CNC ROBOTICS LTD
MANUFACTURING EVOLUTION

CNC Robotics is the UK's leading integrator specialising in the use of robots for advanced robotic machining and additive solutions. To enable customers to realise even more efficiencies and provide cost effective solutions they have introduced a range of standard extras to its robot machining systems. After undertaking several hundreds of projects, CNC have identified and developed the options based on the items most frequently needed by clients.

Some years ago, we introduced a small-scale plug-and-play robot system for manufacturers that are taking their first steps into automated manufacturing, explained Jason Barker, Chief Technology Officer at CNC Robotics. These cells are pre-programmed to do one singular function such as trimming or drilling and offer the benefits of machining with robots as easily as possible. Our new range of extras allows these standard solutions to progress into more complex operations.

They also provide a useful introduction into some of the issues that need to be addressed when developing a system. In the same way that using machine tools requires choices of tooling, software, work holding etc, as well as buying the machine, machining with robots involves much more than adding a spindle onto a robot arm.

The first of the new options tackles one of the most common issues the ability of the robot control to cope with the large file sizes of programs for machining, in comparison with those for simpler types of automation such as pick-and-place operations. Splitting the toolpaths into shorter sections that can be drip-fed to the robot control adds to programming times and limits the time that the system can run unsupervised. The software option from CNC Robotics overcomes the problem by providing increased tool-path capacity allowing much larger files to be processed in one operation.

Another possible issue for manufacturers is access to sufficient tooling options for more complex parts. The standard CNC Robotics systems each come equipped with a tool crib capable of holding eight tools. However, many robot controls, including those from KUKA, are capable of storing data for up to sixteen individual tools. Adding a second tool crib gives increased flexibility to the system, allowing complicated projects to be programmed with the optimum tooling in all areas. For companies undertaking large numbers of one-off jobs, the extra capacity reduces the need to change the tools in the crib from job to job so saving downtime between projects.

As part of its work holding service, CNC Robotics can offer a unique vacuum matrix clamping system. This is based on a 10ft x 5ft matrix bed, within which the vacuum clamping can be adjusted locally to fit the requirements of the component. The kits are easily integrated within any new milling installation or can be added alongside an existing system. In the latter case, consideration will need to be given to current guarding and functionality.

Milling kits from CNC Robotics provide all the equipment needed to convert an existing robot for machining applications. Ideally suited to customers wishing to upgrade an existing robot, rather than

buy a completely new system. The kits include the spindle, mounting plate, cabling and control cabinet, as well as the opportunity to add onsite commissioning.

When upgrading robots, there is often a need to increase their capabilities with additional axis options. CNC Robotics is a leader in providing external rotary-axis solutions, in particular for KUKA industrial robots. Only motor gear units from KUKA are used to maintain quality and consistency of operation.

As the benefits of using composites become more valued in many diverse industries, the industry needs to boost production significantly. Jason Barker, Founder and Chief Technical Officer at CNC Robotics, believes that a wider use of robots across many areas of composites manufacture can generate increased productivity and also improve consistency and quality.

The key benefit of robots is their flexibility. They can be used at many stages in a manufacturing process, including braiding textiles to form reinforcement, the production of models, patterns, moulds and fixtures, and for trimming and drilling composite parts. Depending on the volumes required, one robot can be fitted with different accessories to undertake a variety of operations or a series of robots can be used with each one dedicated to particular tasks.

They are also, in many cases, more cost-effective than machine tools, typically costing around half the price of a machining centre with a similar working envelope. The superior rigidity of machine tools does allow them to work to higher levels of precision and to cut harder materials. However, robots are capable of processing most materials used in composites manufacture and of working to the levels of accuracy required normally.

While robots are being used successfully for the production of all of the different types of tooling used in the industry, their use in the finishing of components usually offers the biggest benefits. Tooling often only needs to be made once, while many hundreds of parts might need to be finished. Most composite parts require trimming and drilling after they have been formed. Robots can usually match the performance of machine tools for these tasks and their flexibility offers major advantages.

In cases where a few simple operations are needed, it can take as long to load and unload each part as it does to process the part. A robot can be equipped to place the part on the fixture, check that it has been positioned correctly, carry out the drilling and trimming, and place the part ready for its next operation. Thus, it can remove tedious manual work and improve consistency, as well as driving up productivity.

With more complicated operations, the multiple degrees of freedom of the robot mean that it can trim and drill more complex components in a single set-up than even a five-axis machine tool. In addition, robots can be made even more capable with the addition of accessories like rotating tables, while the size of part they can handle can be extended by placing them on rails. The latter approach is often the only way to process the larger items needed for wind turbines or for the marine industry. These accessories also provide a relatively inexpensive way of increasing the robot's capabilities as a company wants to take on larger or more complicated parts.

Programming robots used to be a major hurdle but that has been made easier thanks to the software now offered by leading CAM developers. The combination of the robot and the software gives the equivalent benefits to those gained when programming machine tools, including the ability to create toolpaths directly from CAD models, together with options to simulate and optimise the program on the computer. These options help to ensure that the robot will operate efficiently and

safely, giving the desired productivity and accuracy when moving from the computer to the shop floor.

For anyone still sceptical about the benefits of using robots for machining, CNC Robotics can provide multiple successful projects in the composites industry built over ten years' experience in installing systems for all types of application.

One of these projects was to provide Suprema Marine with a robotic system to aid plug manufacturing and enable model-making for each boat. The robot is capable of processing composites, including carbon-fibre reinforced materials, and plastics, meaning all trimming operations can be undertaken quickly and accurately with a single unit.

Suprema Marine's use of robots in machining is part of a broader approach to their use in automating specific tasks in boat building, including the application of gelcoats to fiberglass hulls and decks. As well as helping the company to produce an affordable yet high quality yacht, the introduction of this robotic system frees up the Suprema Marine team from one of the messiest steps in the production process. Using robots to undertake laborious tasks like coating allows the company's highly skilled staff to focus on producing the exquisite interior details for which Suprema Marine is renowned, explained Jason.

Although the workboats built by CTruk are totally different from Suprema Marine's luxury yachts, the company approached CNC Robotics with similar aims. CTruk needed to increase output to meet the demand for its products and was looking at ways to increase automation within its manufacturing process and to remove manual operations. Jason and his team designed a bespoke trimming and milling solution, based around a six-axis robot arm and track, that allowed CTruk to increase output, while also improving accuracy and consistency.

As well as introducing new systems, CNC Robotics also undertakes upgrades of existing equipment. This approach proved successful in a project for Linecross Group, one of Europe's leading manufacturers of polymer and composite products, with a diverse client base including luxury car makers Bentley and Aston Martin. We reviewed their existing equipment and looked to enhance and refurbish where possible to provide a cost-effective solution, remembered Jason. We replaced the robot arm and track system, and created a waterjet cutting and trimming cell that utilised some existing elements coupled with our latest technology. The upgrade provided additional capacity for Linecross, improved efficiency and increased accuracy.

As with other novel technologies, the key to the successful introduction of robots is having detailed knowledge of current levels of performance and clear goals to be achieved. Once we know our client's ambitions, we can ensure they are realistic at a reasonable cost said Jason. We can then develop a system to meet their needs.

Over the past ten years, CNC Robotics Ltd has established a reputation as a leading supplier of robots for machining applications, with customers in many manufacturing industries.

It has developed systems for a huge variety of machining processes, including milling, drilling, trimming, additive manufacturing, and general process automation to carry out packing and pick and place operations as well as for machine tending of conventional machine tools.

The Liverpool-based company has recently celebrated a milestone anniversary by undertaking a significant expansion of its robot-machining business. The company has added a second site near its Liverpool base and have recruited five extra staff.

The addition of the second site will enable a clearer separation of the company's business in the supply of standard cells for single functions, typically trimming or drilling, and its innovative R&D projects for more challenging applications.

Running both services from a single site presented several challenges, not just a shortage of space, explained CNC Robotics Ltd founder and Chief Technical Officer, Jason Barker. For example, we often needed to stop work on confidential projects while prospective customers were visiting to see our standard solutions. Having our innovative research on a separate site means that work can continue there uninterrupted. Equally, we now have room on our main site to keep a standard demonstration cell permanently on show for clients that need a plug-and-play system.

CNC Robotics 10 year anniversary

Along with the five recruits the management team was strengthened with the promotion of Philippa Glover to Managing Director and the addition of former Autodesk and Delcam Director, Bart Simpson, as the company's Non-Executive Chairman.

The expansion follows an increase in turnover of more than 30% during 2019, with CNC Robotics on course for even greater growth this year.

Alongside the general trend towards increased automation, there is a growing appreciation that robots can often provide a more cost-effective solution than milling machines for the large-scale machining of softer materials. CNC Robotics has seen rapid growth in the demand for its systems from both industry and higher education establishments. The extra staff will enable the company to meet that increased demand. They will also help to maintain the high levels of training and support provided to customers as the number of clients grows.

ACRIM-Wheel, the world's first commercially viable, low cost, lightweight, all composite wheel for niche and electric vehicle applications, moves to the next phase of development with the manufacture of fifty wheels by the end of the year.

Additionally, three full vehicle sets are destined for proving on MOTIVÂ, a unique and versatile autonomous mobility vehicle using Gordon Murray Design's iStream Superlight technology, and two sets of world-first overmoulded RTM wheels are headed for qualification testing.

The consortium delivering the wheel, comprising Carbon ThreeSixty, Far-UK, Composite Integration and CNC Robotics, alongside Bitrez Ltd as the preferred resin formulator, have completed the second phase of the programme development and validation of proof-of-concept ACRIM wheels which confirmed the feasibility of achieving significant cost reductions over existing global market offerings.

The work being undertaken will enable wider access to key lightweighting technologies for the lower volume niche automotive manufacturers. The product development consortium previously made a number of key findings, with a highlight being that the modular concept of ACRIM offers unrivalled flexibility in the styling and configuration of lightweight all-composite wheels. This puts it firmly on track to reduce the weight of, for example, a 15 wheel by 50%, which would deliver 5% fuel savings or a 5% CO2 reduction when retrofitted to a petrol or diesel fuelled vehicle.

For the next phase, which kicked off this summer, the consortium aims to decrease manufacturing cost and cycle time with a multi-strand approach. Avenues include processing of a three-component epoxy resin system with an in-mould release agent, piston pump technology to deliver repeatable

and higher quality lamination through increased control and monitoring of the preconditioning of resin prior to injection (metering, mixing, pre-heating and degassing) and a mould pressure closed loop control system to improve yield.

The production scale-up project also aims to prove that robotic machining can be sufficiently accurate and repeatable for secondary machining and final trimming, with fast and flexible operation that opens the door to reduced skilled labour content.

The product is evolving too the consortia are optimising the design of the part to minimum weight and cost with an automatic analysis of manufacturability, particularly CFD material flow. Linking these to analytical techniques will be a powerful step forward. It also plans to prove the manufacturing robustness of the novel overmoulding process for a high reliability structural component.

The modular concept enables the creation of wheels ranging from a traditional two-piece bolted metallic centre, albeit with a composite barrel (mature, low risk architecture) through to an overmolded all composite wheel.

Demonstration of SMC over-moulded centre into continuous fibre RTM barrel offers early indication of high volume capability and short route to manufacture. The ACRIM modular platform also enables a tiered approach to OEMs in specifying lightweight wheels depending on their appetite for disruptive innovation.

Lead project partner, Edward Allnutt, Managing Director at Carbon ThreeSixty, which specialises in the design and manufacture of advanced composite structures, said: The world's first all-composite wheel for electric and niche vehicles has moved a major step forward, and we can confidently say it has the ability to deliver huge cost savings over anything on the market. It can also be manufactured in volume and gives OEMs huge flexibility in what they can specify. This is truly a quantum leap in wheel design and manufacture.

Far-UK is pleased to see this project progressing. We are convinced that the skills of the consortium will help the project progress to a fully carbon fibre wheel that customers want to use for the weight saving and that makes good economic sense to use as well. Dr Kevin Lindsey, Director Far-UK Ltd.

The ACRIM II project is a great opportunity to demonstrate the benefits of using robots for secondary operations, including trimming and drilling, of composite components, said Philippa Glover, Managing Director at CNC Robotics. Robots can offer a more cost-effective alternative to conventional machine tools in these applications and so can contribute to lower overall manufacturing costs for these types of part.

Bitrez welcomes the opportunity to maintain our involvement as the preferred sub-contract resin supplier for the ACRIM II project, building on the successful collaboration as a full project partner in ACRIM I, where our custom formulated Epoxy system provided both the high performance and cost targets required by the project' said Dominic Hopwood, Resin Sales Manager Composites at Bitrez Limited.

Gordon Murray Design are pleased to be associated with the ACRIM II project. The focus of our iStream technology is vehicle lightweighting, particularly important for electric vehicles such as MOTIVÂ® and other autonomous driven platforms. The opportunity to evaluate commercially viable, lightweight carbon wheels will be invaluable for future projects' said Andy Smith, R&D Director at Gordon Murray Design.

The world’s first commercially viable, low cost, lightweight, all-composite wheel for electric and niche vehicles such as driverless cars, last mile delivery vehicles, road sweepers and next generation of agricultural vehicles could now soon be a reality.

Previously seen to be purely performance driven for racing and high-performance applications, lightweight carbon wheels are now being investigated by electric and niche vehicles and OEMs to further reduce fuel consumption, emissions, extend vehicle range and increase payload.