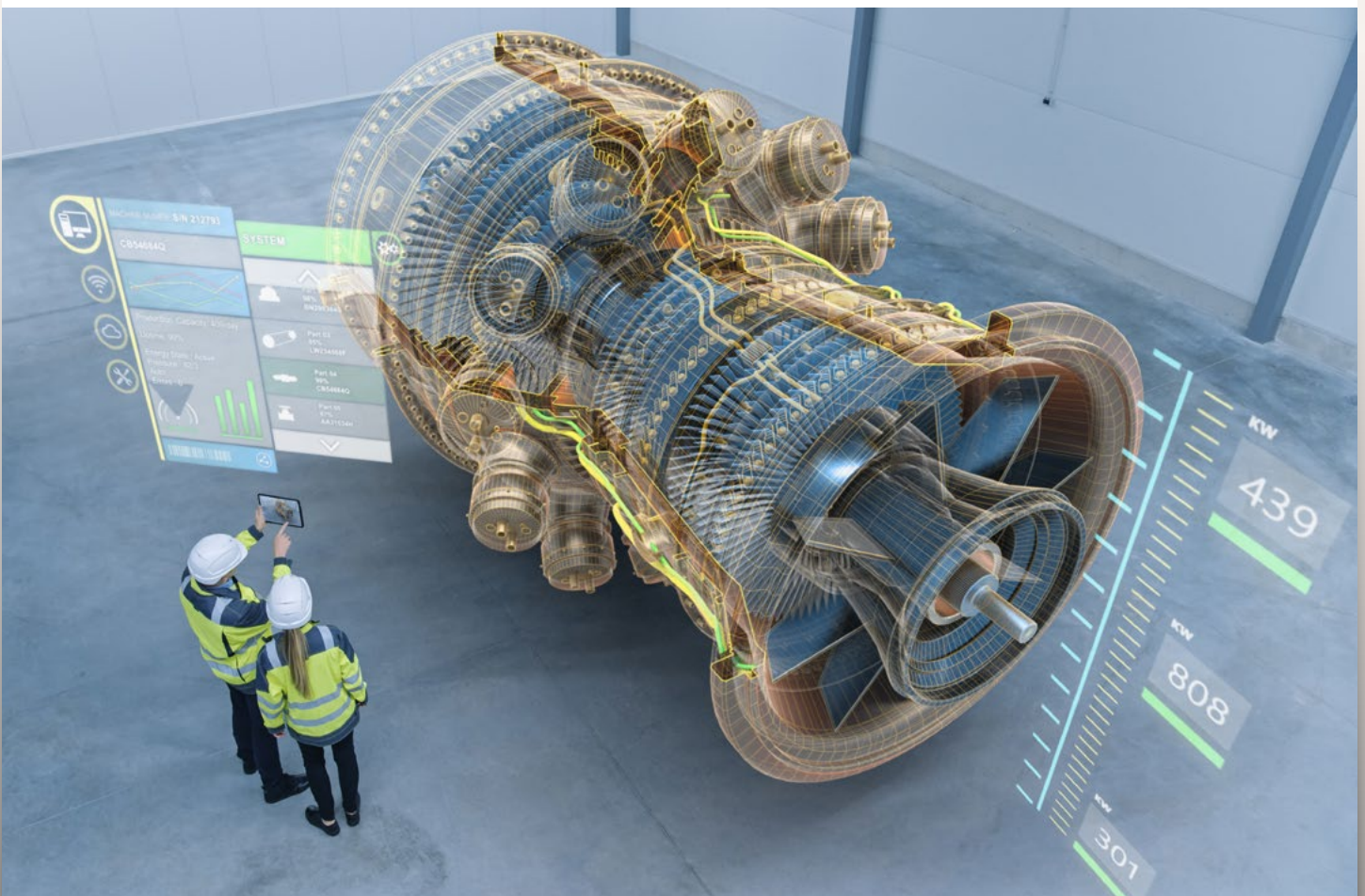# **Realizing the potential** of the model-based enterprise with augmented reality (AR)

By aligning augmented reality (AR) with MBE principles, the aerospace and defense industry can address talent shortages and process inefficiencies while driving value creation across production, maintenance, and supply chain operations.

CIO

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Introduction

The model-based enterprise (MBE) approach is capturing attention in many industries for its potential to improve product delivery, maintenance, training, and customer experiences. In essence, MBE uses 3D digital models (or digital twins) as the primary source of information across the product lifecycle with the goal of optimizing processes at every phase. In the aerospace and defense industry — currently challenged by talent shortages; supply chain issues; longer lead times; and inefficiencies in maintenance, repair, and overhaul (MRO) — MBE offers exceptional promise.

One of the exciting features of the MBE approach is a radical transformation in the way work instructions are delivered to and consumed by the employees charged with making, moving, and maintaining highly specialized aerospace- and defense-related products. In addition to breaking new ground in MRO processes, augmented reality (AR) is well suited for tackling the many new challenges arising from increased global demand for products and aftermarket services. Organizations that embrace the use of AR technology can fully realize the potential of the MBE approach as they transform their workflows.
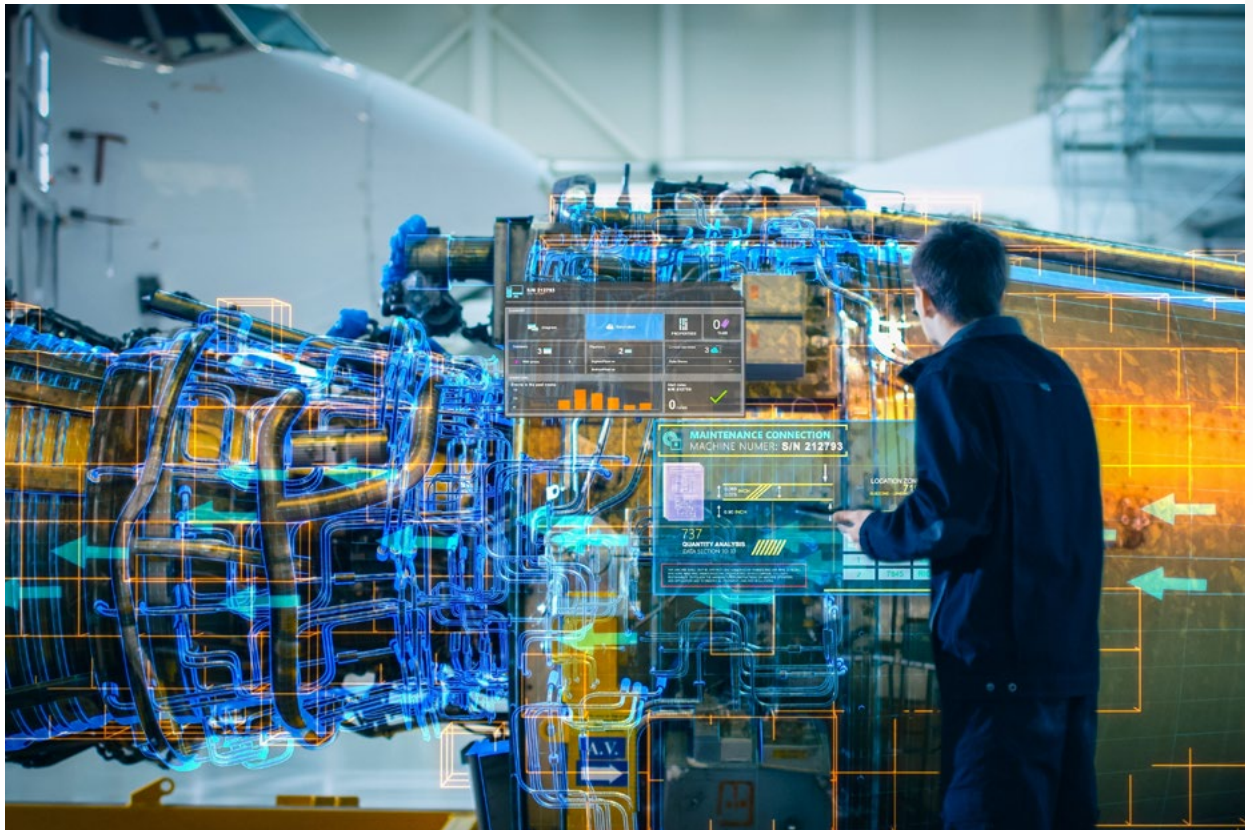
AR versus traditional work instructions

Unlike traditional paper-based work instructions, AR includes .features such as 3D visualization; real-time guidance, data, and collaboration with remote experts; and hands-free interactions. The advantages of these capabilities are well understood.

- **3D visualization.** Workers gain a more immersive and realistic understanding of objects, spaces, or data through 3D visualization of a digital twin, which creates images that appear to have depth and perspective, enabling analysis and exploration from different angles. These visualizations are invaluable for training purposes or to upskill workers on new equipment or methods.

- **Real-time guidance.** AR enables real-time guidance by overlaying work instructions onto equipment in the worker's field of view. This capability can improve accuracy in equipment maintenance and overhauls, cockpit tech support, hub-and-spoke processes, final assembly, and avionics testing, among other uses. This is particularly advantageous for less experienced workers, enabling them to complete tasks more efficiently and with higher accuracy.

- **Hands-free interactions.** The presence of AR work instructions in head-mounted devices reinvents workflows. Technicians can perform tasks with both hands, improving speed and safety. This is of particular importance given the strict regulatory requirements for products and services in the aerospace industry.

Multiple scientific studies have demonstrated the effectiveness of AR work instructions in reducing workers' cognitive load. In carrying out assembly and maintenance tasks, for instance, workers often must divide their attention between spatially or temporally separated information sources, leading to the "split-attention effect." By superimposing virtual objects in real-world environments, AR decreases the cognitive load, enabling workers to carry out instructions faster and more accurately with fewer skipped steps.[1] The appearance of real-time equipment data in mobile and head-worn devices is also useful for remote collaboration, as engineers can often resolve issues such as aircraft inspection problems without having to travel to the site.

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[1] Eversberg, L. and J. Lambrecht, "Evaluating digital work instructions with augmented reality versus paper-based documents for manual, object-specific repair tasks in a case study with experienced workers," The International Journal of Advanced Manufacturing Technology, June 2, 2023 https://link.springer.com/article/10.1007/s00170-023-11313-4

It is clear that ARE can create significant improvement in the way frontline workers consume information and work instructions and that these features enhance worker understanding Providing a warning in the worker's field of vision is another crucial advantage in improving safety and facilitating compliance with stringent industry regulations.

Companies making the transition to MBE are well positioned to leverage these benefits by using digital twins that already exist within their organizations. By shifting to MBE and embracing AR at scale, they can target key areas of opportunity, unlock tremendous value, and create a roadmap for the future.

Creating value in the MBE with AR

AR work instructions that employ digital applications are better than traditional work instructions for many tasks related to training, manufacturing, maintenance, and service provision in the aerospace and defense industry, as the following scenarios illustrate.

- **Scenario 1: Using models for improved maintenance training in MRO and MRO work instructions**

  A leading aerospace company noticed a major shift in technician experience levels, not only internally but also in operator customer ranks. In response, the firm moved to a model-based approach to training, incorporating AR. Using a digital twin from its engineering product lifecycle management (PLM) system, the company developed a training program for a global service bulletin. Instead of training on actual equipment, which is limiting, technicians trained on virtual models with instructors, greatly accelerating training globally. The training content was then repurposed for MRO work instructions to support implementation of the company's service bulletin. Since this was a global initiative, AR provided additional benefits when it came to language. The organization's service bulletins were required to be delivered in English, but AR greatly reduced the amount of text needed, improving the instructions' effectiveness with animated digital models. Participants were more engaged and quicker to learn in an environment free from the risks and potential damage of real-world mistakes.

- **Scenario 2: Building work instructions on models to improve heavy equipment assembly**

  A heavy equipment manufacturer had been delivering work instructions with mounted digital screens. The instructions were comprehensive, including complex text-based descriptions that tended to be difficult and time-consuming to read. Technicians were required to comb through too much information to access instructions pertinent to the task at hand. To address this problem, the company used AR with its existing models to create simplified step-by-step instructions that included animations and video job aids. Using AR expanded the field of view for information, allowing the inclusion of visual data in the assembly workflow.

  Better instructions enabled workers with less experience to complete maintenance and repair tasks, reducing the strain caused by staff shortages. At the same time, they enabled better processes that increase efficiency, decrease errors, and enable quality gains.

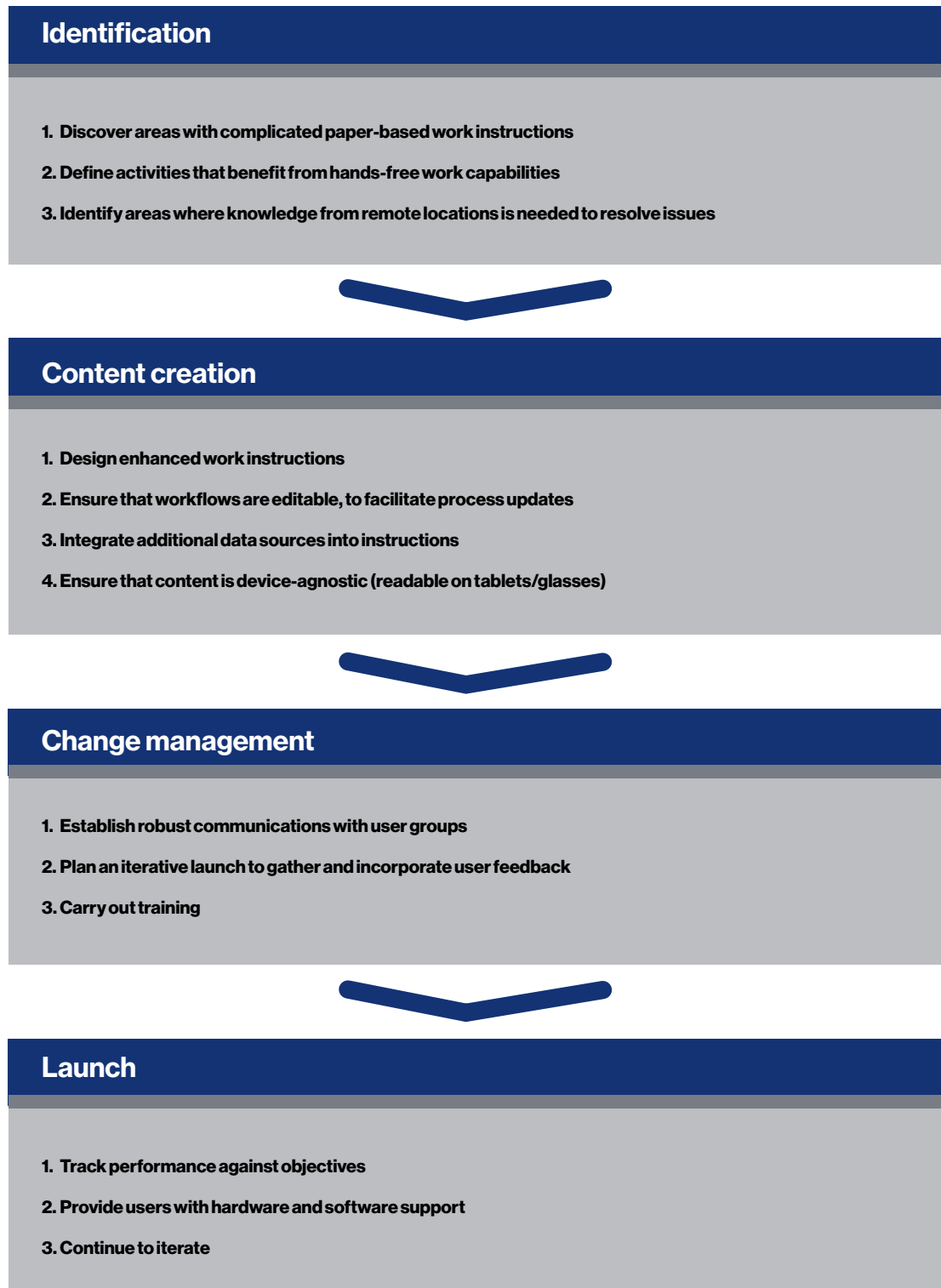## Defining and prioritizing areas of opportunity

AR intersects with the MBE in a host of production, maintenance and service, and supply chain functions, driving business value by reducing risk, minimizing recalls, and lowering the number of aircraft-on-ground (AOG) occurrences. Yet the MBE will not evolve in a wholly linear fashion. By considering areas of opportunity, organizations can find an insertion point for AR technology (see Figure 1) and realize a quicker return on their investments.

Figure 1: Intersection of AR with MBE

Production	Maintenance and Service	Supply Chain
• Tooling • Assembly • Quality control • Inspection • Line changeovers • Training • Kitting/material handling	• Line maintenance • Complex/heavy maintenance • Training • Safety • Kitting/material handling • Tooling	• Warehouse picking • Warehouse put-away • Warehouse cycle counts • Warehouse receiving • Kitting/material handling • Pallet buidling • Quality audits

They can then follow a well-defined AR playbook (see Figure 2) — from identification to content creation, change management, and launch — to achieve maximum value.

Figure 2: AR Playbook

Identification

1. Discover areas with complicated paper-based work instructions

2. Define activities that benefit from hands-free work capabilities

3. Identify areas where knowledge from remote locations is needed to resolve issues

Content creation

1. Design enhanced work instructions

2. Ensure that workflows are editable, to facilitate process updates

3. Integrate additional data sources into instructions

4. Ensure that content is device-agnostic (readable on tablets/glasses)

Change management

1. Establish robust communications with user groups

2. Plan an iterative launch to gather and incorporate user feedback

3. Carry out training

Launch

1. Track performance against objectives

2. Provide users with hardware and software support

3. Continue to iterate

Overcome digital fragmentation and skills gaps with TeamViewer Frontline

Accuracy is crucial for aerospace assembly and inspection routines, but the industry is currently more challenged than ever by fragmented digitalization processes and an increasing skills gap. A solution such as Frontline mitigates a host of problems through the use of AR and 3D models to show each worker when, where, and how to complete every task. Frontline provides the real-time data, knowledge transfer, and scalability needed to unify workers and processes across distances, improving speed and accuracy, and compensating for the unavoidable loss of expertise as long-term workers retire.

Conclusion

The integration of augmented reality into the model-based enterprise framework optimizes processes and addresses many of the thorniest challenges in the aerospace and defense sector. With 3D visualizations, real-time guidance, and hands-free instructions, AR represents a significant leap forward from traditional work instructions. Companies transitioning to MBE can leverage existing models to drive value creation across production, maintenance and service, and the supply chain. Aligning AR with MBE improves operational workflows and alleviates critical industry challenges such as talent shortages, longer lead times, and process inefficiencies.

By providing better instructions and enabling workers with varying levels of experience to complete tasks accurately, TeamViewer Frontline can help reduce errors and improve overall quality. With the trend toward a widening skills gap in the aerospace frontline workforce, AR can be a pivotal tool for ensuring accuracy, knowledge transfer, and scalability in assembly tasks, inspection routines, and training initiatives. Partnering with TeamViewer can help organizations navigate the complexities of the modern industrial landscape to drive innovation and sustainable growth. With a well-defined AR playbook and prioritization of key areas of opportunity, they can reap concrete business benefits by incorporating AR in their MBE transformations.

About Teamviewer

TeamViewer enables companies of all sizes and in all industries to digitalize their business-critical processes through seamless remote connectivity and industrial AR platforms and solutions. To help customers tackle business challenges, TeamViewer proactively shapes digital transformation and continuously innovates in the fields of augmented reality, the internet of things, and artificial intelligence (AI). TeamViewer's connectivity platform enables secure remote access to and control and support of any device, in any location. TeamViewer's software has been installed on more than 2.5 billion devices globally. Its leading enterprise AR platform for deskless workplace digitalization helps streamline onboarding, training, and operational work processes across the entire value chain, increasing productivity, reducing errors and inspection times, and simplifying daily tasks for frontline workers.

Learn more about TeamViewer's **Frontline industrial AR solutions**.