

## The Discovery of the InfiniteWeb

On July 13, 2009 a company specializing in metal conversion met with two of our Engineers hoping they could solve a desire for a system that would increase profit, reduce the need for skilled laborers and work with metal thicknesses they were not able to successfully weld manually. This company was struggling with welding steel and stainless steel strips end to end to generate long spools. The need for longer spools reduces the need for their customers to rethread their equipment. Traditionally the required welds are generated by mechanically sheering the trailing end of one strip and the leading end of the new strip, then welding them using a Gas Tungsten Arc Welding (GTAW) system. GTAW is not able to weld material less than 0.008 inches thick and even this often requires multiple attempts before obtaining an acceptable weld. Scott Boynton knew a solution could arise from building the right laser system for this company. Laser based systems had been used in the past, and were able to weld down to 4 mil thickness, but they were very time consuming and difficult to use due to the criticality of the edge conditioning and alignment. Joining Technologies needed to design and build a system that would generate high quality laser welds between strips to form a consistent web. With a list of necessary requirements and very specific parameters Scott and his team began the task.

Scott Boynton sketched the first concept drawing for the system, using a fiber laser to cut the trailing edge of one strip and the leading edge of the next to create clean, square ends. The newly cut edges would be pushed together mechanically until they touched, and then the same laser and laser optics would be used to weld the two strips at the newly created joint without additional filler wire, creating a high quality splice. The design was refined over the next three months until the system was perfected. It has significant qualities that set it apart from those of similar style. Compared to other laser systems, the proposed solution is extremely fast and easy to use due to the combination of cutting and welding, the degree of automation and user interface development, including a pre-developed, expandable parameter database. The inclusion of an onboard annealing system, which rapidly reheats the strip using high power lamps to toughen the weld, eliminates the need for an additional step and system, and incorporating the annealing information into the main parameter database reduces opportunity for incorrect setup. The use of a fiber laser makes the system extremely compact and mobile, allowing it to be moved between workstations. This is accomplished by mounting all of the laser optics and motion system in a copy machine style lifting cover, giving full access to the work surface during setup and allowing the web to be removed after splicing. Prior implementations of combined cutting and welding systems for splicing were much more complex and bulky due to the CO2 laser source, and trapped the web in the mechanism, requiring a dedicated splicing system for each winding machine. Finally this is the first known automatic laser splicing system that is designed for either ferrous or nonferrous metals. We consider the InfiniteWeb to be innovative because it takes a new approach to strip splicing, using one laser to both cut and weld strip, in addition to the other changes listed above. We expect this to have a significant positive effect on the strip conversion industry, in that it will allow faster, higher quality splices in thinner material than was previously possible,

On February 10<sup>th</sup>, 2010 the first system was placed into production at the Connecticut company's facility. It has been working superbly since, and has allowed a 200-300% improvement in total throughput as compared to the prior GTAW based welding system. This system allows lower material thicknesses to be welded that are not possible on any known competing system, specifically down to 0.002 inches. Joining Technologies has now created a system that in due time can be marketed to other companies seeking this process improvement. Not only did this individual and his team create a system that fulfilled the desire of one Connecticut company seeking relief, profit and productivity, they have also created a venture that will lead to increased profitability for our growing company.