

Gentry Wood is a familiar name to the CWB Group family. He is the Chair of the CWB Association National Advisory Council and a huge proponent of educating aspiring welders on the different facets of welding. We were extremely excited when he agreed to participate and share more about his work and world outside the CWB Association.

CWB: Can you please provide a history of the Apollo-Clad Laser Cladding?

GW: The story of Apollo dates back 50 years with the machining side of the business. Robert Norton, the founder of Apollo Machine and Welding Ltd., started the company in 1971 with a rented manual lathe in the back of a small shop. Through his vision and the hard work of many individuals through the years, Apollo has grown in the past half-century to become one of the largest CNC machine shops in Western Canada. Currently, we operate this portion of the business out of a 120,000 sq. ft facility in South Edmonton with over 250 employees. The main thrust of the company is manufacturing complex, high-value components used by the drilling industry for oil and gas exploration. A division of Apollo-Machine, Apollo-Clad Laser Cladding, the facility where I am based, has been around since 2008. The purpose of this business unit was to enable Apollo to repair high-value components for the drilling industry, which is still our largest customer base. The technology, known as laser cladding, was fairly new, but Apollo management saw massive potential. This leap of faith resulted in a dedicated facility for the technology located in Leduc, Alberta. The facility is an impressive 45,000 sq. ft., where we have just completed and commissioned our ninth industrial laser cell. The growth in this side of the business over the past 13 years has been incredible. Apollo-Clad is one of the biggest production laser cladding shops in North America.

CWB: What were the reasons for the growth of this particular division? Which industries have you branched out into?

GW: The oil and gas industry's uptake of laser cladding technologies over the last decade has been remarkable. The technology is exceptionally well suited to deposit coatings that combat the most extreme wear and corrosion environments imaginable. The adoption has been rather organic, where one successful use case breeds five more potential applications. Our mission as engineers has been to educate the decisionmakers and designers about the technology, which sometimes seems to be one of the industry's best-kept secrets. The issues of wear and corrosion, which are

common to other sectors, particularly those that incorporate ground-engaging equipment, have meant that other industries are starting to take notice and find uses for the technology. Mining, plastic extrusion, nuclear, defence, and aerospace are all adopting laser technologies on an ever-increasing scale.

Another industry segment that has recently started to experience significant uptake of laser cladding is the agricultural sector. Entering this industry has been quite a pivot because it involves much higher volume manufacturing with tighter profit margins. It has been a tremendous challenge to streamline our processes to meet the demands of this new target market. Similar to drilling deep into the earth, farmers also deal with extreme wear and tear as they prepare their fields and harvest a wide array of crops. We have received great feedback from our clients on the performance of Apollo's laser-based coatings in service worldwide from Europe to Australia. We envision this demand to grow as more people see the benefits of protecting and repairing their equipment with the power of lasers!

CWB: Tell us a bit about active and future projects.

GW: Apollo is always looking to push the boundaries and find new uses for laser materials processing applications. We have several research projects underway with various companies in different industries trying to address specific needs. We are currently attempting to use a combination of laser cladding and laser heat treatment technologies to repair and enhance locomotive train wheels. The customer would like to add material and refurbish these wheels quickly and efficiently as the need for repairs arises. Laser heat treatment may also provide some opportunity to tailor the surface performance of the wheel without adding material, only altering the structure of the steel exposed to the laser beam. These technologies are currently non-existent in the railway industry, so we have teamed up with our friends at the Canadian Centre for Welding and Joining at the University of Alberta to find the best solution.

Apollo is in the initial stages of testing laser cladding technology as a viable repair technology for Nickel-Aluminum-Bronze components used in marine applications. These materials are used in Canadian vessels for a variety of specialized equipment from process piping to pumps to even propellers meaning that the successful demonstration of laser cladding in this area will send shockwaves through this industry. Early trials and metallurgical testing have been extremely promising, and we look forward to showcasing these results in the near future.

On the heavy R&D side, Apollo is working on an international project supported by the federal National Research Council Industrial Research Assistance Program (NRC-IRAP). The project is called Artificial Intelligence and Process Sensing for Laser-Based Additive Manufacturing (AI-SLAM), which is a fancy title for using machine learning and state-of-the-art sensors to use laser cladding for metal 3D printing. The opportunities for this project are immense, and the team includes some powerhouse players such as McGill, the NRC, and German partners at Fraunhofer ILT. Apollo plays a vital role in the project as the industrial end-user of the technology, focusing on addressing the mining industry's needs in Canada by the end of the three-year endeavour. This list only scratches the surface of our active projects. Still, it paints a picture of Apollo's capabilities and the exciting avenues to deploy our high-end technology. Creativity and adaptability have been our strengths in finding these exciting new applications.

CWB: In speaking about state-ofthe-art technologies being used at the organization, can you give us more insights into what technologies are available at Apollo-Clad? What products and services do you provide for the benefit of the industry as a whole?

GW: Laser cladding for hard facing and corrosion protection is the leading service we provide at Apollo-Clad, but lasers are flexible and provide a host of other manufacturing capabilities. When you think of welding, you automatically think of joining two different materials, but with laser cladding, the purpose of welding is to apply the same or different material as the coating. For example, if you need your component refurbished, often, only a feature of the component needs repair. With laser cladding technology, there is an option to localize the repairs to the part that needs it. Plus, you can minimize dilution (mixing) with the base metal and maintain the integrity of the component as a whole.

What a laser can do has primarily been influenced by how much power you can output - an equivalent to the larger current capacity in a welding machine. As it stands today, Apollo has equipment with up to eight kilowatts of power; but we are investigating opportunities to step that up to the 20-kilowatt range. To put that into perspective, the military uses between 50-100 kilowatts to shoot missiles out of the sky. With the power of one-tenth of a missile defence system at our disposal, we can do quite a bit! As higher laser powers become available, laser cladding becomes more viable in terms of deposition rates. Productivity scales nicely with power, and we anticipate that as a result, laser technology will become more competitive with traditionally higher deposition rate processes like Gas Metal Arc Welding (GMAW) and Plasma Transferred Arc Welding (PTAW).

From a cladding perspective, we offer a variety of material solutions for wear and corrosion applications. From nickel-based superalloys to stainless steels to even custom alloys, Apollo has the capabilities to tailor the final product to the application. This is one of the benefits of having three Ph.D. metallurgists on staff. We love to tinker with the materials! We also use the





lasers for heat treatment, welding, cutting and surface alloying. Laser heat treatment is a great option for locally modifying the material's surface properties by exposing it to the laser beam. The rapid heating and cooling results in a locally hardened region (material dependent) that gives you the performance in targeted locations while keeping the properties of the bulk unaffected. The cost potential here is quite attractive as it does not require any additional material to be added.

Laser welding is a great option for high-quality, repeatable welds, provided that the part preparation is near perfect. Machined components for high volume production are a go-to for Apollo's laser welding technology, where we increase the laser power from melting the surface for cladding to deeply penetrating keyhole mode welding. This process is fast and minimizes the heat input to the surrounding material due to the pinpoint focus of the laser, but it can be a challenge to start and stop the weld. Certain materials are prone to cracking due to the extreme heating and cooling rates of the process, so it is not without its challenges. Although not the primary method for Apollo-Clad's business now, more laser welding opportunities are presented every day, from welding locally manufactured pressure sensors to tubes that are integral components of oil and gas separation processes. Laser welding will continue to

make in-roads into the welding industry for its host of benefits I've described combined with the shift towards automation that is transforming the industry. Laser cutting and laser surface alloying are also present at Apollo-Clad, but only in minor research capacities – capabilities looking for the right application.

CWB: What advice would you give to the younger generation hoping to enter the industry?

GW: My number one piece of advice to anyone looking to enter the industry is that you need to find something that excites you. For me, that was welding with high-powered lasers; there was an immediate draw to something that sounded so much like science-fiction. It has been excitement that has continued for over 11 years. I still love going to work every day. Finding something that doesn't feel like work and is something you enjoy; that's the secret to a successful career. I fell in love with lasers and welding, and it's a profession that I can see myself in for a long time. Your enthusiasm and passion for what you do every day will carry you through.

CWB: You are also the Chair of the National Advisory Council. What motivated you to get involved in the CWB Association?

GW: Involvement in the CWB Association has directly helped advance my career. I believe that my participation in extracurricular activities and CWB events have helped fuel my passion for the Canadian welding industry. The Association serves as an essential avenue for our community of welding enthusiasts to interact and learn from one another. I was honoured to be asked at the age of 29 to lead this group, which has taught me so many valuable skills and allowed me to meet so many amazing people. I have developed lifelong friendships, which have enriched my life. I am grateful for the responsibility and look forward to continuing to serve for the next two years. I remain motivated to participate in our Association as a small way to give back to an industry and an organization that has given me so much. I believe in the Association's mission to educate the next generation and advocate for the welding industry. The future is unquestionably bright, and I want to thank everyone as part of our individual chapters across the country who work so hard to make it such an outstanding volunteer organization to be a part of.

We want to thank Gentry for agreeing to participate and educating us on the current capabilities and exciting future of Apollo-Clad as part of Apollo Machine and Welding Ltd. We can't wait to see how they will make high-powered laser technology shape the future of welding and manufacturing in Canada!

▶ Rhea Gill, Communications Lead, CWB Group