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The Business of Welding

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AWS Forges on with the Welding Community Taking Center Stage

There is a word that I consistently use to describe these unprecedented times: crazy. Altering a career path and moving your family at the height of a pandemic? Crazy. I am the new executive director and CEO of the American Welding Society (AWS), and it is my humble honor and privilege to lead this organization into the future. Here is a brief background of how I was fortunate enough to join AWS.

Three days after graduating university with an industrial engineering degree, I started my career in the welding industry. Over the past 20 years, I built a portfolio of experiences that has uniquely prepared me to rekindle the growth that AWS has achieved over its 100-plus years. I spent my first seven years working as a technical sales representative in the United States prior to taking on a two-year assignment to work in Singapore. The two-year assignment turned into ten years of living and working in Singapore and Shanghai, China, where I learned that the international welding community has so many things in common with the American welding community. Upon my return to the United States, I shifted gears to focus first on robotic arc welding automation before expanding to be responsible for 13 automation integration companies servicing much more than just welding.

Throughout these experiences, I have seen how critical both vocational and higher education are, the important role that welding distributors play, the phenomenal innovation of the welding product manufacturers, the volunteers who give back, and the different needs and pain-points of the end-user segments that make up our great welding community.

If you are reading this, then you understand there is a tremendous welding ecosystem, and you are also undoubtedly proud to be a part of it. So what does the future look like from an AWS standpoint to warrant your continued engagement? The short answer is you.

We will continue to emphasize an outward focus on the constituents of AWS. From our certifications to our education training offerings, we must ensure that we are addressing the current needs of the welding community. We will extend our stakeholder feedback to include individuals who are not currently engaged with AWS in order to learn how we can better serve a broader base. Finally, we must communicate in language that the different personas can identify with.

To guide our path forward, we are currently focused on four strategic objectives: digital transformation, product portfolio, shortage of welding personnel, and global presence.

- **Digital Transformation.** When you see the phrase “Digital Transformation,” usually a website comes to mind. However, it is so much more than that. It is a marriage of technology and business processes that make interactions easier and more efficient. AWS’s digital transformation falls into two primary categories: foundation building and customer experience. To provide a customer experience that exceeds your expectations, we must have the foundation to be able to deliver.

- **Product Portfolio.** Through in-depth stakeholder analysis, we need to continue to add new products that address the challenges people face today and improve awareness of the existing product offerings. Furthermore, we need to solve pain-points so that our constituents can focus on growing their businesses and remaining competitive in the global marketplace.

- **Shortage of Welding Personnel.** By now, we are all aware of the shortage of welding personnel that our industry is facing, but are we making progress? Over the last decade, Weld-Ed (weld-ed.org) has been tracking the welding student enrollment. Today, there are twice as many students completing some type of welding program or enrolled in a welding program. Through the continued grants and scholarships of the AWS Foundation (aws.org/foundation), along with engagement in your local community welding programs, AWS will continue this resurgence in welding education for this generation and the next.

- **Global Presence.** Supporting the overseas welding operations of U.S.-based companies will continue to be critically important. Therefore, we must continue to engage the global welding community in developing high-quality standards for national adoption.

As we look forward to a post-pandemic world, whenever that may be, the future is very bright for AWS. Through a renewed focus on you, we will continue to build upon the great legacy from all the volunteers and staff who came before. Stay safe.
If there’s one lesson we can learn from the Statue of Liberty, it’s that great endeavors don’t come easy. Lady Liberty took ten years to assemble, built out piece by piece in France and then taken apart and shipped to the United States to be reassembled.

Although the 6-ft sculpture of Welder Liberty won’t take that long to build, it is still a labor of love for metal artists Stephanie Hoffman and Barbie the Welder.

The statue is part of the American Welding Society’s (AWS’s) Arc 2 Art project (aws.org/arc2art), which promotes welding as a creative profession. Both artists are working on separate portions of the sculpture and will eventually come together to join their pieces. The final part of the statue will be a metal American flag draped across on the body, handcrafted in person by both artists.

In September, the women shared their progress on their respective components via two episodes, which were released on the AWS Instagram account @americanweldingsociety and YouTube channel at youtube.com/user/videoaws.

In the episodes, Hoffman gave details about the fabrication of the base, and Barbie explained her process of hand forming the body. Both artists shared their challenges and wins. One thing they both had in common: The project has taken longer than they expected.

The following is a rundown of each episode.

**Episode 2 — A Solid Foundation**

Hoffman had her work cut out for her building the base of the statue, which measures about 3 ft long and 3 ft wide. She started the foundation by beveling the edges for complete joint penetration during welding, which was important to maintain the integrity of the piece once it came time to sand the edges — Fig. 1.

“If I would have just butted these corners all together and welded on it, I would have been worried about cracking from sanding it down,” she said.

Ultimately, Hoffman completed 36.66 ft of gas tungsten arc welding (GTAW) on a ¼-in. aluminum at 225 A. She used a Thermal Arc® 250 GTSW unit from Thermal Dynamics, along with a water-cooled GTAW torch at Exit 74 Custom Fabrications, Whiting, N.J.

Fortunately, there was no cracking in the foundation, but trouble arose when Hoffman began sanding it down. She started with an 80-grit flap disc, then went to a 120-grit disc, and then back to an 80-grit orbital sander to clean up all the corners. She found the orbital sander didn’t have enough power, so she put the sanding discs on a buffer, working up to 3000 grit — Fig. 2.

“It seemed like every grit I went up to, I had to go back...
down a couple of grits because I was finding scratches and things that I didn’t like,” Hoffman said.

In the episode, she displayed the foundation after one coat of polish. The base has an opaque sheen but will don a mirror finish at the final result.

“I wasn’t happy with the RPM rate that I was polishing this at. So now the next coat of polish this thing is going to get is going to be low and slow,” said Hoffman.

Next, Hoffman revealed the copper plate that will be attached to the foundation and hand engraved with the AWS logo and industry scenes such as a refinery, bridge, and airplane.

“I'm also going to do a really cool citycape across the front,” Hoffman said. “I think it’s important to highlight all the people in a lot of those trades unions who help build all of our cities across the country.”

Hoffman plans to sand the copper down with 3-in. sanding discs, taking it to 3000 grit before polishing.

“There’s no welds on this, so this copper will be quick, easy peasy,” she said.

Although Hoffman said building out the base took longer than she imagined, she believes “in the end, it’s going to be well worth all the extra effort I put into it.”

You can see behind-the-scenes details on Hoffman's Instagram account @underground_metal_works.

**Episode 3 — Body Works**

The next episode of Arc 2 Art featured Barbie the Welder displaying the frame of the statue’s body. She used a ¼-in. round bar running vertically and horizontally to create a cage-like shell for the plating — Fig. 3.

The first step of building the frame was calculating the size of the body and limbs. Barbie used the measurements of the original Statue of Liberty and scaled them to determine the proportions of the welder Lady Liberty.

“I know overall that from the top of her hand to the bottom of her dress is going to be 5 ft. So making sure everything is in proper proportion is key,” Barbie said.

Building out the frame took multiple attempts as Barbie worked to get the look just right. Initially, she wasn’t satisfied with the shape of the stomach or bottom of the dress, resulting in a redo of those areas.

“I did not keep in mind at first that as I’m plating this, it’s going to have an extra ½ in. of thickness on it,” Barbie explained. “So I had to go back and make it a little bit smaller so that once I get the sheeting done, it’s going to proportionally look good.”

For the sheeting of the sculpture, Barbie’s first attempt was with an 11-gauge steel, which she uses for some of her other smaller sculptures that have a similar style. But the flat plating of the steel didn’t give the dress the soft flow that fabric usually has.

Barbie decided to try another method: using the ¼-in. round bar that she had used for the frame — Fig. 4. Although time-consuming, it delivered the desired result.

“I’m putting [the round bar] side by side, and then I’m welding the seam between the two. It is giving me that soft look that I want,” Barbie observed. “It’s going to make the dress look flowy like an actual dress would.”

The process has been laborious, but Barbie cut down the time it would take for her to remove spatter by spraying the piece with anti spatter. In the video, the beginning of the sheeting is covered in residue from the spray, but Barbie assured viewers that “in the end, the finish is going to be really beautiful and something that I’m deeply proud of.”

To see more of her work on the piece, visit her Instagram account @barbiethewelder.

**Fig. 3** — Barbie the Welder uses a ¼-in. round bar to build the frame of the statue’s body.

**Fig. 4** — Barbie traded an 11-gauge steel for a ¼-in. round bar for the body’s sheeting.

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In an evolving world fueled by high-speed needs for products and information, the growth of technology has been at the forefront of making these demands a reality. Whether it’s having a package delivered to your door in a day or large amounts of data shot across the globe in fractions of a second, we can all thank the myriad of technological steps that make this all possible. In parallel with these advancements, and fueled by technology, the productivity of the global economy continues to grow and expand. However, the construction sector is one industry that has not shared the same productivity increases as the global economy — Fig. 1. Instead, construction is lagging the overall global economy by a $1.63-trillion gap in productivity.

While the construction industry has been slow in efficiency gains, another similar industry had been experiencing steady growth year-over-year. The manufacturing industry has been leveraging ever-evolving technology, nearly doubling its dollar of productivity per worker compared to the construction industry, which has remained relatively stagnant over the course of 10–15 years — Fig. 2.

**Evolution in Manufacturing Technology**

Manufacturing has continuously pushed the boundaries of technology over the decades to make productivity increases...
increases. These advances are readily apparent. For example, compare the Ford assembly line in the early 1900s, which was sweeping technology for that era, to the modern automotive assembly line, which is nearly fully automated by comparison. This evolution in technology is the catalyst for greater production and higher output of products, which, in turn, generates greater revenue and higher profits. Even though on the outside manufacturing and construction may not seem like a fair comparison, both industries see many of the same constraints, such as shortage of skilled labor, fierce competition leading to tighter margins, similar economic environments, sudden increases in regulatory oversight, and increasing complexity of the products they produce.

With the obvious successes of technology implementation in manufacturing, figuring out ways to have similar achievements in the construction industry should be at the forefront for anyone trying to improve their own business practices. The key to making the leap is being able to identify what technologies will create a positive return on investment (ROI) and which ones are smoke and mirrors.

How did the manufacturing industry determine the need for technology and the type that was appropriate? One way was by utilizing the value chain analysis and lean metrics approach to determine the appropriate technology that would complement the products to be produced in conjunction with reducing the overall cost of production. This is by no means a new theory — first gaining prevalence in the late 1970s to early 1980s partially due to a large automotive manufacturer’s strict adoption of these tools — but it is widely misused, most often over forecasting benefits while not fully understanding the potential pitfalls. These factors may be some of the reasons why these tools have been underutilized in the construction industry.

The Value Chain Approach

The steps to implementing the value chain approach are simple, but the key is fully understanding the available options and all the associated implications at each step. The three key tenants to utilizing this technique (as modified to be more applicable to industrial operations) are improve quality, eliminate waste, and reduce time. Any operation can be measured utilizing these three points to gain an accurate image of where the greatest efficiency gains can be had. These are the tools that allow us to take a page from manufacturing’s book and place a critical lens on construction operations.

Field welding operations have lagged many other operations within the construction industry. Gas tungsten arc welding (GTAW) and shielded metal arc welding (SMAW) are the predominant processes widely used throughout the welding industry and have been for decades. Technology advancements for welding are available to the industry, just underutilized. A lean business analysis can sort through which available tools are appropriate for your welding needs.

Contractor Looking for a Competitive Edge

Field construction operations are prone to being mired in the old way of doing things. The adage “don’t fix what isn’t broken” is a common phrase heard when trying to implement new means and methods in an industry rooted in legacy. However, the way
Work is currently being done is “broken” if looked at from a value-added perspective.

For example, at Kiewit, Omaha, Neb., the welding team could see there was room to generate more value within the field welding operations. GTAW and SMAW were the default choices for field pipe welding for most contractors and, at the time, were viewed as the only choices because that was the industry norm. It was assumed that doing anything different would either cause a detriment to quality or would be more costly. However, to convince projects to abandon the old way of doing things for new technology, the team had to justify that leap to get buy-in from management. The initiative to standardize gas metal arc welding (GMAW)/flux cored arc welding (FCAW) for the company was based on the same approach manufacturing uses — value chain analysis.

**Value Chain Analysis to Field Welding**

As previously mentioned, the value chain analysis can generally be broken down into the following three steps: 1) improve quality, 2) eliminate waste, and 3) reduce time — Fig. 3. To suit these steps to field welding operations more easily, the three steps were further combined into two because waste, in this sense, is not referred to as material waste but rather as wasted company resources. Also, an important facet is that labor cost is such a large part of any welding operation, so the reduce time step was rebranded as production increase in our scenario.

**Design to Value**

The design-to-value approach focuses on providing a product that meets the minimum requirements by contract or code of construction. Minimum is often seen as having a negative connotation, but in this instance, it is positive. Most contractors would agree that giving away product or time is not a sound business practice. To

analyze the design-to-value metric, one must first understand what is being built. In the world of construction, a universal ask of any client is to deliver the project they want on budget and on schedule. Overbuilding is a quick way to undermine all of those desires and ultimately create an unhappy client. If a client asks for piping to be built to the American Society of Mechanical Engineers B31.3, *Process Piping*, they are not going to be upset if you understand and use the weld acceptance criteria contained within. Additionally, as a contractor, wouldn’t you rather fully understand those costs when bidding to be competitive?

One example of doing a design-to-value analysis switch from GTAW for open-root welding to an advanced-waveform, short-circuit GMAW (GMAW-S) process is the removal of the need for internal purges. Most codes do not require a purge for materials such as stainless steels, but a purge is a necessary evil baked in if open-root GTAW is the process selected because GTAW does not physically work without it in this case. Switching to advanced-waveform GMAW-S allowed for the development of procedures. It also alleviated the need for purges while still maintaining the end quality required by the client for the intended service but at a vastly reduced cost.

**Production Increases**

When discussing welding production, there are two metrics that are important. First is deposition rate, or how many pounds of filler metal can be distributed in a fixed amount of time (typically pounds per hour in the United States). Second is operating factor, or what percentage of time (in any time frame) a welder spends depositing metal vs. other things, typically measured as a percent. Exploring these two metrics is the key to unlocking greater welding production.

Deposition rate is probably one of the easiest ways to increase production. For example, just by trading SMAW for FCAW, one can achieve at least a doubling in deposition if not more. The same type of production increase was also seen going from GTAW to GMAW for root welding. Simply by switching a process, we can drastically increase our production. These types of process changes are also within a company’s control.

Increasing operating factors can present challenges and often requires looking at the project in its entirety, not just at any particular weld. Again, the goal of the operating factor is how we keep a welder’s hood down. As a company, Kiewit deconstructed its internal welding operations and observed that welders were not welding nearly as much as one would think, but it wasn’t necessarily his or her fault. There are so many steps, some necessary and some not so necessary, that make up a typical shift that it is hard to get a high percentage of true welding time. Here, a value analysis is helpful in discovering tweaks that can be made to facilitate increases in operating factor.

One classic example here is the SMAW to FCAW comparison again. With SMAW, the welder is forced to stop after every electrode, discard the stub, and grab a new one. Also, good practice here is to clean any slag from the area being welded to avoid defects down the road. However, all these baked-in steps don’t generate any additional value, i.e., the time the welder is forced to spend not welding doesn’t make a better final product. Thus, any way to eliminate that step should be explored. Through swapping to FCAW, that welder can now weld for drastically longer periods of time, only stopping to reposition (and this repositioning step can also be seen as non-value adding and explored, etc.). Both processes create the same code-compliant final product, but one of them does it in drastically less time.

Another operating factor-related area to analyze is what does access look like for the welders? This doesn’t just encompass having good access to the weld itself, but what does access look like to the rod room, break shack, or bathrooms? If the filler metal management program requires welders to pull new consumables every morning and at the start of any new weld, that could be an extra 15–30 min a day spent walking to a rod room that was not conveniently located. If there are 20 welders over the course of a year
The key to making this analysis work is knowledge of your current costs, understanding of your contract and code requirements, and honesty regarding what type of investment and changes it will take to get there.

**Vetting Potential Options**

The goal to the vetting process is to minimize risk when making drastic changes to the way welding was previously done. During this step, there will most likely be multiple options for process improvement. For each option, the theory of increasing output needs to be proven, the upfront costs and ROI need to be understood, and any downside risk needs to be explored. Most importantly, there must be no detriment to the final product quality. Diminished quality is the greatest risk assumed and outweighs a failed ROI. By the end of the vetting process, the best option should rise to the top and will be the one the team needs to champion.

During Kiewit’s analysis, the team determined the best fit for the types of welding applications the company had was advanced-waveform GMAW-S coupled with FCAW. The selected product met all the company’s needs and had a quick payoff period. Additional testing was also performed at this juncture to alleviate quality concerns and begin to develop new operating procedures.

**Developing Buy-In**

Creating buy-in can be a challenge across any company adopting innovation. A large percentage of technology-based initiatives fail in all industries due to lack of stakeholder buy-in, innovation fatigue, and failure to support the transition. There is not an executive or project manager who doesn’t want a project to be more profitable, but there is always a risk of a negative outcome that needs to be weighed. Changing culture and legacy (or old ways of welding) is difficult but can be overcome with a pragmatic approach. When developing stakeholder buy-in, we need to understand all the parties affected by the adaptation of changes, which for Kiewit, and not unlike most industries, were the contractor (the company), the owner (or client), and the craft workers.

The company is going to have concerns of what the return on the investment looks like, warranty risk, and finding a pool of qualified welders to perform the work. By providing factual data upfront to management teams, along with additional research and development, a comfort level can be had when it comes to ROI and warranty issues. To address training welders, plans were put in place with the local unions to train welders, and internal welding training programs were developed to standardize getting welders to the level of competency needed to not diminish quality.

Owners and end users are going to have concerns on warranty and performance risks. Often, changes toward increased construction efficiency are viewed as “corner cutting” or somehow a lower-quality product. Along with that, many owners have specified that GMAW-S is not permitted on projects due to long-held truisms. Strong companies pushing new technology will provide great explanations and benefits of the processes. Small investments on additional testing also provide great comfort levels for owners. Over the years, as advanced-waveform welding has seen greater adaptation on projects, there is a greater comfort level with clients and their corresponding specifications. As an industry, we need to keep this trend going.

Lastly, we look at developing buy-in from the skilled men and women performing the work. If we are going to ask a workforce to completely change the way pipe welding has been done for decades, we have to be cognizant that we are also affecting their job security in an industry where welders are always one failed joint away from losing their job. As a company, showing empathy for this change is key. We are pushing the change and need to support whatever is required to ensure all parties are successful. For example, teaming up with local unions to provide a greater level of training and staffing projects with welding support personnel has helped Kiewit gain the buy-in from craft to make it successful.

**Out with the Old, in with the New**

Change is no easy task, especially in an industry that has highly ingrained ways of operating. Asking the question “why?” about any of the facets of your operations is a good place to start, and analyzing the value generated at each step is really the crux of the issue. If an operation seems superfluous and is done “just because we always have,” it is probably a good candidate to analyze. If a task appears lacking in value, then ask what changes can be implemented to make it more valuable or maybe eliminate it altogether.

Also be aware of trying to force fit technology into old ways. Any technology adopted this way is doomed to fail. For example, if a certain technology allows for faster welding, a crew make-up may need to change to feed that new demand. If this is not taken into account, then the new technology will be underutilized, and the goal of increased production will not be realized.

Ultimately, there is not a one-size-fits-all approach for any company or project. What worked for Kiewit may not work for its competitors. The key to making this analysis work is knowledge of your current costs, understanding of your contract and code requirements, and honesty considering what type of investment and changes it will take to get there.

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