velocities bring with them the issue of shot breakage, dust and fines generation. There is always a price to pay, and the net worth of high velocity and production over machine maintenance and operating costs is debatable. If you like to drive a Corvette, don't complain about the operating cost!"

**The History for High Velocity**

Providing more insight into this, Bill Raby adds, "For more difficult cleaning requirements, increasing the sheave ratio produced higher wheel speed and greater media velocity. Operating a 19.5" blast wheel at 2700 rpm yielded media velocity close to 290 fps. Similar sheave ratio selection for media velocity was applied to lower HP, smaller diameter blast wheels used on smaller tumble blasts, rotary table machines and spinner hangers. These 13", 14" and 15" diameter wheels had 3600 rpm motors and sheaves sized for operating at 2700 to 3500 rpm for roughly the same 240 to 290 fps blast media velocity range as the larger diameter, higher HP wheels."

Tumblasts continue to be one of the most popular machines, closely followed by rotary tables and spinner hangers. All three machine types are commonly seen in peening applications just as for cleaning castings in foundries. Some of the largest landing gear in the industry are shot peened in spinner hanger type machines and on tables prior to hangers gaining popularity. In addition to cleaning tenacious contaminants in foundries, velocity is essential to be controlled in peening applications which could also explain the popularity of variable speed drives for wheel motors.

Ron Barrier urged me to not forget the "Reeves Drive" that was commonly used to vary the wheel speed, particularly in automotive peening applications where peening first started.

Over the years, the drive arrangements for such wheels got simplified with the advent of the direct drive wheel. Though they started off by being used primarily for special requirements, they are now ubiquitous in presence in common applications.

By the late 80s and early 90s, direct drive was gradually becoming the standard for most North American suppliers. Wheel assemblies of 1800 and 3600 rpm were developed and by the mid to late 90s, machines in many high production foundry and steel descaling requirements were being supplied with direct driven wheels. Wheels with 15" diameter produced 300 fps media velocity. Fast and effective cleaning was rarely a problem for these 15" wheels. In the early years of the new millennium, the latest generation of 3600 rpm blast wheels grew larger with 16", 17" and 18" diameters producing media velocities ranging from 320 to 360 fps.

**Is High Velocity Essential?**

A recent visit to an airblast installation revealed another aspect of shot velocity that I had understood differently until then. Upon talking to the operator, I learnt that his productivity was greatly enhanced when cranking up the pressure to 120 PSI, and here I was, advocating that higher velocity was wasteful unless required for specific reasons. I enquired with this operator further on the type of parts he was processing and other influential process parameters such as media size, type, target angle, nozzle design, etc. His response was clear and likely synonymous with at least 80% of such shops. He was faced with such a variety of part styles and degrees of contamination that he did not see the value in taking the time to experiment whether a lower velocity would also give him the same cleaning efficiency.

While we are debating 240 feet per second, consider a wide throat long venturi nozzle blasting at 80 psi. This nozzle will generate a velocity of close to 400 feet per second, taking us farther away from answering our question—is high velocity essential?

For cleaning, the simple answer is negative. For shot peening, there are several applications where high intensity requirements will demand high shot velocities. Shot peening mining bits, truck transmission, railway wheels and parts for the Oil & Gas industry require intensity measurements using C strips, typically greater than 6C, all the way to 15C. Such intensities, in addition to larger-sized shot (S550 and S660), will require velocities as high as 500 feet per second. Such velocities can only be generated using a blast nozzle at pressures close to 90 psi. Velocity and its measurement will continue to play a critical role in controlled shot peening of components, particularly in Aerospace. In "Visions of the Future" (*The Shot Peener*, Winter 2016), Jim Whalen of Progressive Surface commented that their ShotMeter G3 Particle Velocity Sensor was gaining in popularity as customers were interested in a direct approach to velocity scanning as opposed to solely relying on downstream verifications of intensity. Velocity monitoring and measurement will continue to gain importance.

**The Evolution of Shot Peening**

The velocity discussion is indeed profound and one could go on for hours. But my respondents had other interesting stories also to share! "During the 70s, it was common to say that peening was more of an art than a science," says Bill Rhodaberger when talking about its evolution. "North America had two distinct markets, Aerospace and 'everyone else.' A common belief was that the 'everyone else' group viewed shot peening as an added insurance factor whereas the aviation industry used peening as a design tool to ensure performance of the part. It was a real challenge in the *go-go* days of the auto business to have them adopt the aviation attitude towards process controls of shot peening. In too many cases, shot peening outside of aviation was a mixed bag of going through the motions versus process control. Production was more important."

Ron Barrier of Wheelabrator adds that without an experienced engineer in charge of peening, he was often met with the "1000-yard-stare" look when he explained shot peening to them in the 70s, let alone process control. We have certainly come a long way since then. Training has been formalized, equipment design has become more versatile and more industries are taking an active interest in the benefits of the process. Bill reminded me of an anecdote about the college intern of an auto supplier who pounded used Almen strips to flatten and re-use them in order to impress his supervisor with his money-saving tactic on strips! Such incidences have not been reported since!

**Not a Conclusion, a Continuation**

When I started writing this, I thought I was going to list the tips that my retired colleagues gave me, all in one article, but it turned out to be more than that. But then, one must know where we came from to know where we are headed! Therefore, this is not a conclusion. My colleagues have talked about several other aspects of blast cleaning and peening that I think deserve a sequel to this article! In the next issue, we will discuss topics related to blast patterns affected by shot size, media breakdown rate rules of thumb, a special section on tumblast techniques, targeting blast wheels, fixturing, and shot maintenance.

**INSIGHTS**

Mike Hockett | Managing Editor of *Industrial Distribution*

## Siemens Announces Remote Work as Permanent Fixture for 140,000 Employees


*The Siemens logo on a door of the Siemens headquarters in central Munich. Siemens is the largest engineering company in Europe.*

**SIEMENS**, the Germany-based manufacturing conglomerate, announced in July that it is establishing remote working as a key part of its "new normal," making it a permanent component of the company's employee operations.

The provider of intelligent infrastructure for buildings and energy distribution systems said it will implement a system for its global workforce to be able to work remotely two or three days per week on average. The new work model applies to over 140,000 of Siemens' employees, spread across 125 locations in 43 countries. The company has about 385,000 employees in total. "The coronavirus crisis and social distancing measures have shown that working independently of a fixed location offers many advantages and is possible on a much wider scale than originally thought," Siemens said in a press release, adding that a global employee survey confirmed their desire for more flexibility as for where they work.

Siemens said employees taking part in the new working model consult with their supervisors when choosing the work locations where they are most productive. The system will account for local legal requirements, the needs of specific jobs, and individual preferences.

The company said it has enabled 300,000 employees to work from home during the COVID-19 pandemic, and that they've been able to effectively collaborate and hold over 800,000 online meetings per day — all while being in different locations. Siemens also noted that the change will coincide with a different leadership style that prioritizes outcomes rather than on time spent at the office.

While many large corporations have encouraged and instituted temporary working from home procedures amid the pandemic, Siemens is one of the first to make it a permanent fixture. (Source: www.thomasnet.com)