ISSUE 6 - MARCH 2020

AXIS

QUARTERLY NEWSLETTER FROM AUTOMATED SOLUTIONS AUSTRALIA

MEET THE ASA TEAM

FANUC CRX COLLABORATIVE ROBOT LAUNCH

HUMAN MACHINE INTERFACE TOOLS

ASA

FROM THE **DIRECTOR'S DESK**

Welcome to your first Axis Newsletter for 2020 and the first for the new decade! It's been a tough start to the year here in Australia, with bushfires burning across the country. Our thoughts are with all those affected, as well as those who worked selflessly to fight them.

In each quarterly edition of Axis, we challenge our Editorial group to provide you with interesting and informative articles across an ever-expanding cross section of the manufacturing sector, both here and abroad. Delivering great customer experiences is something I'm very passionate about, and I think you will agree that the Editorial team have delivered a broad range of interesting and relevant articles. We start by simplifying robot programming using a smart and functional Human Machine Interface (HMI) as we drive towards Industry 4.0. In keeping with this theme, we introduce the all new collaborative robot range from FANUC, featuring a new tablet interface with icons for touch control, bridging the gap between the programmer and robot. We also introduce you to one of our own, Anoop Khanna, and we recognize our greatest point of differentiation, our people. We dig into the real benefits of surface preparation specific to the Aerospace & Defense sector, as well as advances in overcoming force sensing and vision limitations in material removal processes. Finally, we dispel the myth about too many styles, and too many colors, as we examine a case in point for automated kitchen cabinetry painting.

We trust you will enjoy this edition of Axis, which we will share across social media platforms including LinkedIn and on Facebook. If you haven't already, be sure to follow us on Facebook at @ automatedsolutionsaustralia for even more informative articles, plus the latest industry news. We always welcome your feedback as we strive to be your integrator of choice!

On behalf of the team at ASA, we thank you for choosing to partner with us and look forward to keeping you updated on the latest advancements in automation, while servicing your needs, now and into the future.

Pat Green, Director

ROBOT IN **FOCUS**

FANUC CRX Collaborative Robot

The All New FANUC CRX Collaborative Robot Raises The Bar on Collaborative Technology

The all new CRX Collaborative robot from FANUC made its debut in Tokyo on December 18th at the iREX show. The CRX co-bot has been designed around three very specific core values, ultimate reliability, quick and easy setup, and ease of programming.

CRX Features

The CRX series of collaborative robots features two lightweight models. The CRX-10iA with a reach of 1249 mm, and its longer arm counterpart, the CRX-10iA/L, with a 1418 mm reach. Both robots feature an end of arm payload of 10 kg, and are designed for handling, assembling, and arc welding applications.

The sleek, modern design of this collaborative unit makes it completely safe to work side by side with employees. The new design is backed by decades of experience in the design and manufacture of robots with world-renowned reliability. It is built to the same uncompromising quality standards that customers expect from FANUC products.

The CRX units are sleek white, departing from the traditional FANUC green collaborative robot range. One of the key features of the CRX range of collaborative robots is the quick and easy setup. The lightweight and compact design allows for easy integration into any work area or existing system, and doesn't require a crane or lifting equipment to install.

To minimise the footprint of the unit, the CRX co-bot uses FANUC's latest compact R-30iB Mini Plus Controller, providing even more spatial savings to the customer.

Little to no programming knowledge is needed to program the new CRX Collaborative robot.

A key point of differentiation for the CRX is the 'lead through teach' programming, and a new tablet interface with icons for touch control. A 'tablet vs teach' pendant provides a familiar interface for those who haven't used a robot before, giving users a greater degree of confidence to create programs.

The CRX-10iA/L arm's swing motion makes it easy to access and pick up parts located behind the robot, while the unit easy connects to third-party grippers for a wide variety of applications. The unit also supports FANUC's intelligent robot features such as iRVision® and iRPickTool software.

Be prepared for a new level of reliability, ease of setup, and ease of programming in the collaborative robot space.

The CRX series of collaborative robots are scheduled for release in the second quarter of 2020.

RECIPE FOR **COMPETITIVE, QUALITY KITCHENS**

The race to produce quality cabinetry in a cost-effective manner has never been more competitive with cheap, low cost imported solutions flooding the Australian market.

As manufacturers attempt to combat this challenge, many are turning to flexible automation as a solution. Quite often, manufacturers assume robotics isn't a viable solution for them, as they have too many colours, too many variations, and too many styles.

However, the evolution of flexible automation, and the ease of programming, has bridged this gap for many manufacturers who are focused on providing their customers with an extensive colour palette, and several hundred styles and options.

A robotic solution allows for a quick transfer between paint colours

A robotic solution allows for a quick transfer between paint colours – industry averages suggest somewhere in the vicinity of 24 seconds to move from one colour to the next, depending on whether the paint is 1-component or 2-pac, and if it is the later, the location of the mixing equipment relative to the applicator (a determinate for the amount of paint that needs to be flushed out each time the colour is changed).

Depending on solvent compatibilities, the robots can be set up to apply a primer coat, which is then baked, and the parts are returned to the robot for an application of topcoat. With a correctly set up booth, only a minimal gap needs to be allowed for to prevent overspray between colours.

The flexibility of a robot solution, versus fixed gun automation, is the ability for the system to be able to orient to the necessary angles, or even allow for curved parts. Typically, with a fixed gun system, several guns are needed, mounted at various angles, to reach all of the areas of a door frame, and there are also limitations on size and shape of the product, and the ability of the system to apply paint to these areas.

These systems had very specific applications in large scale, high volume lines producing a very small range of similar products. A well-designed robot system accommodates for all these deficiencies, allowing for articulation of the gun to be at right angles to most surfaces, and at the same time, having a reduced maintenance requirement due to only a single gun being required.

Every time a colour change between doors or panels is required, there is the added saving associated with only a single gun needing to be cleaned versus multiple guns, so the costs associated with waste, and the waste generated at the point source of origin, is reduced.

Because the paint is targeted, the amount of paint that gets onto the part, is also higher, referred to as the transfer efficiency, further reducing waste and emissions from the process.

Without the need for a manual sprayer to be in and out of the zone constantly, there is a significant reduction in the levels of dirt and dust that are caught up in the painting process, so end users have typically experiences a significant reduction in the reject rate.

There is the added benefit that a correctly programmed robot, with application parameters such as paint viscosity, humidity and booth temperature held constant, can be your best painter, on his best day, all day, every day.

Advances in robot programming software, such as Paint Pro, mean that CAD can be used to program paths offline, whereas older systems typically required a significant level of downtime for path teach.

Newer generations of paint robots have also been developed with a specific focus on a reduction in floor space requirements by as much as 68% relative to their predecessors, lending itself to a similar reduction in booth air volumes and subsequent energy usage.

When considering a robot such as the FANUC P50 for a task such as this, the narrow forearm allows for easy manipulation around parts, while the wrist manipulation lends itself to extremely smooth playback. The fast axis speed and acceleration meets the needs to demanding cycle times and cast aluminium light weight arm requires a low power consumption relative to previous models.

With the potential cost savings associated with reduced paint usage, and the subsequent paint waste, the high uptime, highly efficient, high capacity painting solution that flexible automation offers cannot be ignored.

For those adaptive manufacturers who want to stay competitive, using a purpose-built paint robot, designed for an application environment with a small footprint and large work envelope, is the smart solution for those who want to not just exist, but thrive in today's marketplace.

1800 ROBOTS (1800 762 687) for 24 hours a day robot support:

Did you know Automated Solutions Australia has a 24 hour a day robot support number for our customers to call in the event of a breakdown?
The number is **1800 ROBOTS**

ROBOT PROGRAMMING FOR ALL **WITH HMI's**

There is ever increasing value in Human Machine Interface's (HMI's) that remove any perceived complexity for machine tool operators, when setting up and programming a robot cell.

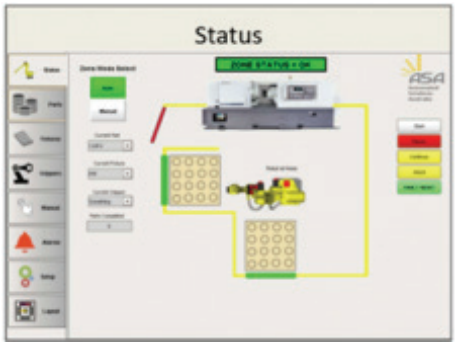
The Human Machine Interface, or HMI, provides a graphical representation that allows the operator to monitor the machine with simplicity and minimal robot-specific training. ASA develops bespoke interfaces for its customer base, across a range of machine tool brands. In this article, we will walk through one of these HMI tools and highlight its benefits and ease of use.

Fundamentally, to be really user friendly, a HMI should be intuitive, easy to use and useful. The use of multiple screens with consistent and standardised layouts and displays, along with clear information and navigational links between screens, helps to provide good visibility of the entire interface without being overwhelming to the operator.

ASA has embraced this design philosophy in the development of a functional and easy to use HMI for Machine Load and Unload. To really understand just how easily this HMI can be used to program and interface with a robot, we thought we would walk you through a nuts and bolts example of a user-friendly HMI.

Zone Status Display (ZST)

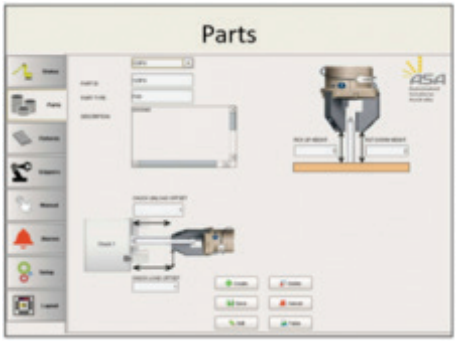
The Zone STATUS Display, or ZST, is the main HOME screen for the cell, and provides the Alarm Status, as well as navigation to the associated sub menus. On the right-hand side of the ZST, there is functionality to allow for the cell to START, PAUSE, CONTINUE, ABORT, and FAULT RESET remotely without having to use the robot teach pendant. The screen can be configured as a touch screen, or on a PC using mouse, depending on the User's preference.



ASA develops bespoke interfaces for its customer base, across a range of machine tool brands.

Parts Tab

Moving down the Sub-Menus on the left-hand side of the screen, the second menu is PARTS. This screen is the home for configuration of all parts, including the PART ID, PART TYPE, DESCRIPTION, PICK UP HEIGHT, PUT DOWN HEIGHT, UNLOAD CHUCK, CHUCK UNLOAD OFFSET, CHUCK LOAD OFFSET. Normally these items would have to be programmed by a skilled robot operator, however the HMI creates a much smoother transition of human to machine interfacing, even for those with little to no robot expertise.

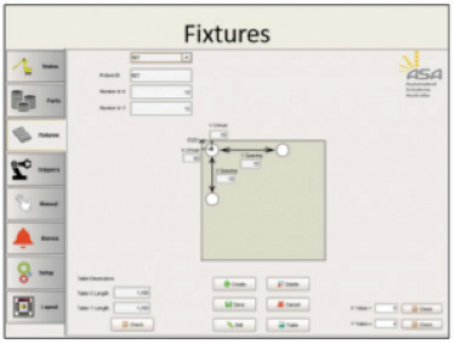


The User has an option of entering, editing and deleting any data, as well as setting CHUCK LOAD data where the machine is a twin spindle unit. On the SETUP Tab, the number of chucks that appear on the screen is configurable as 1 or 2, and the parts entered can be viewed from the TABLE button, which will provide sub-screen detail.

The TABLE button on the bottom of the PARTS TAB allows the User to see all of the parts, and their associated setup values in one place.

Fixtures Tab

The FIXTURES TAB allows the user to configure the fixture templates that align the parts on the pallets. The User enters the Fixture ID, number of units in X and Y Position, the relative X and Y offsets, and the X and Y spacing from the edge of the fixture. All of this data is then summarised in the TABLE. Pallet length, which is entered in PALLET SETTINGS under SETUP TAB, can also be viewed by accessing TABLE.



GRIPPERS Tab

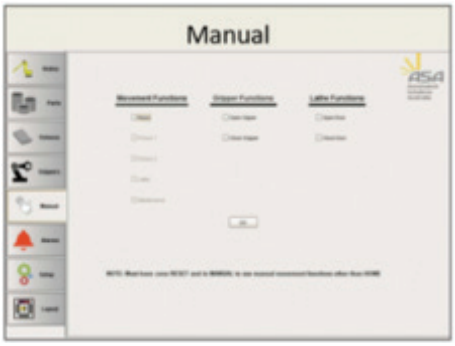
The GRIPPERS TAB allows the user to enter the GRIPPER ID, GRIPPER FINGER ID and DESCRIPTION into a table connected to database similar to PARTS and FIXTURES tables. The GRIPPERS ADDED to the system at any one point in time can be viewed from the Table button.

Continued next page

ROBOT PROGRAMMING FOR ALL **WITH HMI's**

MANUAL Tab

The MANUAL TAB gives the User access to Manual vs Automatic Control of the cell, primarily for robot movement and gripper functionality. Depending on the nature of the application, this screen can be customised to allow manual operation of the lathe functions to check the robot operation and feedback from the machine tool to the robot.



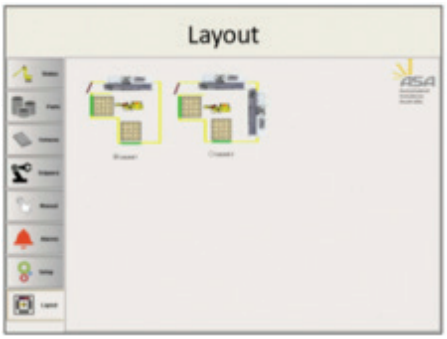
SETUP Tab

The SETUP TAB allows system settings and configurations to be altered. The NUMBER OF MACHINES can be selected, as well as the MACHINE TYPE (Brand), and then based on the number of machines, the number of associated CHUCKS can be entered for each unit. The MACHINE TYPE will alter the graphic on the main ZST screen, configuring it from a known array of loaded machine tools.

NUMBER OF PALLETS lets the User configure the respective pallet quantity, and below that, the dimensions of the pallet can be entered

LAYOUT Tab

The LAYOUT TAB provides scope for the cell to be extended to include alternate layouts for future cell upgrades, and things of the like. These changes are accommodated at the initial setup, to minimise add on costs in the future when changes are likely.



The SETUP and LAYOUT TABS are configurable to only be accessible with a password.

As you can see from the walk-through of this typical HMI, minimal direct robot programming is required, and through the use of a smart human-machine interface, the cell is configured and setup with relative ease.

Human Machine Interfaces can be configured as part of a new system or can be cost effectively retrofitted to an existing system.

Would a bespoke HMI make your day to day operations easier? Then please reach out to ASA on 1800 ROBOTS and we can design something to your specific requirements.

ANNUAL **ROBOT SERVICING**

Has your Robot had it's Annual Service? Call ASA on 1800 ROBOTS to book.

Just like a car needs regular servicing, the same applies to your robots. Your robots work hard for your business, sometimes operating 24 hours a day for long periods, so annual servicing of your robots will ensure your FANUC robots remain in optimal condition. Greasing, battery replacements, checking for excessive wear and measuring back lash ensure motion repeatability, as well as continuing to provide you with a great consistent outcome for your manufacturing processes. Annual servicing helps maintain a high level of Mean Time Between Failures (MTBF), as well as potentially forecasting issues that may be developing.

MEET THE **ASA TEAM**

In this Edition of Axis, we feature an in-depth look at Anoop Khanna, one of our Adelaide-based Paint Process Engineers.

Anoop won the internal "Top Gun" award this Summer for his efforts to go over and above in delivering great customer experiences, measured across the 2019 calendar year. His successes include featuring strongly in his peer reviews as a project lead and someone who customers continually request by name.

Anoop joined ASA in 2015, but he is no stranger to paint automation. Anoop worked for four years at GM India's Talegaon plant as the Deputy Manager in the Paintshop, and prior to that, he was the Quality Manager at Tata Motors. Anoop boasts certifications as an ISO/TS-16949 Auditor and is a Six Sigma Green Belt. Aside from paint experience, Anoop is also renowned for his culinary skills, much to the envy of some of his colleagues, who often set off the smoke detector in their attempts to rival his attempts to recreate last night's Masterchef dish.

On his most recent project for ASA, Anoop's programming skills and customer relations were recognized. Anoop developed cutting edge programming techniques for an extremely complex program to paint buses with over 5,000 possible combinations.

Anoop talks more about his work in automation and describes with more detail, his innovative approach to programming for an extremely complex application which can (and will) be used as a future platform for similar projects moving forward.!

What's your favourite robot to work with?

My favourite robot would have to be the Fanuc P700, as these robots are flexible and easy to program. The P700 has greater reach to the more difficult to access areas, resulting in better paint coverage and quality products, and making my programming job significantly easier.

What's been your greatest challenge?

There have been many – that's one of the things I love about this job. Each project is very different from the next and each project presents its own set of challenges. This gives me an opportunity to learn and grow. In this industry, change is a given. Almost each project has new technology, procedures and improvements that we need to keep up to date with. For this reason, one could never describe this job as monotonous.

What's been your most interesting project?

I would definitely have to say my last programming assignment designing automation for buses would have to have been the most interesting and challenge. We installed automation into a company which produces buses, and I was tasked with the design of the offline programming component in Adelaide. Initially the project sounded simple. A bus is essentially a rectangular shaped object. In reality, the bus is 100% custom and we rarely ever saw a bus which was the same as the last. A custom bus has the option of several different platforms, different size windows, quantity of windows, the order of windows, the location of windows and doors, AC units, brackets and a long list of other variants which can also be in a number of different locations. We used Data Registers and Position Registers, as well as almost every programming instruction available from Fanuc, and over one thousand lines of programming code to accomplish our goal to paint any of the bus permutations (and there are over 5,700).

We used logic (macros) to calculate in the background to work out length of the bus and each and every individual variant. We used Position Register Offset on Y & Rail to shift the path (pillars at this instance) from known fixed position (reference position) or Zero position (highlighted with Red line on bus pic below) , this reduced the amount of processes required as we work out all they are calculated dynamically while the program is running.

What's the best part of your job?

Travelling and explore different cultures. We are always on the move and travel to different countries where we meet different people who speak different languages and come from all different walks of life. We also get to experience all sorts of weird and wonderful foods and drinks. There is so much to learn and explore.

Favourite country you've worked in?

Argentina. This country never sleeps, there's always something going on. People are friendly, there is a multitude of different cuisine, and the capital city of Buenos Aries is beautiful.

THE BENEFITS OF **AUTOMATING MATERIAL REMOVAL PROCESSES**

As manufacturers struggle to overcome an apparent skills shortage, material removal is rapidly growing application area of robotics.

Once constrained to a few specialist tasks due to limitations in force sensing and machine vision, today's manufacturing environment sees a broad range of applications, from trimming flashing from plastic and aluminum moldings, removing moulding flash and edging material from carbon fiber products, polishing molds and dies and deburring edges following machining. While previously these applications relied solely on compliant tools, more recent developments such as force sensing control and vision have created the ability to handle variability in the position and size of the material that has to be removed. Force sensing provides greater control over cutting loads and the direction of the applied force, leading to more consistent and cleaner edges. In more recent times, the robot is used to articulate the part itself over the tool, versus the traditional method of a robot mounted tool. Whichever approach is used, the accuracy and path repeatability of the robot provides less variability across the substrate, irrespective of the die or machine they were manufactured in, overcoming one of the major hurdles for manufacturers – rejected parts due to inaccuracy and a lack of consistency. By applying the appropriate amount of pressure between the part and the material removal equipment, precise results can be achieved in every cycle.

This robot shown in the picture to the left is fitted with a force torque sensor. It is mounted between the frame of the end of arm tooling and the spindle so that the robot can "feel" the loads during trimming and deburring. The spindle has a tool change function which allows it to change between a range of tools using BT30 tool changers.

The most obvious advantage of robotic material removal solutions is the superior repeatability when compared to traditional means, however there are several other key advantages and flow on effects that need to be considered when evaluating the benefits of a system:

1. Accuracy and consistency in an automated material removal system results in a significant reduction in reject parts. The flow on effect is a reduction in quality related concerns, such as rework, scrap, or warranty concerns. Typically, when a customer finds a part that doesn't meet the tolerance, they will return the entire batch, so it is critical that these are reduced or eliminated at the point source of origin. The adoption of robotic vision provides real time error proofing to ensure proper process and product quality.

2. Another major advantage is the improvements in throughput, or speed. A correctly programmed vision and force sensing material removal system can reduce the production time significantly. A recent case study by ASA found that throughput was able to be increased by 50% over traditional manual operation.

3. The expense related with tooling consumables means that the tools wear at a much lower and more predicable rate, so the preventative maintenance costs associated in maintaining these items is further reduced.

4. Removing people from the process facilitates in a reduction in exposure to harmful fumes, dust, and repetitive tasks that can often lead to repetitive strain injuries such as carpal tunnel syndrome and vibrating white finger. At the same time, reducing human exposure also reduces the annual expense of Personal Protective Equipment (PPE) in the form of protective eyewear and earmuffs.

5. A further flow on effect of the higher consistency part-to-part is a reduced requirement for manual inspection labor.

The recent technological advancements in robotics have created a much more diverse application range for material removal. While the applications for automated material removal have grown, the benefits of implementing a system are sound and proven – precise results resulting in less scrap and a reduction of waste at the point source of origin, improved throughput, a reduction in consumables, reduced exposure for personnel to potentially hazardous working environments, and a reduction in the labor requirements for manual inspection. These considerations need to be carefully balanced against a business case for automating your material removal process to determine the total annualized rate of return on the equipment.

SURFACE PREPARATION
IN AEROSPACE & DEFENCE SUPPLY

Robotised surface preparation is synonymous with improved productivity and efficiency, but what does that really mean if you are a manufacturer in the Aerospace & Defence sector supply chain?

Surface preparation, specifically shot peening, assists in the correct preparation of a surface to avoid premature fatigue, corrosion, wear, galling and fretting which is vital for Aerospace and Defence suppliers.

It's not unusual to hear reports of higher levels of output, product quality and flexibility amongst the benefits of automation. This article looks at where those real savings can be achieved, at what cost, and how the benefits can be quantified.

Cost Benefits

The first and most obvious benefit in moving to a robotic surface preparation solution is a reduction in capital and operating costs, the latter being in the form of direct or overhead costs. Compressed air consumption is a case in point. Studies suggest that between 10 to 30% of industrial energy consumption costs go toward compressed air.

A robot fitted with a single blast nozzle can achieve an equivalent or superior finish for a fraction of the compressed air consumption compared to an automatic machine requiring six to eight nozzles.

Let's put that into real numbers. At our warehouse in Adelaide, we pay 36.46 cents per KWH for our electricity – some of the most expensive in the world!

For arguments sake, consider an air compressor which uses 7 KWH to generate 1 cubic metre of air per minute, or 0.198 KWH per cubic feet per minute (CFM). If for instance, the complex automatic machine uses 8 x 45 CFM nozzles to prepare the part, or 360 CFM, at the price we currently pay for electricity, this equates to $26.02 per hour of operation. Alternatively, a robot fitted with 1 x 75 CFM nozzle would cost just $5.42 per hour to run.

The electricity costs for this one application in a facility running two, eight-hour shifts, five days per week, for 52 weeks a year, would reduce from $108,232 to $22,548, close to an $86,000 saving per annum.

But, that's not the only direct cost saving – the media consumption used for the blasting is also dramatically reduced because of there is no cross firing of guns. The media used in shot peening varies from between aircraft fuselage and the hull of a frigate, but is generally cast steel, cut-wire, stainless, glass, ceramic or something of the like. For this reason, the cost saving on the usage of the shot is very application specific, but what isn't is the reduction in waste, which can be as much as 30% based on previous industry experience.

In addition to compressed air and material savings, the ancillary media reclamation system required for one nozzle versus six or eight is much smaller in scale, which has a flow on effect to other smaller screen classifiers, smaller shape classifiers, and smaller cyclone and dust collectors. The reduction in size and scale of this equipment results in a lower capital investment and a reduction in the required footprint for the application. Further to this is the obvious labour savings associated with robotising the application.

Improvements in quality and consistency

Another benefit of robotising a surface preparation is the improvement seen in the product quality and consistency.

Blasting steel serves to clean the substrate and produce an etched surface profile (anchor pattern) when the abrasive strikes the metal. The surface profile improves the ability of a corrosion prevention coating to adhere to the surface, and at the same time, it is designed to generate an even compressive stress pattern, eliminating microscopic defects in the surface of the parts – critical to aerospace applications.

Permissible stress levels for various materials are improved through the adoption of this process, increasing the overall life cycle of a product. Because of the nature of a repeatable robotic program, where target distances are maintained, and speed is used to minimise crossfire, a robot has the ability to generate a surface profile that is far more consistent in application measures such as Ra and Rz.

Furthermore, the optimal shot impact angle can be maintained and repeated, providing an even residual stress profile across the part that may otherwise have not been achievable with a manual application.

Reduction in downtime

Increased manufacturing uptime is another tangible benefit from robotic shot blasting.

Operators in a manual application are required to wear heavy personal protective equipment that can be stifling, and as a result, operators require significant rest allowances to meet occupational health and safety requirements. In comparison, robots can operate around the clock, and reduce the requirement for constant visual inspection of the part due to their inherent repeatability.

These factors greatly increase the uptime of the cell. Advances in offline programming capabilities for robot systems have also mitigated the need for excessive downtime between production runs, as parts can be simulated offline and new parts can be brought online without significantly impacting production schedules.

The manufacturing uptime is also higher when compared to fixed peening machines, which may need significant downtime between different types of parts for nozzle adjustments. The flexibility of running a robotic application means that there is a minimal amount of downtime between product changes, as the industry drives towards smaller batch sizes.

In conclusion, robotising surface preparation in the Aerospace and Defense sector provides a unique opportunity for manufacturers to reduce their operating expenditure, while improving their product quality and consistency. In the competitive world of surface preparation, robotic solutions are enabling manufacturing efficiencies that are once again allowing companies to compete with low cost overseas markets.

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- Find your competitive edge with increased reliability and quality
- Reduce System Downtime
- Decrease Process Cycle Time
- Reduce Labour and Material Costs

To learn more call us on **1800 ROBOTS (1800 762 687)**

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