



Electromech Technologies

CASE HISTORY



THE WORLD'S TOUGHEST WELDING APPLICATIONS: TWO COMPANIES TEAM UP TO SOLVE TWO DIFFICULT AEROSPACE AND DEFENSE CHALLENGES

The aerospace and defense sector is one of the most challenging and competitive markets in modern industry. Not only must designers and engineers constantly innovate with their products to keep the sector moving forward, but welders and fabricators need to be able to meet the high demands of bringing these concepts through development to production.

With the high regulatory standards of government applications, welders are often put in a seemingly impossible scenario. These challenges can result from the designs of the products themselves. Whether it is for a new fighter jet engine or a novel rocket prototype, welds must work with the often-complex designs of evolving equipment. Welders need to be able to perform these welds safely and reliably, while maintaining the product's structural integrity so that it holds up in harsh environmental conditions.

Being adaptable is also crucial here, as prototypes can go through several iterations before landing on the final design. Even small design changes can impact how a part is welded, so having flexibility in prototype welding and fabrication can help ensure that details and requirements on the engineering sketch successfully make it to the final product.

With the high demands of the aerospace and defense sector, only the most advanced welding practices and technologies can create the products of tomorrow. In this case history, two companies – Electromech and EB Industries – team up to solve two of the industry's most complex challenges.

BACKGROUND: GOING BEYOND STANDARD WELDING

Electromech Technologies is a global leader in servicing aerospace and defense markets. Known for providing extensive aerospace and defense industry certified outside processing services, Electromech fabricates components that can be found on many aircraft flying today.

Working in the high-level aerospace manufacturing sector, Electromech regularly encountered challenges that needed a higher degree of welding innovation than standard welders could provide. Most welders gave up too quickly on their projects, saying that they could not weld the designs that Electromech brought to them. They would deny Electromech's designs without providing a valuable alternative.

For Electromech and its customers, this simply would not do. That is why the company turned to EB Industries, a preeminent supplier of advanced welding solutions. EB Industries had the expertise and advanced technologies to solve Electromech's problems in a way that did not shut down the company's ideas. Instead of telling Electromech that something was not possible, EB Industries would work with the premier aerospace supplier to manufacture a weldable product while optimizing the design for advanced performance and efficiency.

CHALLENGE #1: Juggling Different Welds in a Lab Prototyping Experiment



The first challenge that Electromech and EB Industries faced was a resolver application where different welds were required for a lab prototyping experiment. Initial issues had to do with the design having piece part weldment instead of a finished part weldment. That meant that everything had to be preassembled for the end goal of a complete part.

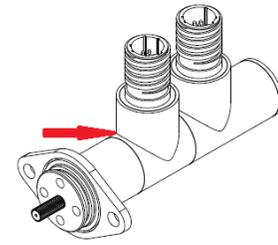
Another issue was that Electromech and EB Industries had to reduce the heat input, as high temperatures would impair efficiency. At the same time, the part had electromagnetic bearings and needed an electromagnetic filament that required higher temperature welds. With a tolerance of +/- 9 ark minutes, minimal degrees of error were allowed. Isolated temperatures would also run up to 1200 degrees Fahrenheit.

THE SOLUTION: Finding the Right Type of Welding for the Job

With all of the above stipulations at play, EB Industries decided to test which type of welding would create the best final part, while still meeting all of the application's conditions. The company tested both laser welding and electron beam welding on the piece to see which was more efficient. After thorough prototype welding, EB Industries found that because these parts did not require deep penetration, laser welding was the perfect fit as it was a flexible option.

To further prove the success of the design and fabrication, the welding experts at EB Industries suggested that Electromech have a sample test run using temperature probes. This type of temperature monitoring during welding allowed the two companies to watch what kind of temperatures the parts were exposed to during the process. EB Industries' suggestion aided the development process by offering an added layer of design viability and risk mitigation.

CHALLENGE #2: Multiple Welds on Precision Parts



Electromech's next challenge was a part design that, as initially planned, would require 7 different welds, including 2 saddle welds.

Saddle Welds are a weld joint made from two intersecting cylindrical parts. Because of their shape, the welds are known to be more complicated for main two reasons. First, the weld requires a multi-axis path, complicating the programming required to ensure that the weld is laid in the right place all the way along the joint. Secondly, because of the intersecting oval shapes, the joint can often have poor fit-up and varying thicknesses, which can result in weld burn through, poor penetration and other issues.

In addition to the challenges the saddle welds presented, the 5 other welds would also present additional challenges;

- *The heat added by each weld increased the chances of material warping.*
- *Weld strength needed handle the stresses of the part use, and not fail prematurely.*
- *The need to connect parts radially required a connector tower.*
- *Arranging the joints for the weld would require extra time, fixturing, and precise placement*

THE SOLUTION: Partnership and Proof

This part showed where the unique working relationship that Electromech and EB Industries had built really paid off.

The two company's engineers worked together early on, making sure the design was optimized for functionality and production. Once parts were ready for testing, and with quality control a paramount concern, multiple sample parts were created. This allowed for the rapid adoption of new design iterations without requiring extra downtime and provided part stock for actual production.

Once production design began, Electromech and EB Industries continued working together. By exchanging production notes and design changes with the documentation and tracking data that allowed for quick updates, process improvements, and refinement aimed towards producing the best resolution to the part's multiple challenges and application requirements. Both companies knew that it was not just about welding a good part, but in also understanding why a weld was made so that it could be changed, replicated or updated as the design progressed.

- *Programming of the saddle welds was refined with improved welding automation.*
- *Material warping was mitigated, and weld strength increased through the use of different weld processes and weld order.*
- *Fixturing was refined and tested with different ID/OD (inside and Outside Diameter) Recommendations, reducing set-up time and creating a repeatable process.*

Then, all the process refinements and design changes were tested, not just to the applicable specs, but to the requirements of the application. This ensured that the part would perform to the design, and to the rigors of actual use.

This relationship between the companies, from the early consulting on design, to the open communication during production design and refinement to the tracking and testing to prove out the process, resulted in a finished part that met all requirements, and allowed for full production to begin.

THE IMPORTANCE OF TECHNICAL EXPERTISE AND GOOD COMMUNICATION



When it comes to the demanding environments of the aerospace and defense sector, having suitable welding technologies is not enough. Companies must be able to use those technologies in adaptive and innovative ways, while keeping a good line of communication open with their partners.

Electromech went back to EB Industries after the first project they worked on together because of EB Industries' technical expertise and collaborative communication. While other welders would say no to Electromech's projects, EB Industries always found a way to a solution – one that was viable both for the shop and out in the field.

Flexibility was the backbone of the partnership between Electromech and EB Industries. Electromech could hand EB Industries' engineering experts a sketch, and they would be able to provide design assistance to ensure that the part was weldable and manufacturable. This included offering material recommendations to help optimize the final product, though EB Industries would still find a workaround if Electromech needed a specific material.

ELECTROMECH AND EB INDUSTRIES OFFER ONGOING INNOVATION

Since the aerospace and defense sector is constantly changing, innovation must come both from a product's design and fabrication for it to be successful. Together, Electromech and EB Industries offer a combined expertise that can help solve the industry's next greatest engineering challenge.