GRAY MATTER ROBOTICS

WHITEPAPER

WHY YOU SHOULD AUTOMATE SANDING OPERATIONS

INTRODUCTION: THE NEED FOR SANDING AUTOMATION IN HIGH-MIX APPLICATIONS

MODERN MANUFACTURING RELIES HEAVILY ON THE PROCESSES BUILT AROUND HIGH-MIX PARTS.

ADVANCES IN MANUFACTURING PROCESSES AND MATERIAL SCIENCE HAVE UNLOCKED INCREASING VALUE AND EFFICIENCY FOR MANUFACTURERS WHO ARE ABLE TO INCORPORATE INCREASING VARIETY IN THEIR OUTPUT.

Unfortunately, material finishing, and sanding in specific, remain largely done by tool-in-hand human labor.

Millions of US workers daily use a largely undifferentiated and imprecise process for surface finishing, while effective automation has been technologically impossible - until now.

We would like to highlight several of the problems with the manual labor approach to high-mix part sanding, and how high-mix manufacturers can and *should* consider automated sanding as a *must-adopt* process to overcome these problems.

LABOR SHORTAGES AND TURNOVER IN MATERIAL FINISHING

A prime problem with tool-in-hand, labor-based sanding is the shortage of labor supply and short-term nature of such labor.

Often considered ”entry level” and non-expert work with limited career mobility, industrial sanding labor for mixed parts is in low demand for a labor market already in general shortage. As hard, challenging and dirty work for employees, high-mix manufacturers commonly see average sanding employee career spans measured in months instead of years.

This has a ripple effect – not the least of which are the high costs and lost productivity of using existing employees to train a constant flow of replacement workers. It can be the weak link that slows down the production cycle.

OUR RESEARCH AND ENGAGEMENT WITH AMERICAN HIGH-MIX MANUFACTURERS HAS SHOWN ANNUAL CHURN-RATES OF OVER 60% IN SANDING APPLICATIONS, LEAVING PRODUCTIVITY AND CONSISTENCY IN A CONSTANTLY DEPRESSED STATE.

This generally unpopular work becomes difficult to recruit for by reputation, with unusually expensive costs associated with sourcing, training and retaining replacement workers who are statistically more likely than not to voluntarily leave within a year on the job. An ideal remedy to this would be to introduce automated systems that could be used with the best employees in a process focused on high-quality finishing. The sanding could be done without the human hand, freeing up workers to instead focus on quality assurance, throughput process and very small ”detail work” on well-sanded parts. The integration of a smart automated system could stabilize these labor problems. A worker otherwise likely to quit after two months of hand-sanding could instead develop expert process and part knowledge over two years in a much safer work environment with real responsibilities shown through increased part quality and output.

MANUAL SANDING IS INCONSISTENT AND WASTEFUL

Aside from the sheer labor costs of running a short-staffed sanding operation, a powerfully negative second problem is the inconsistency of work output. Simply put, high-mix sanding is a task conducted by human hands and senses, highly dependent on intangible “feel” and muscle memory. Experience matters. Dexterity is developed unevenly over long periods of time. Even in the most experienced teams, the apprenticeship-like learning curve and methods of manual sanding can create wildly different outcomes in identically manufactured parts, which lead to high percentages of these parts needing “rework” (repeat sanding to make up for incomplete or botched sanding jobs) or being “scrapped” (disposed completely for the same quality shortfalls).

In a tight labor market with high turnover, a single new employee can repeat mistakes that are hard to catch, requiring enormous amounts of post-process inspection to rectify these mistakes. Root-cause analysis and quality control methods are difficult to execute in a revolving-door atmosphere - multiplying the time spent in quality assurance by many factors. Conversely, the loss of a single experienced employee and his/her singular knowledge base can be devastating to overall productivity.

IN A COLLABORATION WITH A FORTUNE-500 HIGH-MIX MANUFACTURER, WE CALCULATED THEIR TYPICAL PART GOES THROUGH THEIR SANDING PROCESS OVER FOUR TIMES ON AVERAGE BEFORE FINAL ASSEMBLY, WHEN IDEALLY ONE TRIP SHOULD BE NEEDED.

Another manufacturer estimates they scrap nearly 15% of their output to improperly sanded items before final painting and coating – it is actually cheaper to scrap these parts entirely than to process them for reworking. In some industries such as aerospace and advanced composites, the material and production costs of scrapping any parts can be unacceptably high.

The time and often material economic losses add up as a sort of “sanding tax” on mixed-part production, which could be avoided if a standardized and efficient automated solution sanded every part to an equally high standard. The reduction in time and waste could decrease costs by significant factors. A smart robotic cell could not only offer immediately higher quality but can give complete transparency into “how” it is sanding, making any adjustments or process improvements easy to identify and immediately enduring in their effects. The process learning is immediate, and the improvements are documented and enduring when operated by an AI-enabled system.

Consistency in high-quality sanding not only eliminates the aforementioned waste, it eliminates production bottlenecks and uncertainty, allowing for a much more nimble and scalable manufacturing output.

THE HUMAN TOLL OF SANDING OPERATIONS – ERGONOMIC CHALLENGES AND INJURIES

Often overlooked but ultimately most important, sanding is a hard job that is ergonomically and physically challenging for humans.

Involving unnatural human motions with heavy tools repeated hundreds of times a day, sanding is a potentially harmful task for labor in high-mix manufacturer. It requires highly protective PPE, which is difficult to wear for a full work shift.

RESEARCH HAS SHOWN THE SANDING TASK IS ONE OF THE MOST RAPID INDUCERS OF BOTH PERMANENTLY DAMAGING CARPAL TUNNEL AND HAND-ARM VIBRATION SYNDROME (HAVS) AMONG AMERICAN WORKERS.

Even the best PPE leaves some exposure to the dust and particulates left by sanding what are often irritating, toxic and carcinogenic materials. A day spent in strange postures and exertions can contribute to a number of soft tissue, back and orthopedic ailments that compound greatly over time. Sanding is hard on active workers and discouraging to potential workers.

Introducing automation into this process is about far more than just gaining efficiency - it is also critical to the safety of employees. A smart robotic cell can capture over 95% of the dust from sanding in most applications. It can avoid the collisions with parts or people that are common in high-fatigue work environments, adding a dimension of pre-programmed observational safety by monitoring and proactively stopping operations when conditions become risky. It allows workers to stay alert and focus on quality and throughput by eliminating the sources of fatigue. And over a short period of time, it exponentially reduces the exposure and development of the ailments that are all too common among surface finishing workers.

THE DIFFICULTY OF INCREASING SANDING OUTPUT TO MEET DEMAND

For all the reasons a high-mix manufacturer may want to increase their output, there remains no simple way to scale the sanding function quickly when so dependent on high-turnover labor.

Quick additions of sanding labor require enormous focus and resources, flooding an already deficient process with a wave of untrained employees. The quickly diminishing returns of adding “hard-sell” labor can not only be disruptive but can eventually be counterproductive as established space and process footprints are exceeded.

Spreading out this new labor over new shifts likely requires excessive financial incentives that could disrupt the established workflow and supervisory practices barely able to cope with normal production. Manufacturers are left with missed opportunities for profit and growth - due to the bottlenecks unique to labor intensive surface finishing as it exists today.

Smart robot cells, by contrast, can be adopted rapidly and easily with a minimum of upstream or downstream disruption in existing manufacturing processes.

CAPABLE OF SANDING 1.5X-4X FASTER THAN A HUMAN, ROBOTIC CELLS CAN WORK ANY TIME OR SHIFT WITH MINIMAL HUMAN OVERSIGHT.

Backlogs can be addressed outside of normal shift-times, as parts can be loaded, sanded at the press of a button by a robot, and moved to be processed at the next normal shift by a single person on an off-hour shift.

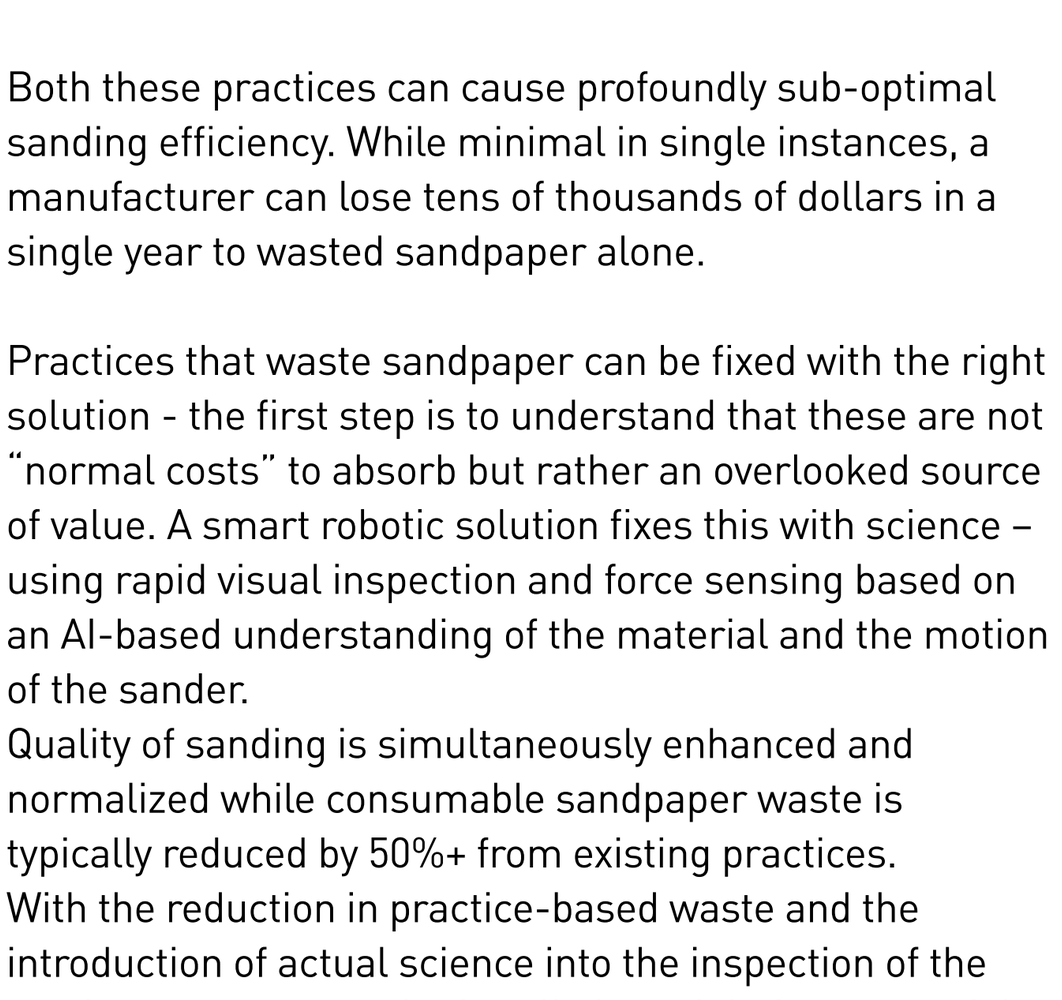
This automated capability can be installed and fully operational in less than two days without expensive up-front CAPEX commitments.

Equally important, smart robot cells do not require expensive or slow integration with other parts of your manufacturing process - it offers the benefits of automation with greater ease than hiring sanding labor.

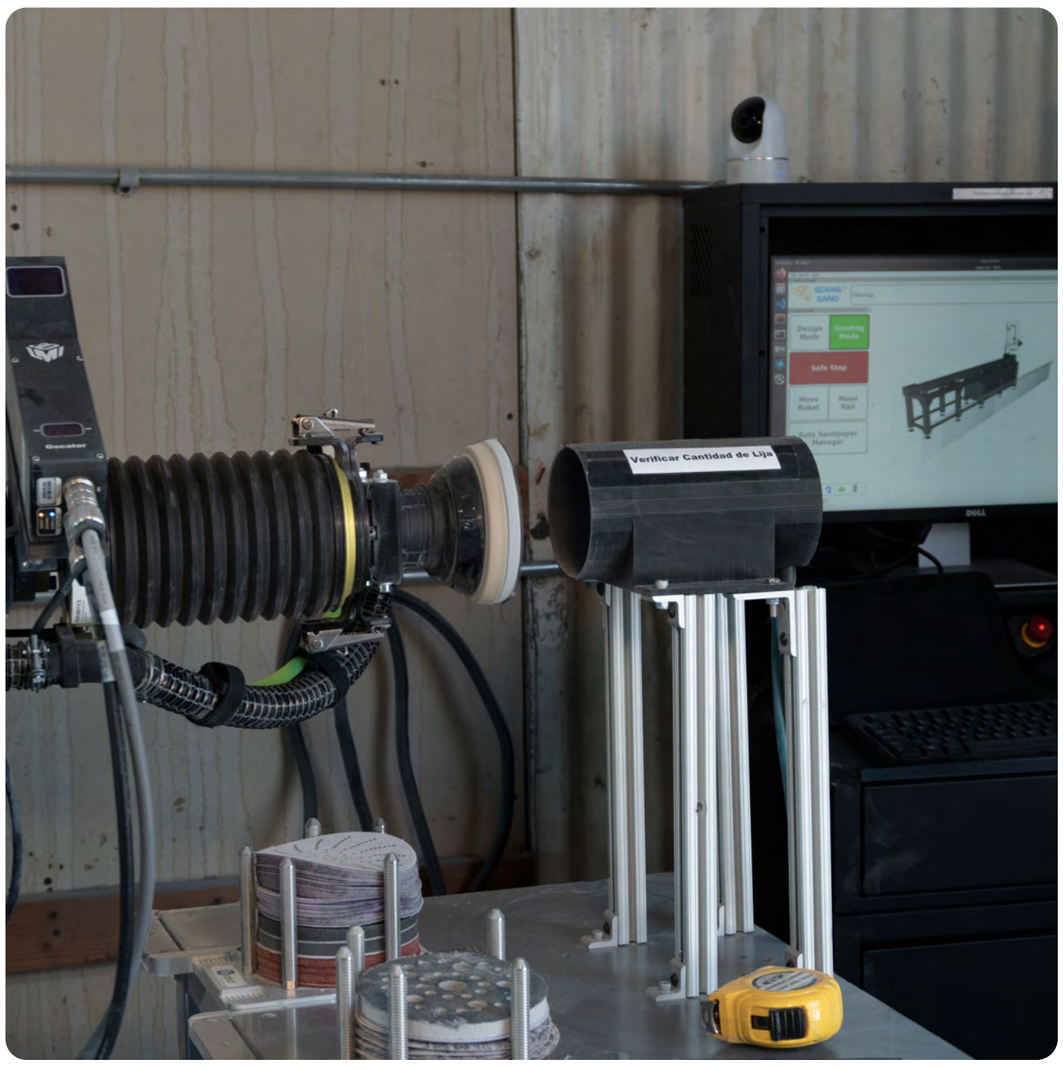
CONSUMABLE SANDPAPER IS WASTED IN UNOPTIMIZED SANDING FUNCTIONS

A significant problem that has been simply thought of as an “operational expense” is the waste of sandpaper used in the sanding task. We have observed companies spend tens of thousands annually on consumable sandpaper discs – and often have workers remove and throw them away with 90% of sandpaper life left.

There are two aspects of this phenomenon – the inability of a worker to assess the effective state of the abrasive grain of the paper, and the difficulty or confusion of “unloading” or removing the residue off a perfectly functioning piece of sandpaper after use. This becomes imbedded in a culture of work; the time penalty for disposing of sanding discs and replacing with a new ones is under ten seconds, the penalty for inspecting and testing them can be over a minute, whereas the penalty for reworking a part that was inadequately sanded on worn paper can be many hours after quality inspections. As a new sanding disc “always works”, we regularly see workers replacing their sandpaper when starting a new part or using unscientific “minutes-of-use” heuristics derived from anecdotes and muscle-memory.



Both these practices can cause profoundly sub-optimal sanding efficiency. While minimal in single instances, a manufacturer can lose tens of thousands of dollars in a single year to wasted sandpaper alone.



GrayMatter Robotics Scan&Sand™ Cell inspecting and changing sandpaper disc

Practices that waste sandpaper can be fixed with the right solution - the first step is to understand that these are not “normal costs” to absorb but rather an overlooked source of value. A smart robotic solution fixes this with science – using rapid visual inspection and force sensing based on an AI-based understanding of the material and the motion of the sander.
Quality of sanding is simultaneously enhanced and normalized while consumable sandpaper waste is typically reduced by 50%+ from existing practices.
With the reduction in practice-based waste and the introduction of actual science into the inspection of the sandpaper, a smart robotic cell also minimizes potential overuse, achieving far more consistent quality in the sanding process.

As the robotic cell is designed to inspect and change its own sandpaper autonomously in a minute (based on multi-sensor AI calculations based on the part shape and material), lowering sandpaper costs can also increase productivity and finish quality with a smart solution.

THE SMART ROBOTIC SOLUTION FOR SANDING AUTOMATION FROM GRAYMATTER ROBOTICS

Automating the task of sanding for high-mix applications would solve many serious shortcomings in dimensions of speed, cost and human quality of life.

Until now, introducing sanding automation in high-mix manufacturing was ineffective on account of technological shortcomings and high costs – leaving manufacturers no choice but to continue with labor-intensive inefficiencies and plan around them.

GrayMatter Robotics has developed a smart robotic cell that finally can address these shortcomings and can be used in a monthly service-based model for ease of adoption.

THE GRAYMATTER SCAN&SAND™ SYSTEM IS TECHNOLOGICALLY REVOLUTIONARY – IT PERMITS AN INDUSTRIAL ROBOT TO SCAN ANY PART IN SECONDS AND IMMEDIATELY START TO SAND THAT PART AT UP TO 1.5X-4X SPEED.

With this speed also comes a higher quality finish than provided by human tool-in-hand labor, with consistency in a completely observable and documentable processes. It fits in small spaces safely, runs quietly on electric power and can easily be moved and repositioned in a manufacturing environment. It can handle a high-mix workflow, solving for both variety and variability without the need for any prior programming.

It routinely catches 95%+ of sanding dust and enhances worker safety as part of an integrated electronic safety system - with the option of additional real-time remote monitoring. It inspects its own sandpaper visually and computes the performance based on active force sensing in the application (and is constantly teaching itself process improvements). And it is operated literally at the push of a button – empowering employees to focus on efficiency and quality while letting the robot do the difficult sanding work that can be dangerous for a workforce.

With a service-based operating model, using Scan&Sand™ is as easy as contacting us – no upfront costs are required. It is the solution to sanding automation that high-mix manufacturers can use immediately. With the right solution, automation of sanding is more than just possible - it is better. Better for the people who work for you, better for the quality of your products, and better for the bottom line of your manufacturing business.

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TO LEARN MORE ABOUT HOW GRAYMATTER ROBOTICS CAN SOLVE YOUR AUTOMATED SANDING NEEDS, WRITE US AT

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OR VISIT US BY SCANNING THE QR CODE:

WWW.GRAYMATTER-ROBOTICS.COM