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The AWS Foundation Supports Future Welders as Need for Reindustrialization Grows

“Welding professionals and businesses will be essential to the reindustrialization of America, and it is critical that we put a focus on training and educating the next generation of leaders for our industry.”

The election for president of the United States will take place next month, and it comes at a most challenging time. We have tragically lost many lives to COVID-19, but our country has also shown resilience and a dedication to forging a new path forward.

Included in that path forward must be a renewed focus on manufacturing in the United States. The COVID-19 pandemic has uncovered the impact from decades of offshoring critical manufacturing and supply chains. Our inability to manufacture important medical devices, pharmaceuticals, and protective equipment have put our country at greater risk. More importantly, it revealed that a reliance on offshore production by many industries can send damaging ripples through an entire supply chain during a global disruption.

The two men vying to become president have different views on nearly every issue, but one area of common ground is the need to reindustrialize America, both to maintain our resilience and to grow our economy. Investments need to be made at every level of government and throughout the private sector to increase our competitiveness and self-reliance.

A national prioritization of innovation, manufacturing, and infrastructure will mean further demand for skilled tradespeople, including welders. The need for welding professionals was high before the pandemic and will be even higher if we, as a country, can commit to this reindustrialization.

Aside from the prospects of future demand, a career in welding has become an intriguing option for young people and career changers during this pandemic, as most states deemed welding organizations as “essential businesses.” Many engineers, technicians, technical sales staff, and other personnel experienced less disruption than their counterparts in industries such as tourism and hospitality. The pandemic has highlighted the importance of these jobs in keeping our country running.

The American Welding Society (AWS) Foundation (aws.org/foundation) remains a driving force to encourage people to see the opportunity of a career in the welding industry and to support their path in achieving that goal.

Last year, we awarded scholarships totaling $1.5 million to more than 1000 students to further their education and training in the field.

Our Welding Workforce Grant program continues to help schools expand training capabilities to create more welders to support local businesses and the economy. More than $850,000 in grants have been awarded since the program began in 2017.

One of our newest initiatives, the Light a Spark Grant, provides starter welding equipment packages for high schools that did not previously offer welding. This grant will allow hundreds of students each year to experience welding for the first time and open their eyes to the many opportunities available in the profession.

One of our flagship programs to expose young people to welding, the Careers in Welding Mobile Exhibit, has unfortunately been sidelined this year with the cancellation of most events due to the pandemic. However, the AWS Foundation and partner Lincoln Electric remain committed to this important endeavor and look forward to having the trailer back on the road in 2021.

While we may not have been able to meet everyone face-to-face this year, we increased our ability to engage digitally. Articles, blog posts, and videos related to careers in welding have regularly been featured on weldingdigest.com and AWS social media channels, some with views reaching in the tens of thousands.

Careersinwelding.com remains the go-to source for information on careers, salaries, educational opportunities, and more. We continue to add additional content, such as a page devoted to veterans, and resources for welding educators, a few specifically to assist with remote learning. Continued improvements to the site, as well as new digital initiatives, are planned for 2021.

Our country will re-emerge from this pandemic under a new normal. Exactly what it will look like is yet to be determined. But we do know that it will include a new appreciation and commitment to making things with our own hands here in the United States.

Welding professionals and businesses will be essential to the reindustrialization of America, and it is critical that we put a focus on training and educating the next generation of leaders for our industry. As welders remain essential, so too is the work of the AWS Foundation.
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SAVE MY SEAT
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The Statue of Liberty stands tall in the New York Harbor, a beacon of freedom that historically greeted immigrants arriving to the United States by sea. Now, thanks to welding and fabricating artists Barbie the Welder and Stephanie Hoffman, a smaller version of Lady Liberty will stand just as proud, if not as tall. The estimated 6-ft sculpture, outfitted with a welding torch held high in her right hand, welding helmet, and code book cradled in her left hand, will be a symbol of artistic expression, inviting people of all backgrounds to consider welding as a career option — Fig. 1.

Lighting the Way from Across the Miles

The sculpture’s fabrication is part of the American Welding Society’s (AWS’s) Arc 2 Art project, which highlights welding as a creative profession.

The artists are joining forces from a distance, each working on a different part of the statue in their separate shops. Once their respective components are finished, they will meet at Exit 74 Fabrications, Whiting, N.J., to join their sections and complete the final part of the sculpture: an American flag that will be draped across the figure’s body. It will be the first time either woman has made art with someone else.

Join the Journey

During the process, the two artists will keep a video diary of their progress and post their footage at aws.org/arc2art for a total of eight episodes. For more behind-the-scenes details, follow the women on Instagram @underground_metal_works and @barbiethewelder.

In August, the first episode of Arc 2 Art featured Hoff-
man and Barbie enthusiastically discussing the project on Instagram Live — Fig. 2. The event attracted participants from around the world. Hoffman revealed her sketch for the sculpture, which was inspired by the artwork on a sticker she had designed. The two artists also covered technical details, answered questions, and mused on what the statue means to them.

“I think this sculpture really symbolizes coming together, and the fact that at our core, [we], as Americans, are strong,” Hoffman said. “We’re going to get through anything.”

Barbie’s sentiments also reflected a popular national value. “[The statue] represents freedom to me. Welding gave me the freedom to do so much with my life. It’s given me so many opportunities,” she said.

Barbie the Welder, as she’s commonly known, is a metal sculptor from Erin, N.Y., who has been welding for 13 years. She’s created commissioned artwork for individual and corporate clients, including a sculpture made completely out of scrap for Harley Davidson’s 115th anniversary. Her diverse repertoire includes figures of otherworldly creatures with humanoid bodies. This part of her work lends itself to her role in the project: crafting the body of the statue. The figure will be framed out in ¼-in. round bar and covered with 11-gauge steel sheet.

“If you think about a chocolate Easter bunny, how it’s hollow inside, it’s the same concept but 5 ft tall,” Barbie explained. “It’s going to push my skills past anything I’ve ever done.”

She will also use ¼-in. ER70S filler rod for welder Lady Liberty’s hair, which will be in a ponytail.

Hoffman has been welding since her freshman year in high school and spent her early career working in a shipyard doing hydraulic pipe repair and anodized aluminum pipework. She then took her experience from the dock to the classroom, becoming a vocational school welding instructor. These days, she creates metal art from her New Jersey shop and works as program manager of workforce development for AWS.

“A person can pick up a torch and create something. Whether it’s from a blueprint or not, they’re artists. Fabrication is literally just a creation of art.”

“A Reveal to Remember

The unveiling of the sculpture is planned for mid-November. Afterward, it is hoped the welder Lady Liberty will be a centerpiece inside the Careers in Welding Trailer during its 2021 tour across the United States, showing visitors that welding goes beyond construction and pipelines.

“Welding is an art before you do anything else with it,” Barbie concluded. “A person can pick up a torch and create something. Whether it’s from a blueprint or not, they’re artists. Fabrication is literally just a creation of art.”

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Welding automation is not a new concept, but the way it is implemented is constantly evolving. Automation doesn’t eliminate the human element or intelligence — it just uses it in a different way. For example, rather than having the welder climb a scaffolding, balance themselves on a slippery surface, or squeeze into a dangerously tight place to fill a groove, he or she can change the wire feed, heat range, wire diameter, and much more via a computer screen while the robot does the physical labor.

This article aims to take the mystery out of automated welding and provide examples of how the process doesn’t have to be threatening to the welder workforce.

Getting Ahead with Offline Programming

Bottlenecking is a problem that is often experienced in traditional programming. A bottleneck occurs when the capacity of an application or a computer system is limited or slows down. According to Teemu Rusi, robotics manager at Pemamek Oy, Loimaa, Finland, the ability to program robotic applications offline is ideal for low-volume, high-mix jobs because the next welds are preprogrammed while the robot works on another piece simultaneously — Fig. 1. This solves the bottleneck problems where the operator needs to be next to the robot to control its motions with a teach pendant. Offline programming also enables a preanalysis of weldments; the operator can examine which ones will be suitable for robotic welding.

“The customer can have an additional license not only for programming but for the production planning phase,” Rusi noted. “They can import the piece as a 3D model in the software and see whether the robot can reach difficult welds or how it should be attached to the workpiece positioner.”

The simulation enables collision-free paths and an exact-time study already in the preplanning phase.

Large parts and structures can take time to program and often have irregular groove welds due to the nature of their geometry and size. Adaptive welding paths can be programmed offline as well, allowing the software to adapt those paths to fill grooves of different depths and sizes. This is especially suitable when working with one-off or low-volume jobs in succession.

“In the case of a ship bulkhead, which has many intricate parts and pieces, the first part can be programmed well before you ever get it to the point where you can start to weld,” said Michael Bell, national sales director, Pemamek North America. “When you start to weld the first part, the second part or section can be programmed while the first is welding. You can choose to what degree you want to program the operation.”

Creating Weld Paths Using Parametric Inputs and Scanning

Adaptive welding is practically tailor-made for the jumbo-sized parts
found in wind towers and foundations, power, and offshore industries. The sheer size of these pieces almost guarantees there will be inconsistent grooves and measurements that are difficult for welders to manually reach with the welding torch.

Rusi recalled a challenging job brought to him by a Norwegian offshore customer who was building a large steel winch for vessel anchors — Fig. 2. Previously, the customer welded these pieces manually using 39.37-in.-long welding torches. Hard-to-reach sections inside the piece and exceptionally thin sections were impossible for a human welder to get to, and they experienced numerous quality issues as a result. The solution was a welding cell with two robots on two column-and boom-type gantries with three-axis movement: X = 5 ft (1500 mm), Y = 6 ft (1800 mm), and Z = 10 ft (3000 mm). A 50-ton, two-axis welding positioner sat in the middle, capable of rotating the part 21 ft (6500 mm) in diameter.

“In this case, we had 59.05-in.-long-reach robotic arms that could weld inside the workpiece. Two robots welded simultaneously with the welding positioner. Welding paths were programmed using parametric input methods whereby the operator entered the outer diameter of the piece and the inner core diameter and the number of ribs inside where the robot was welding. Tailor-made welding programs were created based on these parameters entered by the operator,” Rusi explained.

Welding time was reduced from 36 to 6 h, and the welds were spot-on accurate.

“There were hard-to-reach areas on that vessel,” Rusi recalled. “The welder became the operator, preparing the next pieces while the robot was doing the tough welding task. I think one of the biggest advantages here is that the welder could get away from welding fumes, arc illumination, and positions that are hard on the back. The robots can do these hard tasks.”

Another approach to creating custom weld paths for tough-to-weld workpieces is by allowing the robots to scan the workpieces themselves, then generate programs based on the scanned data, automatically adapting each welding pass to those areas where the grooves need to be filled. As with offline and parametric programming, the operator can take a symmetrical 3D computer-aided design image of the workpiece and split it down the middle to create a mirror image — Fig. 3.

“The operators can use copy and mirroring tools to create one weld on a piece that they can copy or mirror to the opposite side of the weldment,” Rusi said.

In some cases such as the one described above, welders become operators by trading in their welding torch for a sophisticated software program that controls robotic welding arms to accurately reach and join those tough-to-reach spots where manual processes just won’t do.

Multigenerational Welding Approach

Younger, newly graduated welders have had robots in their lives since birth, and they have most likely used some sort of basic welding path software program. It’s the more experienced welders, those who are nearing retirement age, who might balk at the idea that a robot can do a human’s job. But, what if the two generations combined their experience and knowledge to create the most optimal adaptive welding processes around?

According to Bell, software developers “take that welding knowledge — metallurgy, speeds, feeds, etc. — put it in a program and automate it. Welders still need their education, background, and understanding of the process but
can program the robots to do the work."

Robots are especially beneficial for back-bending work. Manual welding can be a physically demanding job with workpieces ranging from manageable sizes like those found in automotive applications to those requiring scaffolding and precarious positioning to reach a welding area. At some point, the welder can be put in a precarious position that jeopardizes his or her safety. Automated welding technologies take advantage of the welder’s practical experience and knowledge honed over years on the job and give the physically tough tasks to an entity that can’t really get hurt.

**Onshoring the Production Process**

Manufacturing in the era of the COVID-19 pandemic has highlighted the weak links in the supply chain from country to country. There is much talk about onshoring manufacturing, not just in the U.S. but in other countries in Europe and beyond. Investment in automated technologies goes a long way toward keeping production in-house for many companies.

“It helps you to keep manufacturing close to home. Automating welding cycles can result in big savings during the manufacturing process and increase efficiency,” said Pemamek CEO Juha Mäkitalo. “Some of our customers have realized more than 50% reduction in cycle times by automating their welding operations. In time, you can add another shift using only automated processes (think preprogramming) using the same number of people on the job. I think there are a lot of opportunities to increase efficiency.”

Customization of equipment can help speed along processes even more. “We always analyze customer production and the products they are planning to use for robotic welding,” Rusi said. “We check their portfolio of products and then determine how big the welding stations should be, how long the robot arm reach should be, how much movement for the external axis do we need, and what the capacity should be of our workpiece welding positioner. All of our robotic systems are modular and can be modified according to customer needs.”

**Welding of the Future**

In the future, Rusi envisions an all-automated process, from programming to final weld, for seamless, collision-free movements, while Mäkitalo looks to the integration of different types of software such as welding control programs with enterprise resource planning systems so that every aspect of the manufacturing process is documented. One thing is for certain, if accuracy, efficient welding operations, and the ability to have absolute control over the manufacturing process is a priority for your shop, you’ll be adopting automated welding technologies quite soon.

**Fig. 3** — The PEMA WeldControl’s offline copy and mirror functions allow operators to create one weld on a piece and copy or mirror it to the opposite side of the weldment.

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SPARKING CONNECTIONS –
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