AN INSIDER'S PERSPECTIVE
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Understanding Changes To Our Industry

THE ONLY CONSTANT

"Change is the only constant" is no longer just a catchphrase. Though I have often compared the pace of change in our industry to watching paint dry, a multitude of events have transpired in the past few years that have altered this pace. It is irresistibly tempting to use yet another catchphrase, "the new normal"—but I will refrain! Though not as eager to adapt as some industries, we are still a progressive community of blast cleaners and shot peeners. We learn from each other and that is exactly the purpose of this discussion.

The automotive industry of recent past has exposed us to several new terms: EV, ICE, PHEV, etc. This is the first trend that matters to us all. The second point of discussion is the ongoing issue of the supply chain, and what that means to our industry going forward. The third trend relates to component shortages and related cost pressures. The first trend has been on everyone's radar since not only does it receive consistent press coverage, but the underlying concerns it presents could alter our landscape.

Automotive and Aerospace continue to be the largest users of cleaning and peening equipment, more of the former than the latter type. In the automotive world, our machines continue to process engine components, and those related to transmission, suspension, and structure. If a component is cast or forged, it is almost always blast cleaned as a final or preparatory process to coating. If it undergoes cyclical loading such as gears and shafts, it gets processed in a shot peening machine. In an electric vehicle, there is a threat of this volume diminishing or vanishing altogether.

Is this trend going to be limited to automotive, or are we likely to see this influence aerospace designers? We will certainly question, attempt to validate, and address it here.

ELECTRIC VEHICLES – TERMINOLOGY

Let us start by listing some of those catchy acronyms in the following table as copied directly from myev.com[i]:

BEV	Battery Electric Vehicle – a 100% battery-powered Electric Vehicle
EV	Electric Vehicle – Any vehicle that uses electric motors, either in full or in part, for propulsion (motion)
EVSE	Electric Vehicle Supply Equipment – controls safe current flow between the charger and EV
FCEV	Fuel Cell Electric Vehicle – A vehicle that uses a fuel cell, usually hydrogen-based, to generate electricity that runs an on-board motor
HEV	Hybrid Electric Vehicle – A car that integrates a small battery and an electric motor to enhance the efficiency of the IC engine. The engine charges the battery; it cannot be charged by plugging into an electrical supply
PHEV	Plug-In Hybrid Electric Vehicle – configured like a traditional hybrid, but with a bigger battery pack that can be charged by plugging into an EVSE
ICE	Internal Combustion Engine. The technical name for the petrol/diesel-powered engine that powers most cars and trucks

WORKING CONCEPT AND PARALLELS

In simple terms, the car plugs into an electrical outlet and draws electricity from the grid. The electricity is stored in rechargeable batteries that power individual electric motors that turn the respective wheels. In other words, the "engine" does not exist in an EV; it is substituted by an electric motor. There exist several publications on the drawbacks of EVs such as initial investment, range, charging time, serviceability, environmental impacts of additional power generation. All

	ICE	EV
Energy conversion	Internal combustion engine	Electric motor
Energy transfer	Multi-speed gearbox (Multiple gears, shafts, and other components)	Simple, single-speed device (except a Porsche Taycan with a two-speed gearbox) EVs driven by in-wheel motors (common feature) also do not have differentials
Energy storage	Fuel tank	Li-Ion batteries
Ride comfort	Suspension – leaf and coil springs	Suspension similar to ICE
Braking[iii]	Disc and Drum brakes	Combination of mechanical and regenerative braking systems

that adds little value to our discussions. The attempt here is to be practical about the impact adoption of EV technology could have on our work lives, and not to diminish the value of one technology over the other.

A comparison of the different parts of an ICE and EV vehicle is presented in the table above.[ii] The table reveals some interesting information that we will analyze in terms of vehicle production. Manufacturing data from 2020 and 2021 are not exactly representative of a normal world, so this analysis takes 2019[iv] data into consideration.

With the exception of data not reported from a handful of car and truck manufacturers, the world was populated with an additional 91,786,861 passenger and commercial vehicles in 2019. As per International Energy Agency (IEA), about 4.79 million vehicles produced were purely EVs, which leaves us with about 87 million vehicles that operated with ICEs.

On a very conservative scale, let us assume that the average vehicle has four cylinders and an equal number of wheels. Just for reference, the 87 million does include trucks with more than four cylinders and more wheels. This manufacturing data translates to the following component volumes that were potentially processed in 2019. (See Table in next column.)

Though only a partial list, with the exception of * marked components in the table, production volumes could come under threat with the growing popularity of BEVs. Change is always met with skepticism among everyone, and this change elicits a similar response which I will explain. Another term that has crept into our vocabulary is "range anxiety," much like checking your phone regularly and hoping it will last long enough to allow scanning your boarding pass at the airport after a long day!

To ease into this change, PHEVs offer an acceptable bridge. PHEVs consist of an ICE in addition to a battery pack that can be charged like an EV, but with limited range. This relaxes the load on the ICE and utilizes electric technology as a supplement. Due to the presence of an ICE, this category of vehicle continues to carry all components listed above that will need the services of a blast cleaning and shot peening machine—a smoother transition for the consumer as well as advocates for blast cleaning and shot peening!

Component	Annual volume	Notes	Application
Engine blocks, crank cases, transmission housing and related cast parts	87 million	Assuming a four-cylinder engine	Descaling
Transmission gears	870 million	Assuming ten gears per transmission	Descaling and shot peening
Drive shafts	348 million	Assuming four shafts per transmission	Descaling and shot peening
Connecting Rods	348 million	Assuming a four-cylinder engine	Descaling and shot peening
Valve springs	696 million	Two per cylinder	Shot peening
A, B and C Pillars*	522 million	Six per vehicle	Descaling
Miscellaneous gears and shafts*	435 million	Five additional per vehicle	Descaling and shot peening
Brake drums and discs*	348 million	Assuming four wheels	Descaling
Suspension springs*	348 million	Assuming four wheels, not accounting for leaves	Shot peening

EVs AND SHOT PEENING

Drive components such as shafts and axles, albeit not as prominent as in ICEs, will continue to be present in EVs. "A turning shaft will be subject to torsion and require peening to enhance its fatigue life, just like shear force on a gear tooth is not going to disappear as it engages with another tooth," explains Liam Nother, President of Latem Industries. Latem Industries is a large facility that processes automotive parts for cleaning and peening in Cambridge, Ontario, Canada. "We work with several Tier 2 suppliers that plan far in advance for future car and truck platforms. Though they acknowledge that volumes of components might be reduced in the future due to the growth and adoption of EVs, they expect enough new components in EVs and PHEVs that will balance it out." Companies with long-term strategies proactively seek other industry sectors to insulate their business risk arising from focusing on a single sector, regardless of this emerging trend. A similar sentiment was echoed by foundries in the mid-west United States that focus on engine blocks and other such large castings.

"EV adoption is going to be gradual, and even at that pace, transmission components will continue to show appreciable volumes in EVs," explains Mike Wern, President

of Engineered Abrasives® (EA®) in Alsip, Illinois. EA® is one of the foremost shot peening equipment manufacturers for transmission gears, supplying to big three Automotive and their different tiers. "Though I cannot elaborate under conditions of confidentiality, we can see that the torque generated even at slow speeds with an electric motor is quite high, requiring moderation through a specialized electric drive train, components of which will require shot peening," added Mr. Wern. Other industry leaders manufacturing blast cleaning and shot peening equipment I spoke to though agreeing to the perceived threat, were confident in their strategies to offset production volume with newly introduced components and/or components from other industries.

It is good to see that our seemingly reticent industry has spread its reach to include additive manufacturing and similar advanced sectors. One of the respondents emphasized on their company's plans of focusing on the "finishing" of niche medical implants through not just blast cleaning but also vibratory finishing techniques. This type of cleaning holds the promise of also peening the component to enhance its useful life; a fact we discussed in a past issue of *The Shot Peener* ("Vibratory Peening: Promising Performance", Summer 2019).

SUPPLY CHAIN – END OF GLOBALIZATION?

Our discussions typically are technical in nature, but cabin fever has now led to exploring exactly those issues that have brought us here! I can recall several instances where a customer has called me in complete shock in the past two years to report that a container that used to cost them $5,000.00 to ship to/from Asia is now well over five times that value—if luck prevails to locate one in time! A ship stuck in Suez Canal no longer continues to be an issue, they are all stuck at different ports instead, without labor available to load/unload cargo! Several reasons are cited for this issue of labor, and the problem extends to manufacturing plants that are forced to truncate working hours due to lack of human resources.

But since this is not a lesson in global trade and economics, I would like to focus on the critical issue of the threat to globalization. Can a customer located in Asia, for example, rely on a North American supplier (and vice-versa) if service or part support is needed for a mission critical process? Though troubleshooting of machinery has been conducted remote for quite some time now, the burgeoning cyber-risks have forced corporations to strengthen their firewalls, making remote access all the more challenging.

Will end-users increase their reliance on locally manufactured blast cleaning and shot peening machines? This may well apply to North America and EU since locally manufactured equipment hold more merit than imports, but what about those regions where local products are not seen in good light, or are simply incapable of meeting stringent requirements laid out by automotive and aerospace customers? Will this force the metamorphosis of local equipment design, skills and technology or will it result in subcontracting such processes to overseas vendors?

The supply chain crisis has affected equipment manufacturers much like the microchip shortage has emptied out the parking lots at car dealerships. A large aerospace prime was complaining to me about a sophisticated peening machine that was embroiled by delay in receipt of electronic components, further exacerbated by the current environment preventing travel of personnel to witness machine testing prior to shipment.

Though Zoom and other platforms attempt to bridge that gap, many aspects of custom engineered machines have to be witnessed in person. Engineers spend considerable time in specifying the exact type of equipment and features they desire, and it is difficult for them to verify that the actual machine has in fact been built to specifications without an in-person inspection. Also, modifications, if needed, are best accomplished at the vendor's manufacturing plant, prior to shipment, than at the installation site.

WHAT NOW?

I have often discussed specification conformance, benefits of process control especially in peening equipment, training, and related topics. I feel that the changes that we are experiencing can be engineered to work in our favor. I take the liberty to list some of those areas of opportunities:

1. EVs are still in their infancy as a technology, and there is ample room for new processes to be "built in" within their manufacturing plan. Shot peening has always demonstrated great benefits to enhance component life, and as an industry we need to better explain this to potential users. There will be room between pure EVs and PHEVs where custom-designed rotating components will require surface treatment that may even be different from our conventional cleaning and peening operations. We need to learn more and be open to such possibilities.
2. Composites (and carbon fiber) will gain importance as a material of choice in the automotive industry. Surface texture is critical to maintain in these materials and our knowledge of process control from peening and grit

blasting aerospace components will benefit these newly added applications.

3. "Quicker," "cheaper" will be replaced with "innovative," "reliable" and "repeatable," with "quicker" underlining every requirement! This will amplify the need to shore up our skills gaps. Material science will be an important knowledge base in addition to pure manufacturing expertise. We are going to be exposed to some new and exotic materials that will perform differently than conventional steel and aluminum.
4. We used to be an industry where equipment pricing remained fairly steady over 5-7 years. This is no longer the case with the above challenges and rising industrial inflation. "Doing more with less" is another catchphrase that we will start hearing in commodity-type products. In other words, operating efficiency will need to be demonstrated along with product quality. This demands a new level of expertise in this field.
5. Though the shelf-life of technology in our industry will continue to be longer than most advanced manufacturing sectors, only those that innovate will thrive. I am sure mere survival is not a goal any of us desire to pursue.
6. Consolidation of technology is a definite possibility. Until now, it was common for a blast machine manufacturer to integrate handling equipment with the machine, but this will now extend to other upstream activities. For example, a finishing equipment company could partner with a parts manufacturer using additive manufacturing technologies. A consumable producer could extend their reach by offering the servicing of equipment that uses their consumables. These do create some inefficiencies and duplication of efforts. However, if we can warm up to an idea of "renting" a stranger's car, we might surprise ourselves with a contemporary style of industrial partnership that could benefit all.

I see opportunity and, to a considerable extent, regionalization of business. Innovation has no boundaries, and I am confident that our industry will look excitingly different in the future years!

[i] www.myev.com
[ii] https://www.innovativeautomation.com/the-electric-vehicle-drivetrain/
[iii] https://getelectricvehicle.com/brake-system-electric-vehicles/
[iv] OICA.net International organization of Motor Vehicle Manufacturers
[v] IEA.org,
[vi] Vibratory Peening, The Shot Peener, Summer 2019
[vii] https://www.nytimes.com/2021/07/17/world/middleeast/suez-canal-stuck-ship-ever-given.html