Light Guide™ Systems

The Augmented Workplace

The Rise of Augmented Reality (AR) in the Age of Industry 4.0

The Augmented Workplace: Building on a legacy of innovation

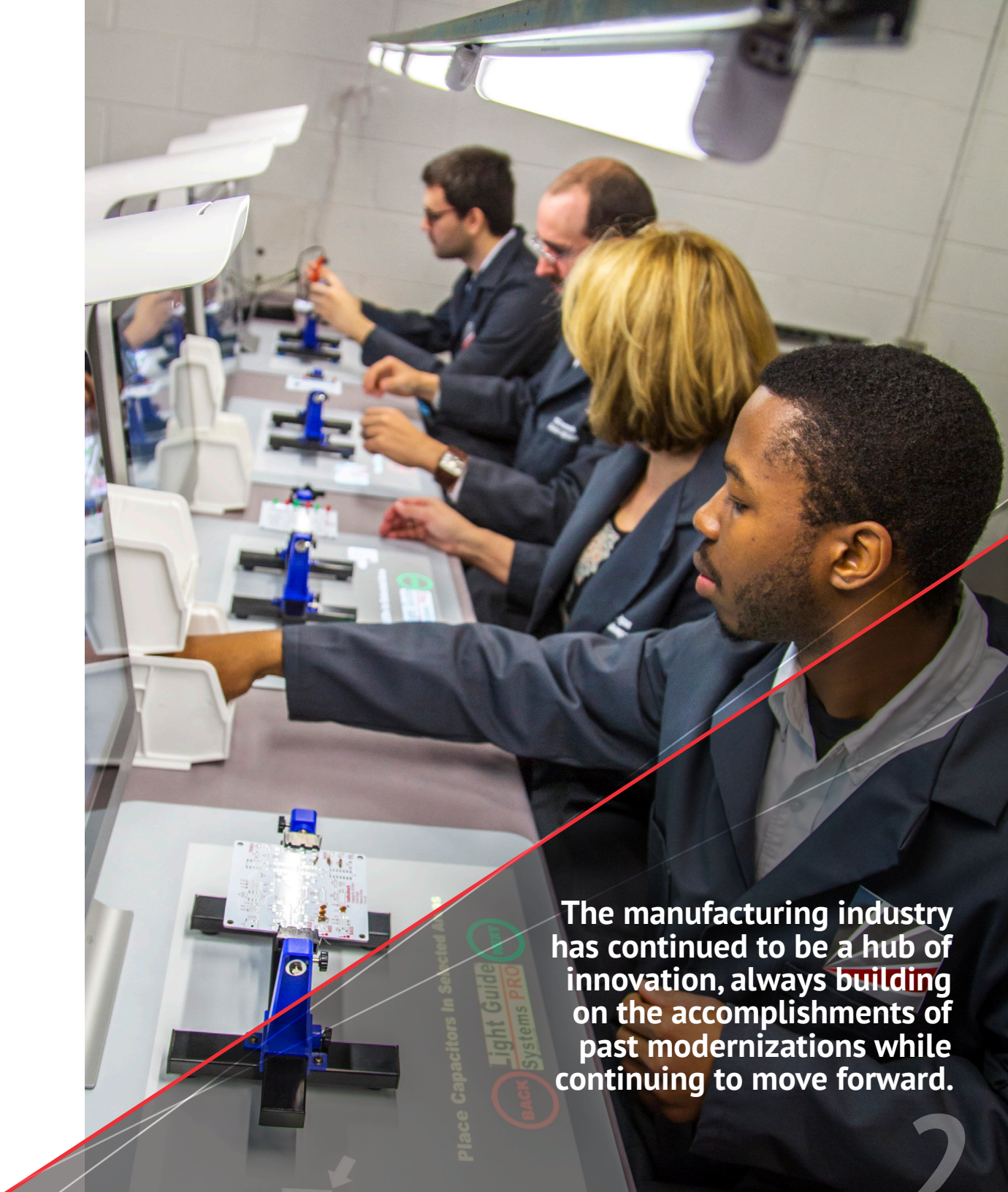
The history of the manufacturing industry can best be told as a story of innovation.

Henry Ford's moving assembly line, to this day, is still one of the most iconic innovations in the manufacturing industry.

While that assembly line, first installed in 1913, reduced the time it took to build a finished vehicle from 12 hours to two and a half, Ford's innovations included more than just the assembly line. Ford's insights into process, specialization, performance and efficiency were all radically ahead of his time.

He broke the Model T assembly process down into 84 individual steps and stipulated that each individual worker would be trained to specialize in executing just one of those steps. He also solicited the guidance of motion-study experts to enhance workers' efficiency and performance on the line, and designed and built machines that could create parts faster and more consistently than any human craftsmen.

Since Ford's defining breakthroughs over a century ago, the manufacturing industry has continued to be a hub of innovation, always building on the accomplishments of past modernizations while continuing to move forward.



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Industry 4.0: A transformative movement and the introduction of new technologies

A pivotal burst of innovation swept across the industry with the introduction of automation, robotics and IT—the industrial revolution referred to as Industry 3.0. While Industry 3.0 fundamentally transformed traditional factory floors by making them more technologically sophisticated, recent advances in modern technology have given rise to a new era of industrial transformation: Industry 4.0.

Industry 4.0 technologies, such as the Industrial Internet of Things (IIoT), machine learning, artificial intelligence, big data, cloud computing and more, are already having a profound impact on manufacturing operations, and are destined to change the industry in a lasting manner. In fact, some consider the introduction of Industry 4.0 technology to be the most significant re-imagining of how manufacturing environments operate since Henry Ford.

Systems and software can now operate with enhanced connectivity, unlocking new capabilities—and new opportunities.

Product Lifecycle Management (PLM) software feature new data management tools, automated functionality and granular process management that allows more visibility and efficiency.

The network of sensors and connected devices that make the IIoT possible collect vast amounts of detailed data that can be leveraged in new ways.

Advances in machine vision technology are also enhancing manufacturing capabilities, leveraging AI and machine learning innovation to be able to distinguish between good and bad parts, identify defects, and even operate independently and "learn" over time.

Powerful and portable 3D scanners are becoming faster and more accurate, making it possible to quickly generate a fully interactive 3D model of a production part that allows you to take measurements and determine if it has been assembled correctly—in real time.

But the category of tech with the greatest potential to make a significant impact on manufacturing operations in the near term is Augmented Reality (AR), which is being used to augment manual processes by streamlining the way work instructions are utilized in today's Industry 4.0 age.

INDUSTRY 4.0 TECHNOLOGIES

Industrial Internet of Things (IIoT)

Machine Learning

Artificial Intelligence

Big Data

Cloud Computing

Augmented Reality (AR)

Augmented Reality: Creating an interactive and adaptive environment

So, what exactly is Augmented Reality?

> **AUGMENTED REALITY (AR)** *is a type of interactive, reality-based display environment that takes the capabilities of computer-generated display, sound, text and effects to enhance the user's real-world experience. Augmented reality combines real and computer-based scenes and images to deliver a unified but enhanced view of the world.*

The media and popular depictions of goggle- and headset-wearing AR users have contributed to a circumstance where the general public thinks of AR exclusively as a wearable technology. The reality, however, is that AR technology is a much more diverse segment that includes projection-based AR.

While wearable AR tech has come a long way in recent years, persistent challenges remain. Safety, ergonomic considerations, cybersecurity issues, network requirements and battery life limitations are foremost among them. Because of this, the theoretical benefits expected from wearable AR technology are often outweighed by challenges associated with practical implementation of the hardware.

While wearable technology has dominated the media landscape, projection-based AR is quickly being adopted by some of the world's leading manufacturers and dominating on factory floors.

Projection-based AR, uses digital projection technology to overlay a virtual operating "canvas" onto any work surface and works with existing manufacturing equipment to deliver interactive instructions through visual guidance that simplifies the complex manual tasks that are part of a company's manufacturing, assembly, inspection, sequencing and training operations. Think of it like a virtual "road map" that can be projected directly onto the work space, providing operators with real-time instruction, pacing and direction for virtually any process. Similar to GPS in your car, projection-based AR provides an interactive and adaptive guide which walks you through every step of the process—and checks your work as you go.

Designed to make factory floors smarter, safer and more efficient, projection-based augmented reality eliminates the need for hard copy or monitor-based work instructions and is significantly more powerful than other AR alternatives available.

While projection-based AR is being used around the world to gain a competitive manufacturing edge, many business leaders still only have a vague understanding of its powerful capabilities and have yet to embrace this critical new technology.

Putting AR to work

Projection-based AR solutions, like our patented Light Guide Systems technology, are already being used in manufacturing environments across a number of industries to support training, assembly, inspection, and part picking and kitting processes, and are driving significant improvements in throughput, quality, and training effectiveness.

The list of benefits that a projection-based AR solution provides is long, including (but not limited to):

- Work process standardization that employs a no-faults-forward approach to manufacturing, ensuring each product is built with speed and precision, and identically with every cycle.
- Built-in quality control metrics —an ideal fit for processes that demand extreme precision and tight tolerances.
- Data collection and analysis capabilities that allow manufacturers to quickly identify process deficiencies, and identify solutions for greater efficiency.
- More effective training solutions that bridge the skills gap and decrease ramp time.
- Seamless integration with existing workstations and tools, including 3D sensors, torque wrenches, machine vision cameras and collaborative robots, removing the need to invest in other compatible technology.
- Flexible programming that allows manufacturers to toggle between different products and processes via integration into their Manufacturing Execution System (MES), or by simply pushing a button or scanning a bar code.

Projection-based AR solutions are driving significant improvements in throughput, quality, and training effectiveness.

Seamless simplicity

While projection AR systems—which use industrial strength projection technology and proprietary software—are powered by sophisticated technical architecture, the best examples of projection AR solutions are expressly designed to function in a way that delivers the exact opposite of complexity.

A big part of the appeal of these leading systems is their simplicity and usability. The best platforms are intuitive and user-friendly, as easy to use as the GPS mapping function on a smartphone or mobile device.

Augmented analytics

Leading projection AR solutions unlock an entirely new level of sophisticated real-time monitoring and analytical horsepower. Machines and automated processes generate a large volume of data, but the latest generation of AR technology makes it possible for the first time to monitor what is happening in a *manual* workstation—in real time—with clear and concise data and analytics that allows supervisors to get a complete picture of process performance.

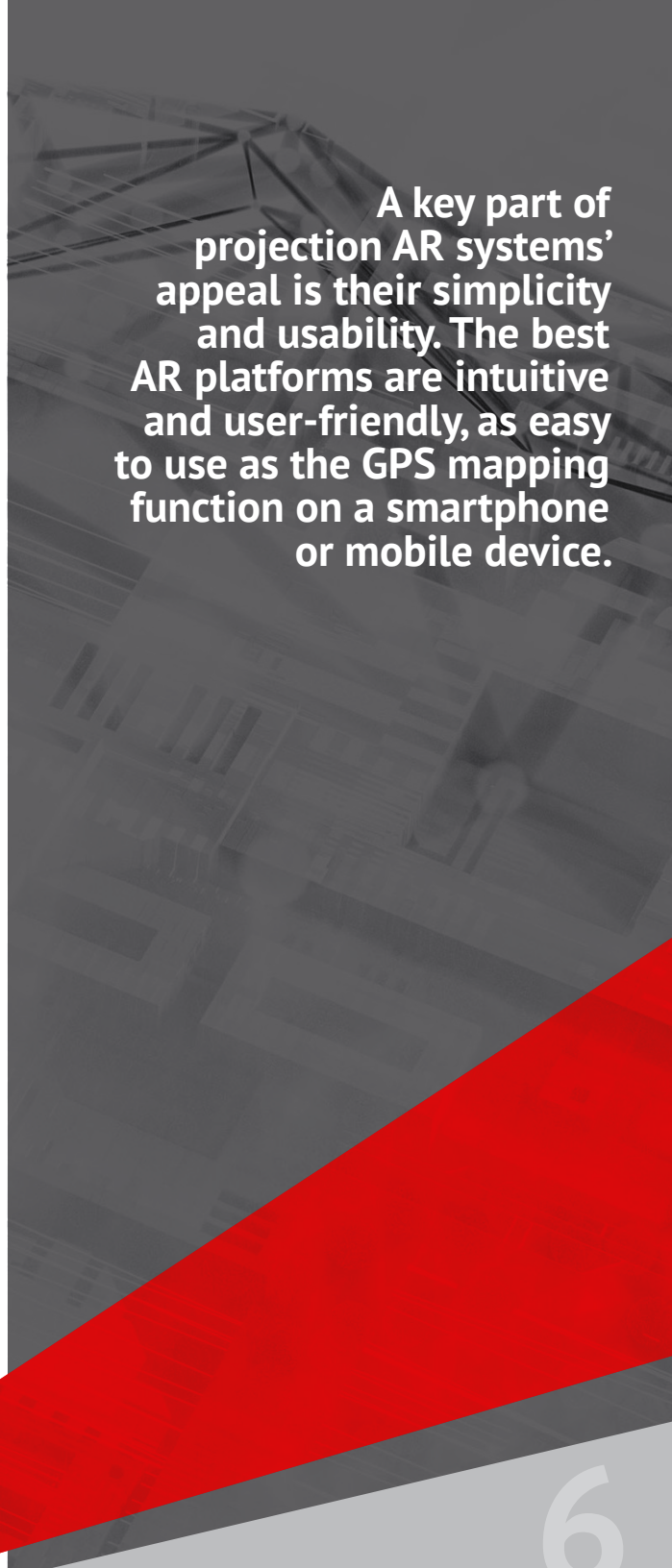
Access to this real-time data and analytics enables immediate, data-driven decision making. Precise tracking makes it possible to leverage detailed build and cycle time metrics in real time, allowing manufacturing professionals to identify bottlenecks and other process improvement opportunities. Process refinement, logistical support changes and additional operator training needs can all be quickly and precisely identified.

The ability to evaluate performance and processes within a specified time period, or under certain conditions, means you can isolate opportunities for improvement, and introduce measures designed to optimize workflow one step at a time.

The ability to gather and manipulate the extensive amounts of data generated throughout complex processes means companies can evaluate their operations through previously inaccessible variables. By eliminated the need for yearly stopwatch-based time studies, it is now possible to assess performance through "real-time" time studies including all individual cycle times as well as operator performance and a myriad of individual variables like experience language preference, and dominant hand preference.

AR platforms can generate digital "birth certificates," along with detailed process data—not only for each product, but for each individual part that went into that product. This type of end to end traceability can provide confirmation that parts were assembled and shipped correctly—the kind of verifiable data that ensures consistency and saves potentially significant sums of money by avoiding flawed assembly or fraudulent claims.

While the newfound ability to quickly and accurately identify pain points and defects can boost efficiency and productivity—ultimately saving both time and money in the process— the insights gleaned from combining AR with sophisticated analytics can enable companies to make smarter and more strategic business decisions. In other words, not just optimizing operations today, but for the future, as well.



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Making it work

For the manufacturing industry, AR has a uniquely appealing value proposition: it improves the work and efficiency of manufacturing professionals, not by replacing them but by enabling much greater productivity and quality in manual processes.

At a time when there is justifiable concern across the industry about the implications of growing automation, augmented reality is a welcome middle-ground solution and provides a way forward that works for a remarkably wide range of industries.

Most importantly, as a *practical* AR technology, it works. While the promises of some new technologies have had high profile hits and misses, AR has quietly made its way into manufacturing spaces and almost immediately began delivering extraordinary results. Manufacturers that have integrated augmented reality into their operations have reported high-impact results, including 90%-100% reduction in errors, cycle time reductions of nearly 50%, and a bottom-line boost in overall throughput of approximately 25%. Regardless of the industry or the environment, AR is delivering remarkable results on the factory floor.

Diverse applications

Powerful projection-based AR technology is transforming the way products are made – from powertrains, to pacemakers, to pizzas—while dramatically streamlining and error-proofing the manufacturing and assembly process.

While automotive and aerospace have been among the first industries to adopt AR technology, a wide range of industries is following their lead including electronics, healthcare and food production.

The same AR-based tech solutions that are improving manufacturing and assembly processes and making manufacturing environments safer, smarter and more efficient, have the potential to make an equally transformative impact in food production and food service environments. From high volume food production facilities to restaurant make stations, AR technology can improve not only training but sanitation and safety; speed and efficiency; and quality and consistency.

In medical device manufacturing, where precision and quality controls can potentially be (quite literally) issues of life and death—and where liability prevention and verifiable parts and processes could make a million-dollar difference in litigation, AR is not just a difference-maker, it is a game-changer.

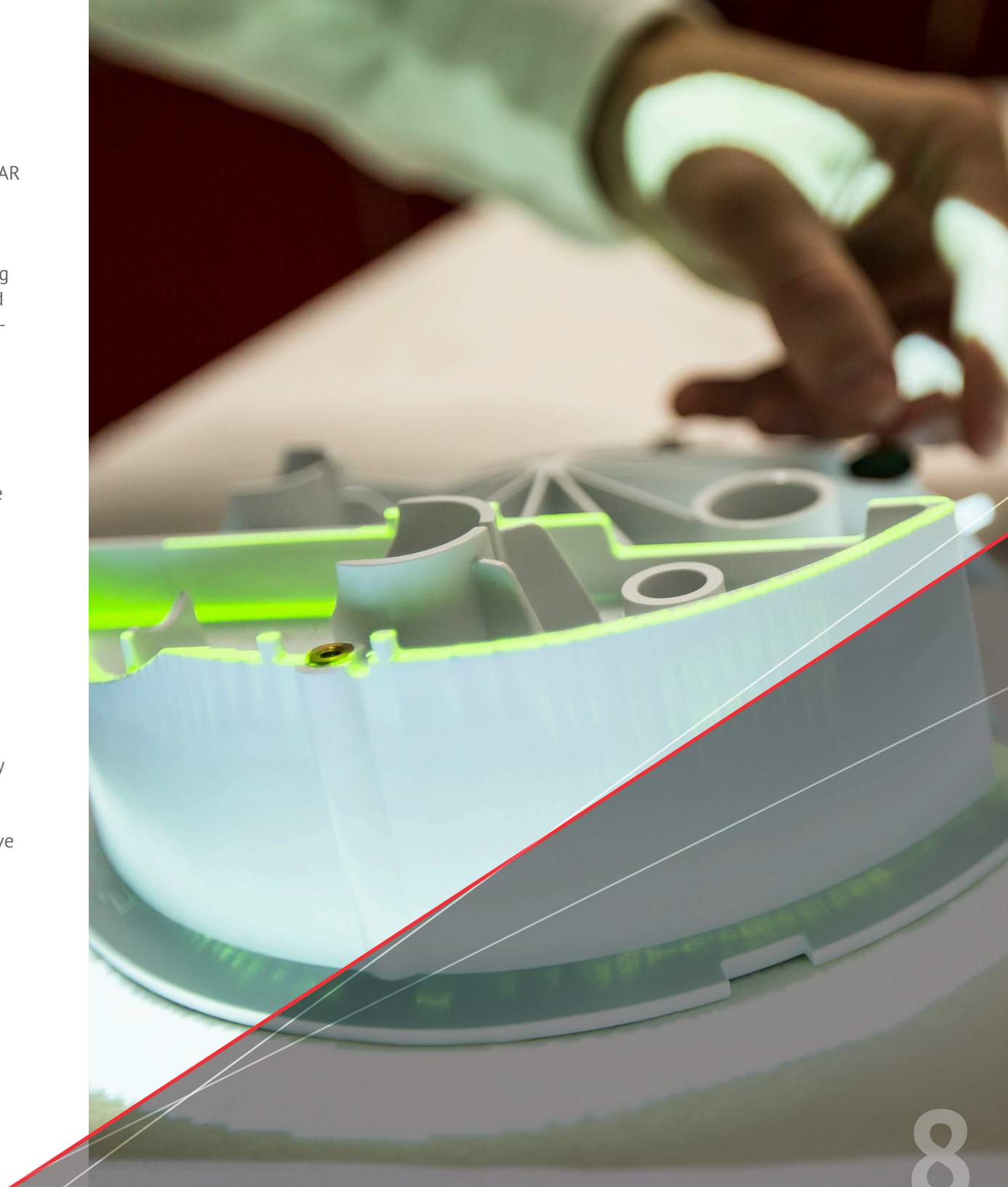
While the application details vary slightly across industries, the foundational tools and principles of AR technology have similarly transformative potential to change the game for almost any application in almost any industry. AR is particularly well-suited for manual operations in competitive manufacturing environments—spaces where growing variation and variability present new challenges, and where error-free quality control is non-negotiable.

One rapidly growing AR application is training—a usage that is especially valuable in high-turnover environments and for complex processes and assemblies. In an increasingly competitive labor market, where manufacturers may not be able to be as discerning and selective in the hiring processes, the fail-safe training functionality that AR offers is only going to become more important.

Challenges, solutions and misconceptions

Regardless of the industry in which they work, many manufacturers face common challenges. Are tasks being performed correctly? Did operators get the process update, recognize the quality alert, or receive the change order?

Plant floors can be very opaque. Information is sluggish. Figuring out what happened when something goes sideways is notoriously difficult. Insufficiently rigorous inspections and shift-to-shift inconsistencies plague many manufacturers.



Beyond Industry 4.0, there has already been movement towards Industry 5.0 which increases collaboration between humans and smart systems. Consumers high demand for product individualization and customization as well as increased efficiency on the production line is causing manufacturers to create more space for the critical thinking skills of humans. As consumers' demands for a degree of "hands-on" personalization increases, augmented reality systems such as Light Guide Systems become an integral part of this transition, elevating the overall quality of production, making it dramatically easier to switch quickly and efficiently between various models and customization options, without losing the same procedural rigor.

Projection-based AR solutions like Light Guide Systems are remarkably accessible and can be deployed on a plant floor and start working from day one. This allows a manufacturer to begin functioning like an Industry 4.0 operator without a wholesale transformation. It is an ideal way to take an important step forward in a legacy industry, allowing users to realize most of the benefits of cutting-edge tech without the corresponding upheaval.

Best of all, you don't have to throw out your existing system to make this happen. Light Guide Systems works equally well with most offline and analog legacy systems as with the best of the new cutting-edge 4.0 platforms that are hitting the market. Light Guide Systems is essentially plug and play, and can be integrated seamlessly in a wide variety of automated environments. Every setting, work instruction and data connection can be easily customized and modified as needed.

Light Guide Systems gets your foot in the AR door and unlocks access to next-generation 4.0 efficiencies, with no compromises required.

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The bottom line

Manufacturers looking for AR solutions and expertise would be wise to avoid newcomers to this fast-growing field. Instead, focus your search for the right AR partner who has been a part of the AR development curve since its inception. OPS Solutions is not an AR company trying to retrofit AR tech to manufacturing—we are manufacturing experts who identified the need, developed the technology specifically for manufacturers, and brought innovative AR solutions to industry.

OPS Solutions has been doing this since 2005. With our deep manufacturing background, and a mature AR technology platform, we are a proven partner providing high value solutions for globally recognized brands and companies. We understand the challenges that manufacturers face, and we have designed our AR technology and services specifically to respond to those challenges.

AR is changing the way products are made and tested, the way personnel are trained, and even the way factories and facilities are designed and run. It seems clear that when it comes to AR, the future is now. And Light Guide Systems is the leader in Industrial AR.

To learn more about how to take advantage of the extraordinary opportunities that AR technology solutions provide, contact us! Send an email to **info@lightguidesys.com**, or give us a call at **1.248.374.8000**, to connect with a member of our team.

Let's Light, Guide, and Go!

Light Guide™ Systems

lightguidesys.com