

Visions of the Future

Part two 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

WELCOME TO PART TWO of our discussion on “Visions of the Future” in the shot peening world. In Part One, we established the current status of our shot peening industry through interviews 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 eclectic group further enlightened me on their thoughts on where we are headed—let’s see what they had to say.

The Next Generation of Peening Equipment

Our group of experts was unanimous in their opinion that computer-controlled equipment—for better monitoring and control of the peening process—was the most important innovation in the past 20 years. However, each member of this group had a slightly different picture of the future.

“Progressive Surface has successfully experimented with ‘intelligent’ machines that reduce set-up time in the field,” said Jim Whalen of Progressive Surface. To explain the concept of intelligent machines, let’s use the auto industry as an example. In the last decade, the automotive industry has developed the driver interface with safety features such as lane control, back-up cameras and collision avoidance systems. They have concentrated less on the traditional engine, drive train and suspension. Similarly, Jim believes the shot peening machines of the future will incorporate error-proofing, enhanced internal communication and better process design, leading to a clearer handle on the machine’s health. He summarized, “This in turn will result in a machine that will not just raise alarms when the process is off track, but will actually be a few steps ahead in working towards a fix.” Jim also raised a very valid concern: The challenge of finding personnel capable of working with these intelligent systems.

Alain Portebois and Ron Wright of Wheelabrator see the future a bit differently, though still leading to a similar conclusion. “Peening equipment design is heading in the direction of a machine tool, much like a machining center. There is a growing similarity in accuracy, repeatability and controls intuition,” said Ron.

Alain added, “Aerospace customers of Wheelabrator are favoring offline programming techniques to optimize machine utilization.” Alain also said that part programs are prepared well ahead of time with 3D models of components. Wheelabrator R&D is working on techniques to improve the efficiency of existing media propulsion techniques in both wheel- and air-type systems.

Scott Nangle of Empire Abrasive Equipment Company also believes in connectivity. “We are already seeing our sophisticated customers connect their peening machines with the rest of their production machinery and processes. This is not just for validation and transfer of peening results, but also to put their already available electronic footprint to productive use,” said Scott. He feels the end goal is to make the diagnostics more intuitive, leading to earlier predictability of maintenance. This is especially valuable for aerospace and medical components.

Jim Harrison of Curtiss-Wright/Metal Improvement Company explained his vision relating to component design. “The future is about building shot peening process recipes as part of the component design. This will greatly reduce set-up time, costs and add better value to the entire operation. The design of aerospace components will follow tighter norms with the use of finite element analysis,” said Jim.

Michael Brauss of Proto Manufacturing believes X-Ray Diffraction (XRD) will eventually become part of the peening specification. “More companies are following their Almen strip validations with our XRD services,” said Mike.

Specifications and Conformance

Dominic Cimino of Curtiss-Wright/Metal Improvement Company is well-informed on specifications. He said, "We don't see a relaxation in specifications. We see them getting tighter as companies spread their operations over multiple locations."

Jim Whalen said, "Specifications have been harmonized to a great extent and they're the best they've ever been. As a future step, they might include closed-loop monitoring of impact energy, and not just its constituents such as air pressure and media flow. XRD could gain a place in specifications, too."

Scott Nangle commented that the next stage in the evolution of specifications will include machine diagnostics, additional traceability measures and features to make the process smarter for the user.

Michael Brauss mentioned the liability issues of specification non-conformance. He thinks the use of specifications will spread through industry sectors.

While Ron Wright and Alain Portebois agree with their colleagues, Ron thinks there is a possibility that specifications may be relaxed in the future because improved technology and machine controls will assure repeatability.

Almen Strips and Process Validation

"Almen strips will remain the prime process monitoring tool. We know the processing history of the part prior to peening will impact the effectiveness of peening. We use XRD to quantitatively validate the effectiveness of the peening process in introducing sufficient residual stress into the part. When the Almen strip results indicate peening process changes, it is important to use residual stress characterization by XRD to understand the actual impact on the part. XRD will continue primarily as a quantitative audit process," said Michael Brauss. When quizzed further on XRD and the likelihood of inline measurements, Mike said, "Inline measurements are used now. However, in order to conduct them in a completely non-destructive manner, there needs to be more developments in critical components such as X-Ray tubes and detectors to allow non-destructive stress with depth measurements."

Jim Whalen was pragmatic in his response and feels that quite a few users are still in the process of learning the traditional validation technique using Almen strips and this technique will continue to be popular. Scott Nangle maintains that traditional validation techniques such as Almen strip tests and media drop tests will continue to be used and he emphasized the need for education in such techniques so users derive the benefits of these practices.

My discussions with the group from Wheelabrator and Curtiss-Wright/Metal Improvement Company yielded the same feedback about traditional validation techniques, with an added comment from Jim Harrison. "Fatigue testing is also very important. Users can't solely rely on XRD or

validation with Almen strips," said Jim. Jim's employer, Metal Improvement Company, is often involved in this process from the initial stages of component design.

Alternate Materials

Most of us have read about the increased use of composites in airframes. No one in our group views composites as a threat to the shot peening equipment industry.

The Future

The future is here. We are already exposed to some of the elements our respondents have mentioned. What does this mean for users of peening equipment? There is no doubt that education is key. The technology that runs the process is as important as the peening process itself. As a pleasant surprise, the lower cost of electronic inputs hasn't resulted in increased costs in technological innovation. In addition, healthy economic cycles, industry consolidation and increased competition will ultimately result in quality peening equipment.

The potential skills gap identified by Jim Whalen is of great concern to me and everyone with a vested interest in the growth of this industry. Michael E. Porter of Harvard University uses a five point analysis to rate the competition within an industry. These are: Bargaining Power of Suppliers, Threat of New Entrants, Bargaining Power of Buyers, Threat of Substitutes and Rivalry Among Existing Firms.

In the shot peening industry, however, an ageing workforce adds a sixth dimension to competitiveness. I think it's time to retract our heads from the sand and ask the difficult question, "Do we have a new generation that is willing and able to take on the challenges and act on the opportunities identified here?"

Inherent weaknesses always present opportunities. For example, an industry-academia alliance for the metal surface finishing industry has been established by Purdue University to provide research to its members, establish a knowledge base and provide research experience for students. Since primes and their tiers can hardly be expected to share their R&D activities, university alliances provide research at a reasonable cost for smaller companies.

Stakeholders in this industry need to develop and protect the industry knowledge of its current workforce. However, the growth of technology in the surface finishing industry, particularly in shot peening, is sure to attract bright new talent. The potential for technological innovation in areas of intuitive controls, robotics, new applications, innovative materials and academic research will draw talent to this industry from other advanced manufacturing sectors.

The possibilities at this stage are practically limitless as we look at the future with renewed optimism. ●