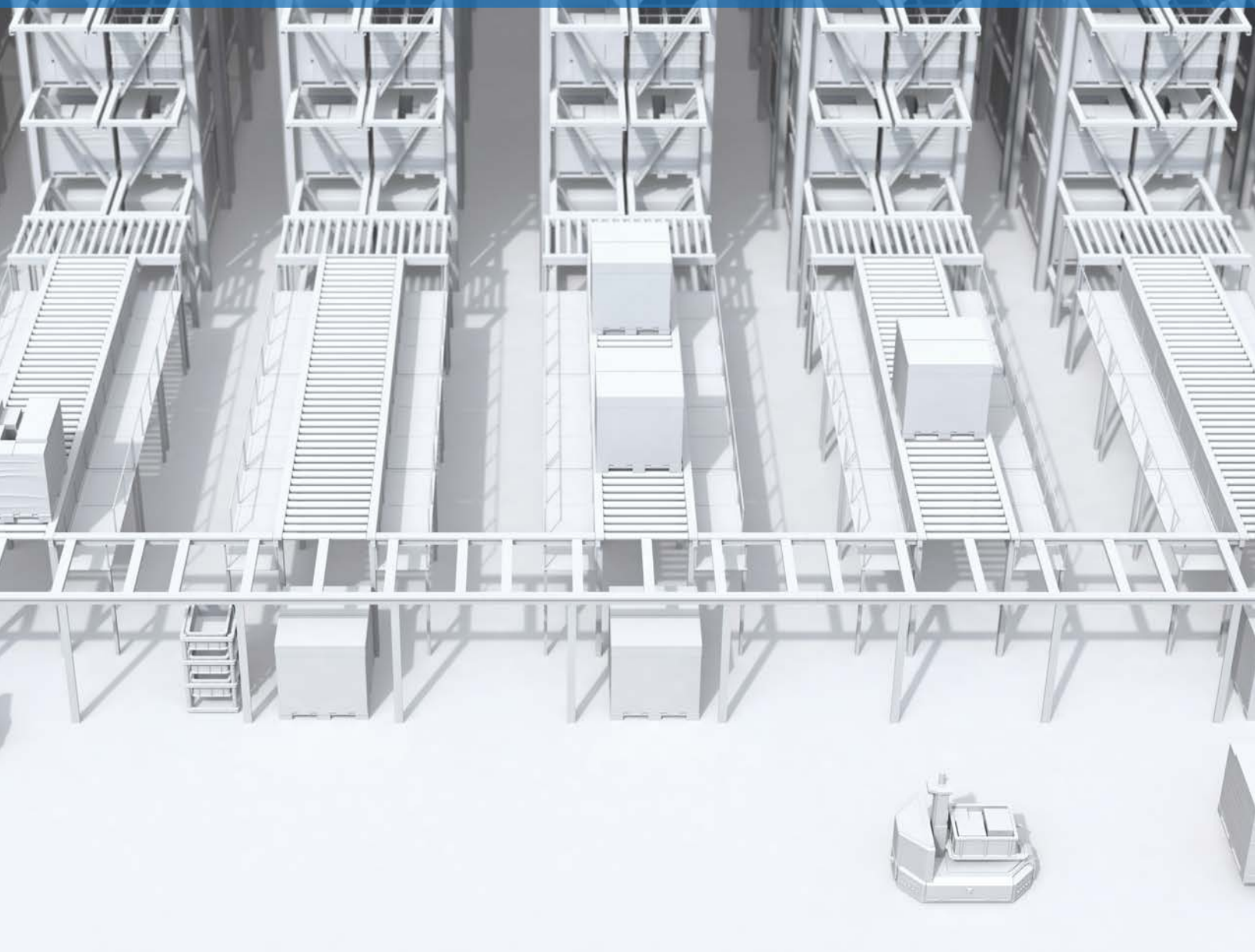
PEAKLOGIX

AN ALTA MATERIAL HANDLING COMPANY

WHITEPAPER

Operating through Automation: COVID-19 and the Greater Acceptance of Robotic Solutions



Many of the societal changes caused by COVID-19 are obvious. But less conspicuous are the teams of engineers, PhDs, and executives reckoning with the necessary changes that need to happen in material handling and logistics to overcome this crisis, and better meet the next.

2020 has been marked by banner headlines such as "There Aren't Enough Ventilators..." and "... Will There Be Enough Ventilators" and "...N95 mask shortage..."[1, 2, 3] Outside of the material handling industry, fewer are the headlines that discuss the changes in systems and infrastructures being developed to create a more resilient supply chain to better guarantee the availability of these medical necessities.

The run on toilet paper[4] in the spring of 2020 will likely be a joke for decades to come. The move away from offshoring – so-called 're-shoring' or 'onshoring' – to create a more nimble supply chain will likely make few headlines of major news outlets.

And while quarantines and lockdowns have made ecommerce and curb-side and in-store pickup ubiquitous, the changes in order profiles and the new demands they place on both distribution centers and retail stores have gone unnoticed by the public at large.

Dramatic are the changes COVID-19 has brought to order cycling, warehouse staffing, and even the layout and design of facilities that just 12-18 months ago were considered state-of-the-art. To meet these new and changing demands, businesses are looking for new, versatile solutions that allow them to meet the needs of both a physically distanced workforce and an accelerated demand for ecommerce.

Intelligent, robotic solutions to a 21st century problem

COVID-19 has done more than test the global market's capacity to manufacture, ship, and receive

key goods; it's shown us the fragility of our systems. At the close 2019, same-day shipping – and in some cases same-day delivery – of luxury items was considered an achievable, if problematic, pinnacle of material handling logistics.

For those companies that are most likely to lead their industries in the near future, the takeaway from the challenges caused by COVID-19 isn't that we need systems capable of handling COVID's particular complications. Instead, systems are needed to handle both the unique challenges of 2020, as well as future, as-yet-unforeseen challenges.

This need today, and the uncertainty of future needs, is driving CXOs across industries to accelerate their plans to invest in automation and robotics to better manage operations, despite facing revenue declines that will result from the pandemic, according to *Material Handling & Logistics*.

Physical distancing

Physical distancing has been one of the most effective and affecting tools in fighting COVID-19. While COVID-19 can spread through a community more quickly than influenza,[5] its manner of transmission is not unique. Solutions that address this proximate factor will be robust enough to meet similar challenges in the future.

There are two major tools facilities have in creating a physically distanced workspace – distancing by space, and distancing by time.

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Distancing by time

Increasing the physical distance between workers can be accomplished by decreasing the number of workers in a facility at any one time.[6] Many facilities have managed to accomplish this while maintaining their throughput by adding a second or even third shift, or increasing from five days/week to seven.

Further distancing can be accomplished with staggered start times. Instead of an entire shift beginning at 7 AM, some employees will be scheduled at 6:45, some at 7, and 7:15, and so on. By not having everyone show up at the same time, entryways and walkways are not as congested, making social distancing easier.

The role of automation in this process is to use the Warehouse Management System (WMS) to optimize the labor to the extent that start, stop, and even break times are appropriately staggered. By keeping busy areas such as lobbies and breakrooms free from crowding, physical distancing is better enforced.

Distancing by space

The more obvious way to gain physical distance is to design facilities, and implement solutions, that allow people the space they need to do their jobs without physical contact with coworkers.

Some automated solutions have this baked into their designs already. In order fulfillment, many goods-to-person systems employ picking and packing stations, for example, in which goods are brought to the worker with no interaction with another person. Such systems include:

- Vertical Lift Modules,
- Horizontal and Vertical Carousels,
- Shuttles and bots,
- Unit- and Mini-load AS/RSs, and
- Micro-load Stockers.

These kinds of goods-to-person systems don't only prevent contact at the pick site or packing station. By reducing the need for human labor to move through a facility, you eliminate many potential sources of contact.

Many facilities, needing to gain the benefits of a goods-to-person system but also faced with the sudden demands of COVID-19, have had great success with Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs).

These units are both relatively quick to integrate into a facility's existing processes, and easy to reprogram once installed. They move through a facility more or less autonomously with an array of sensors that allows them to avoid obstacles – including people. And they have been engineered in a variety of forms and with a variety of tools, to meet nearly any need.

For example, as COVID-19 ramped up in the spring of 2020, some hospitals were able to use their AGVs to deliver pharmaceuticals and other necessities to doctors, nurses, and even patients. Many manufacturers and distribution center also reprogrammed their fleet of AGVs to accomplish tasks such as passing tools and other goods between workers.

Contact tracing

In addition to physical distancing, another key component of responding to the novel coronavirus – or any virus – is contact tracing.[7] Contact tracing allows people who may be recently infected to limit the spread of the disease, to get tested even before they may themselves become infectious, to seek help early enough for it to be effective, and to protect those most vulnerable to the disease by keeping apart from them.

In Europe and especially in the United States, legal concerns regarding privacy, a lack of trust regarding the government and technology companies, and a strong belief in individual rights makes contact tracing in the general public difficult.[8, 9]

However, automation eases these concerns by baking contact tracing into a facility's business model as a routine part of operators' everyday tasks.

First, as a key part of the Internet of Things and the Internet of Everything within a warehouse, one role of the WMS is to improve efficiency by tracking the location throughout a facility of every piece of equipment and each item. This includes equipment in use by operators – such as pick-to-voice or pick-to-light technologies that are worn on the wrist, forklifts and other heavy machinery, or robots such as AGVs or AMRs that work collaboratively with people.

Because these machines and their operators are directed, and their progress tracked, by the WMS, their locations relative to each other are already known, and all possible contacts between operators can later be traced.

Second, goods-to-person systems using pick stations, for example, eliminate the need for operators to walk the floor hunting for items. This means they don't come into contact with other employees as a routine part of their job, which makes it easier to limit their contact.

Third, by using automation to shuttle items between people – as opposed to handing the items off in person – contact between operators can be minimized. This can happen with something as simple as a conveyor belt, or as complex as a fleet of AGVs.

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> **In a distribution center, building trust in operators is a key step in the acceptance and proper continued use of automation.**

Onshoring and product buffering

Before COVID-19, many of the tools of Industry 4.0 were focused on maximizing efficiencies, which meant in part focusing on global value chains.[10] Costs were lowered through just-in-time inventory – materials from across the globe were received just as they were needed, which helped lower the costs of storing and maintaining high inventory counts.

In a post-COVID world, however, the global supply chain of 2019 has been shown to be insufficient. Today, some of the tools of Industry 4.0 – including Artificial Intelligence (AI) and machine learning – are being geared not toward increasingly lean systems, but more toward increasingly resilient system.[11]

As noted in the paper by Rapaccini, et al, four key components of a resilient system are preparedness, agility, elasticity, and redundancy.

In the context of manufacturing, a more resilient system in many cases means creating flexible redundancies[12] such as maintaining higher levels of stock, staggered closings of borders to match needed mitigation of the outbreak, and onshoring or re-shoring – bringing the operation from overseas so that it is more closely located to the customer base. This will allow for demand to more easily be met when global supply chains are disrupted.

In the context of order fulfillment, more resilient systems will have less focus on just-in-time inventories, particularly in the case of medical supplies, foods and beverages, pharmaceuticals, and consumables such as toilet paper, paper towels, and hand sanitizer.

Instead, organizations will work to maintain a buffer of product.

To handle this changing demand, systems will need to be well designed, with an increased focus on the use of machines for non-value adding, high-risk tasks. Jobs such as palletizing, restocking, and even sanitizing can all be done robotically, and carry risks to employees of injury or infection that don't apply to automation.[13]

The need to focus AI on inventory controls, however, can't be overstated. In March of 2020, for example – a time when hospital staff across the United States were desperate for medical supplies – 1.5 million N-95 respirators were found to be sitting out of date in a warehouse in Indiana.[14] While reports didn't specify any fault, it's easy to imagine their being placed in that warehouse with an out-of-date, paper-based system, and then forgotten.

That's the kind of mistake that inventory control systems don't make.

High Density Solutions

Among the issues that will be found with buffering product and re-shoring is the need to store items more densely and efficiently than ever before.

Facilities that store small parts or eaches will benefit from automation such as Vertical Lift Modules. These are enclosed systems in which items are stored on columns of shelves. An inserter/extractor operates between the columns to store and retrieve product automatically. As items move to storage, the height of their tray is scanned. The system then maximizes use of space by fitting each tray in the smallest possible slot.

Mini-load Automated Storage and Retrieval Systems (AS/RSs) are also often used for small parts or eaches. Two aisles of narrowly spaced racking comprise Mini-Load AS/RSs. A Storage and Retrieval Machine (SRM) moves between the aisles in two dimensions, at rates of up to 100 cases per hour per aisle (use depending). These systems typically handle items smaller than 100 lbs.

Vertical and Horizontal Carousels have been shown to save up to 75% of the floor space over traditional racking systems. These systems move like Ferris wheels or lazy Susans, moving shelves either vertically or horizontally to bring items to operators at a pick face.

In large systems that demand high throughput and tremendous accuracy, Unit-load AS/RSs are perhaps the most efficient and accurate means of storing product automatically. These systems are composed of narrowly spaced aisles that can be as tall as 100 feet. Product can weigh as much as 5,500 lbs.

Goods-to-person solutions such as these are not only able to store items more densely than traditional racking, but they are also both more efficient and accurate than traditional picking. When combined with technologies such as pick-to-light, something like a carousel-based storage solution can increase a picker's accuracy by as much as 99.99%.

These high accuracies are a necessary component of e-commerce, in part due to the problems of reverse logistics.

Reverse logistics

Ecommerce has always had a high rate of returns– as much as 50% in some markets.[15] At the same time, post-purchase factors, including returns, are an essential component of retaining a customer base.[16] COVID-19 has changed consumer habits. That consumers are unable or unwilling to visit retail stores means they are engaging in ecommerce more than ever.

This hasn't slowed the rate of returns. If anything, we should expect a higher rate, as consumers new to the market learn how to navigate that space. Handling this high rate of returns efficiently is as crucial as it is difficult, time consuming, and costly. Perhaps the greatest challenge is proper sortation. By its nature, the reverse supply chain is most often single units. Very often, they are clothing, shoes, or apparel accessories, and they have to be sorted between their various sizes, patterns, and materials. They may be damaged or returned incomplete, and they may have missing or damaged identifying tags. A single best solution has eluded the industry.

Nevertheless, the efficiencies and accuracies that automation brings to this environment will play a crucial role in handling the increased demand for reverse logistics.

Automated barcode scanners, combined with sortation conveyors and a robust WMS, form the basis of an effective reverse logistics platform. Returned items entering the facility are scanned and sorted automatically, according to the information the WMS has on file for the return. This allows them to be sent for repackaging, or to a claims area for damages, before the need of an operator's intervention.

Throughput

One paradox of the COVID-19 pandemic has been the increased demand placed on operators in distribution centers and warehouses, while at the same time calling for people everywhere to be physically distanced.

Online retailers have struggled to keep up with demand, and have in many cases reportedly failed to follow social distancing guidelines.[17]

To reach the critical mass of operators needed to keep a facility running and its employees safe, many organizations are either turning to automation for the first time, or are escalating its use in their facilities.[18] In extreme cases, some facilities are going "dark" – operating wholly autonomously, with no human interface.

Most analysts, however, predict that the role of robotics will not be to completely replace a human workforce. Rather, robotics and automation will supplement a human workforce in strategic ways.

A simple example in manufacturing would be a robotic arm capable of spot welding. To increase this machine's throughput means adjusting its controller – essentially, reprogramming it to perform the same tasks at higher cycle times.

Adjusting cycle times of a robotic workforce can address issues of work shortages and a physically distanced workforce. However, what a robotic welder can't do is be reprogrammed to do anything other than weld.

Task-specific machines such as welders – or, in material handling, AS/RSs, sortation conveyors, barcode labelers and scanners, etc. – still have their place in their industries. However, the greatest demand that COVID-19 has brought is for systems with a high degree of versatility.

Because AGVs and AMRs, for example, are able to move more or less freely, they are highly versatile solutions. An Automated Guided Cart (AGC) that was originally programmed to shuttle raw goods from inventory to a work station can easily be reprogrammed to move items between operators – allowing them to maintain their social distance. AGVs and AMRs are also being deployed as front-line sanitizers.[19] Sanitizing and disinfecting problematic areas – such as break rooms, lobbies, or door handles – is known to be a high-risk task for human operators. Programming a collaborative robot (cobot) to first disinfect these areas with a strong UVC light allows a person to more safely follow-up with disinfectant wipes for those areas the UVC light couldn't reach.

Trust, acceptance, and continued use

One critical factor in implementing automation is the trust the workforce and end-users have in these systems. Yamani, Long, and Itoh discuss research regarding the trust people place in automation, highlighting three factors: predictability, dependability, and faith. Their research underscores the need to show users and stakeholders how and why automation works.[20]

This understanding is a crucial step in developing trust in automation, which is needed for its acceptance and continued use.

Other critical factors brought to light by Yamani, Long, and Itoh include perceived risk and user workload. Users must familiarize themselves with the machines, understand their need and how they help, and finally have any fears allayed.

In ecommerce, for example, customers must understand how the cobots they interact with at in-

store pickup sites work. They need to know the steps taken to keep them safe from any perceived threats– such as the spread of COVID-19. And finally they must be given the chance to familiarize themselves with these machines.

This might look like a retail store having an online tutorial to explain the process, its need, and all of the precautions taken. At the pickup site, having trained staff available to answer questions and guide users through the experience will further help develop that trust and continued use.

In a distribution center, building trust in operators is a key step in the acceptance and proper continued use of automation. Bringing operators to a facility where they can practice with the machines they will use will allow them to familiarize themselves with the machines, and begin the process of building trust.

Trusted automation improves performance

While there is some debate about the need for distribution centers and warehouses to become fully automated, most industry leaders expect few facilities to go "lights out." Most facilities will still need people to make decisions and perform operations that computers and machines can't. Tasks, rather than entire operations, will be automated.[21]

What is clear is that leaders in almost every industry are ramping up their use of automation, and are looking for solutions that are versatile enough to help them steer through the current crisis, and possibly also meet the next.

Finding solutions that enable employees to maintain the recommended physical distance, that can trace contacts between possible sources of infection, and that can also maintain or even increase throughput, is crucial.

No matter the solutions employed, acceptance by the end user – the operator or customer – is equally crucial to the system's continued and proper use. Implementation of automation must include real-world experience and training – two key drivers in developing trust in these machines.

About PeakLogix

PeakLogix, an Alta Material Handling company, is a leader in material handling, excelling at making manufacturing facilities, distribution centers, and warehouses more efficient and more profitable by streamlining operations. PeakLogix specializes in concept design and engineering; automation, systems integration and equipment solutions; turnkey project management and implementation; and service and support. PeakLogix has experience within a number of industries, including healthcare/medical, food and beverage, fulfillment, third-party logistics, secured data centers, document storage, and the U.S. government. You can find case studies highlighting specific projects online at **www.peaklogix.com**.

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