

Achieving the Perfect Equilibrium: Elevating Manufacturing Safety and Productivity



Executive Summary

Achieving the perfect manufacturing equilibrium – peak worker safety and productivity – is no easy task. The very nature of manufacturing, which often includes heavy and fast-moving equipment and physical work, takes a toll on people and productivity.

The safety concerns are pressing. In 2017, the National Safety Council (NSC) estimated that:

- A worker was injured on the job every seven seconds.
- Over 104 million production days were lost due to injury.¹

Eye-opening statistics like these have rightfully led many manufacturers to temper productivity goals with rigorous safety protocols.² But manufacturers shouldn't be forced to choose between safety and productivity.

Advanced automation solves this dilemma. Robotic innovation gives manufacturers of all sizes new ways to achieve the ideal state, where workers remain safe and productivity remains high:

- Collaborative robots (cobots) and autonomous mobile robots (AMRs) can work alongside people and automate the repetitive, risky and dangerous work – increasing productivity and reducing injuries through automation.
- Cobots and AMRs free the team from monotonous work, positioning people to focus on critical productivity KPIs, including throughput, quality, innovation and overall performance.

This Teradyne report examines the intersection of safety and productivity across the factory, and the vital role played by advanced automation.

¹ Workplace Injuries from the National Safety Council, (2017-2019)
Retrieved from <https://www.nsc.org/work-safety/tools-resources/infographics/workplace-injuries>

² Blanchard, Dave (2019, April 16) "A Smarter Way to Safety."
Retrieved from <https://www.ehstoday.com/safety-technology/article/21920103/a-smarter-way-to-safety>

Robotic Innovation: The Antidote to Dirty, Dull and Dangerous Work

Manufacturing ranks among the top five occupations with the largest number of workplace injuries that result in days away from work, according to the NSC.

The most common workplace injuries in manufacturing – overexertion; contact with objects and equipment; and slips, trips and falls – are often caused by the nature of the work. Examples include:

- **Repetitive motion:** tasks like screwdriving and machine tending are repetitive and often cause injury to joints. The tedious nature of the tasks can also lead to distraction and fatigue, resulting in more serious injuries when fingers, hands or arms slip into machines.
- **Interaction with and near large-scale equipment that use force at high speeds:** production equipment, forklifts and other industrial machinery lack vision and sensing equipment to stop motion when a person's body or limbs get in the way.
- **Lifting and transferring heavy items:** low-value transportation and palletizing tasks often involve over-reaching and carrying items that are large, heavy and awkward, resulting in falls, trips or muscle strain.

Advanced automation – specifically the deployment of cobots and AMRs – reduces the frequency and impact of these incidents. Advances to software and safety sensors enable cobots and AMRs to work alongside people, reducing or eliminating the risk of collision altogether.

In 2017, forklifts were involved in **over 9,000** nonfatal workplace injuries or illnesses that resulted in days away from work.³

— Bureau of Labor Statistics



³ Occupational Injuries, Illnesses, and Fatalities Involving Forklifts from the Bureau of Labor Statistics (2019, June 10). Retrieved from <https://www.bls.gov/iif/oshwc/cfoi/forklifts-2017.htm>

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Once deployed, these machines quickly and easily automate several risky and repetitive tasks that have been known to cause workplace injuries:

- Autonomous mobile robots (AMRs) can take over low-value and dangerous material movement tasks – such as palletizing and forklift operation – **eliminating the need for people to lift, transfer and move heavy objects.** Today's AMRs can easily handle anywhere from 100 kg (200 lbs.) to 4,536 kg (10,000 lbs.). Artificial intelligence-driven navigation functionality and multi-sensor safety systems enable AMRs to determine optimal delivery paths in real-time, and autonomously stop to avoid collisions.
- AMRs also add predictability to manufacturing and distribution centers. By traveling along a pre-determined network of approved paths, the vehicles safely coexist with other industrial vehicles and humans, **eliminating uncertainty from internal logistics.**
- Cobots are built to perform highly repetitive tasks such as machine tending, packaging, polishing and assembling parts. They don't require breaks to alleviate fatigue, distraction or the wear and tear on joints and tendons. Like AMRs, cobots are designed with force-sensing and configurable stopping times to eliminate the risk of forceful collisions. Today's cobots can handle payloads of 35+ pounds (16 kg) with ease, **eliminating the need for people to lift heavy items and perform highly repetitive tasks.**

The safety benefits of AMRs and cobots starkly contrast with traditional industrial robots, which typically require expensive cages, fencing and human operators. These machines lack the sensing technology necessary to avoid collisions and reduce force impact, and can increase the production risks associated with operator fatigue, distraction and errors.

According to the National Safety Council, the **total cost of work injuries** in 2017 was **\$161.5 billion.**

80%

of the thousands of UR cobots deployed across the world operate alongside humans without safety guarding (after a risk assessment).



Making Work More Productive with Advanced Automation

With collaborative and mobile robots automating routine work and employees focusing on more strategic tasks – such as problem solving and process innovation – productivity, creativity and quality increase.

A 2019 IDC Research study found that more than 70% of order fulfillment operations and warehouses that deployed AMRs reported double-digit improvement in key performance indicators such as cycle time, productivity and inventory efficiency.⁴

Human-robot collaboration will also serve as a boon for efficiency and performance. **In 2014, the Massachusetts Institute of Technology found that the cooperative process between robots and people reduced human idle time by as much as 85%.⁵** The findings were supported in a different 2019 analysis, where the Universities of Göttingen, Duisburg-Essen and Trier study found that teams of people and robots working together outperform both robot- and human-only teams.⁶ The research team simulated a process from production logistics with a team of human drivers, a team of robots and a mixed team of humans and robots. The result: the mixed team beat the other teams both in terms of efficiency and the fewest number of accidents.

More than 70%

of order fulfillment operations & warehouses that deploy AMRs report double-digit improvement in key performance indicators such as cycle time, productivity and inventory efficiency.

— IDC Research



⁴ IDC Research (2018), 2018 North American Commercial Service Robotics Survey. Retrieved from <https://www.idc.com/getdoc.jsp?containerId=US44189718>

⁵ Knight, Will (2014, May 16) "How Human-Robot Teamwork Will Upend Manufacturing." Retrieved from <https://www.technologyreview.com/s/530696/how-human-robot-teamwork-will-upend-manufacturing/>

⁶ U. of G. (2019). Better together: Human and robot co-workers more efficient, less accident-prone. Retrieved from <https://phys.org/news/2019-05-human-robot-co-workers-efficient-accident-prone.html>

Safety and Productivity Improvements: Manufacturers Can Have Both

Today's manufacturers face a daunting climate: labor shortages, competitive pressures, uncertain market conditions and more.

Choosing between safety and productivity simply is not an option – to survive and thrive, manufacturers need both. Advanced automation delivers an immediate, cost-effective and powerful solution to achieve safety and productivity goals.

Copenhagen-based Carlsberg A/S, the global maker of beer and other beverages, [provides a great case study](#). The company deployed two [Universal Robots](#) cobots to tackle the packaging process. Prior to the installation, workers manually carried packaging cartons from the pallet to the line, taking up to 60% of a worker's time and often incurring repetitive strain or severe cuts when removing cables that bound the packaging.

"Today, this stage only requires an operator to drive a pallet of cardboard boxes onto the line and oversee the process. The UR10 and UR3 quite literally does all the rest," said Thomas Kern Ruby, senior project manager at Carlsberg Fredericia.

With cobots on the job, Carlsberg has made great strides toward its corporate objective of zero accidental injuries⁷, and has repositioned workers to concentrate on high-priority tasks, including line maintenance and quality control.

FORD Spain offers another great example. The [auto manufacturer deployed the MiR100 autonomous robot](#) to boost efficiency and safety across its production environment, without disrupting people and other vehicles in the plant.

Eduardo García Magraner, a FORD Spain engineering manager said, "We programmed it (MiR 100) to learn the entire plant map and this, together with the sensors with which it is equipped, means that it does not need any external help to circulate safely. When the tests started, the operators were staring at the robot as it passed by, as if in a science fiction movie. Now, they go on with their work knowing that the robot is smart enough to work around them."

The result in both cases: safer, more satisfied workers and better operational performance.



Automating with UR cobots has helped beer and beverage manufacturer, Carlsberg, progress toward its corporate objective of zero accidental injuries.

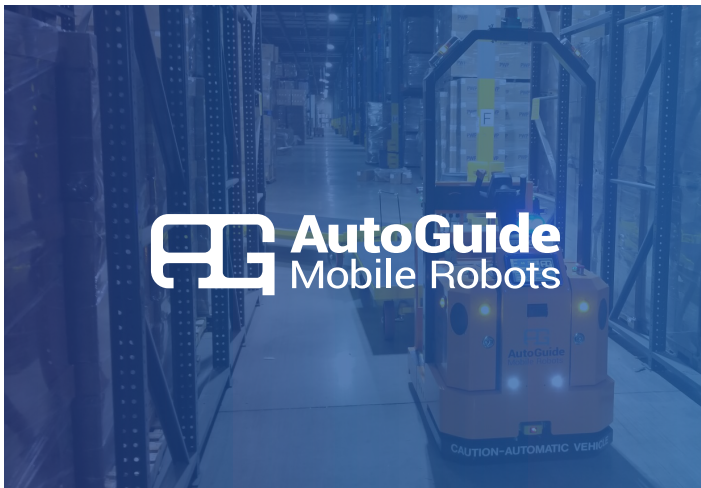
⁷ Cooker, Rob (2020, January 6) "Carlsberg Fredericia achieves zero accidents with cobots"
Retrieved from <https://www.eppm.com/machinery/carlsberg-fredericia-achieves-zero-accidents-cobots/>

Teradyne: Equipping Manufacturers to be Safer, More Productive and Efficient

Teradyne's advanced automation portfolio equips manufacturers with proven solutions for increasing performance and safety.

With Teradyne, companies of all sizes can affordably deploy automation in ways that drive immediate and long-term value – making it easier to win and grow business and reduce risk in increasingly unpredictable and competitive environments. Unlike traditional automation, Teradyne's portfolio of collaborative and mobile robots are affordable, safe, reliable and easy-to-deploy. They are safe enough to work side-by-side with humans and are being deployed globally every day – with no specialized programming or coding.

Learn more about Teradyne's Industrial Automation Portfolio



What's Next

Go deeper to explore the benefits of collaborative automation.

[Read our latest report: The Automation Economy: Human and Machine Collaboration](#) 

Teradyne helps transform industrial automation with collaborative and advanced robotic innovations.

[Learn More](#) 

See AMRs in action.

[Watch the Video](#) 

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