



**Rockwell  
Automation**

# Vuforia INSTRUCT

Augmented work instructions



# Product quality is impacted by a variety of forces



GROWING WORKER  
SKILLS GAP



INCREASING PRODUCT  
AND PROCESS  
COMPLEXITY



EVOLVING CUSTOMER  
DEMANDS

## Industrial enterprises are facing a talent gap related to technically skilled workers.

Much of their current workforce is aging out and retiring, and they're taking their deep institutional knowledge gained through years of experience with them.

The training methods for new employees coming onboard are often antiquated and ineffective. Furthermore, it's difficult to find new talent in this space – many new entrants to the workforce have a negative perception of industrial work.

And on top of that, these companies are challenged by travel bans and social distancing requirements on the frontline, all brought on by the COVID-19 crisis.

Even with so many job-seekers on the market today, a recent survey by the National Association of Manufacturers found that more than half of manufacturers believe that even after the pandemic has subsided, attracting and retaining employees will continue to be difficult over the next 12-18 months.

This has been particularly hard hitting for industrial manufacturers.

Digital transformation and the use of innovative technologies such as Augmented Reality can help.

## Checklists and hard copy instructions present challenges

Traditionally information and instruction comes in the form of paper documentation, training classes, over-the-shoulder mentoring, and face-to-face troubleshooting.

Companies can no longer rely on the memory and skill retention of their operators and technicians to handle the increasing necessity to quickly adapt to complexity and variation of products and production lines.

Paper-based processes both within and outside of manufacturing are error-filled, difficult to act on, and ultimately expensive. The cost of rework and errors is high at any phase of the assembly or maintenance procedure.

Industry polls from Quality Magazine indicate that 67% of manufacturers still utilize manual paper processes and inspections within their manufacturing process. Many companies physically store the written forms in file cabinets making retrieval difficult; others struggle with tedious data entry or uploads and deal with errors in transcription. Paper-based processes are error-filled, difficult to act on, and ultimately expensive.

For those industrial manufacturers using paper, printed schematics, illustrations and paper checklists and there are a lot of challenges that they are encountering today when they approach with these methods.

**67% of manufacturers still utilize manual paper processes and inspections**

Why are inspections important?

- **RECALLS & DEFECTS**
- **SAFETY & LIABILITY**
- **SCRAP & REWORK**
- **EFFECTIVENESS & PRODUCTIVITY**

Our organization needs us to get to a place where we no longer hear about quality issues. On an annual basis, these issues **cost us hundreds of millions of dollars.** We know we need to evolve.

*Global VP Engineering and R&D*

## Let's take a closer look at these challenges

Technicians don't understand the **context** of the inspection. They are constantly looking back and forth between drawings, checklists, schematics and the physical product.

They are doing a lot of **comparison** and the onus - the burden - the cognitive load is on the inspector to map what they should be seeing to what they actually are seeing.

Because all of this information and instructions are presented on paper - it's a one-way **communication**. The inspector is basically told or directed to look for certain things but there is no way for them to provide feedback. Without providing feedback, there is no way for them to help to improve the inspection process.

And finally, there is really not an effective way for them or their managers to **confirm** what the status of the inspection was. If the inspector checked off the work as it was completed or took some notes - there is no way to easily capture that and tie it back to the inspection process.

## Current inspection issues

### CONTEXT

What am I working on? / What part is this? / Where is it located?

### COMPARISON

Is it the same? / It's hard to see the details. / This is confusing.

### COMMUNICATION

What if it's wrong? / How to I provide feedback? / This keeps happening.

### CONFIRMATION

Guess I am done? / Did I do everything right? / Does anyone need to know?

At every stage of the rebuild process we need to inspect and verify it was done correctly. If we don't the cost of rework is so high. **It costs \$47,000 per hour if the customer's tool goes down.** The huge issue is that a lot of that information doesn't exist outside the technician's brain.

*Innovation Lead, Field Service*

## Industrial organizations need AR-enabled quality inspection work instructions

These can help address those challenges and provide the where to go, what to do, how to do it, is it done, and is it done correctly. The move from AR-guided work instructions are going to provide better context. Ambiguity related to the context is eliminated with 3D digital content overlaid on top of the product itself – the inspector is going to be able to look at the physical product and see the information that they need. This makes comparison much easier. They are going to see where the measurements need to be taken, what the product or part they are inspecting should look like – so that nothing slips through the cracks.

Because the instructions are digital, the **communication** and **confirmation** fundamentally change:

### Communication

- The inspector now has the ability to be included in the process
- A digital feedback loop ensures faster reactivity to defects identified on the shop floor and improve mobility to take action
- It provides much more efficient ways for them to communicate feedback, capture notes and suggest improvements to the process

### Confirmation

- Digital data capture ensures standardization of captured information and visual cues to ensure workers stay accountable to what information they are required to collect
- Inspection checklist digitization provides technicians visual feedback in the moment (and in place) that helps frontline workers stay accountable
- This feedback capability also provides better ways for managers to understand what's actually happening
- They no longer have just a checklist that says yes inspected by inspector X – they now have digital proof

## AR-enabled inspections

### CONTEXT

3D context makes it so easy! / I know which part I'm looking at... / And exactly where to find it.

### COMPARISON

Visual reference was clear! / Defects are easier to spot. / Markers save me time.

### COMMUNICATION

I can provide feedback! / I can capture defects quickly. / I can let people know there's an issue.

### CONFIRMATION

I have confirmed everything is done/right. / Collected data can help ensure continuous improvements.

# Introducing Vuforia Instruct

As a new addition to the Vuforia Work Instructions offering, **Vuforia Instruct is the fastest and easiest way to author CAD-based work instructions** to scale engineering excellence, digitize manufacturing processes and empower front-line workers.

Vuforia Instruct is designed for manufacturing companies who seek a scalable, out-of-the-box solution to improve quality, machine performance and compliance by reducing the errors associated with traditional training and instruction methods.

Vuforia Instruct will enable our industrial customers to leverage their 3D CAD to **easily create, deliver and scale interactive work instructions** to front-line workers for Quality and Field Service Inspection use cases.

Front-line workers will benefit from in-context, highly visual work instructions, clearly presented in AR, to help them do their jobs more efficiently, accurately, and safely. Vuforia Instruct not only allows for the easy creation of CAD-based work instructions, but it also enables clear communication and collaboration by closing the loop between frontline and knowledge workers.

Procedure execution data and quality issues are easily captured on the front-line and can be share with stakeholders throughout the process enabling corrective action and opportunities for improvement

An employee on the factory floor, for example, will be able to use Vuforia Instruct to receive work instructions, but also provide feedback on how the work is going. If they encounter quality issues, inconsistencies, or opportunities for design improvement, they can easily share that with designers and engineers upstream in the process.

Fast and scalable authoring and sharing of 3D work instructions

**Scale engineering excellence**



**Improve quality and compliance**



**Boost front-line confidence and efficiency**

vuforia® instruct™

## Instruct addresses two highly valuable areas of inspection

At launch, Vuforia Instruct will focus on high value **Inspections** use case, with Assembly and Service work instructions to follow on the roadmap in the near future.

Vuforia Instruct will enable our industrial customers to leverage their 3D CAD to easily create, deliver and scale interactive work instructions and digitized inspection checklists to front-line workers for Quality and Field Service Maintenance Inspection use cases.

As we see here - industry research shows the impact of poor quality for Industrial Manufactures.

In order to achieve better quality - they need to find a way to improve the inspection process. Vuforia Instruct makes visual inspections a lot more visual and a lot more accurate!

According to Quality Digest, experts have estimated that **Cost of Poor Quality (CoPQ)** can range from **5% to 30% of gross sales** for manufacturing and service companies.

### MANUFACTURING QUALITY INSPECTION

Based on Aberdeen's independent research, **unplanned downtime**, from non-functioning equipment, can cost companies **\$250K/hour in lost production**, this equates to more than **\$2 million annually**.

### FIELD MAINTENANCE INSPECTION

# Vuforia use cases leverage 3D CAD

## Examples of quality inspections in manufacturing

### TRAINING FOR INSPECTION

Instructions are used to educate new hires or upskill existing employees on inspection procedures. Inspection training applies to all the above use cases: For inspection procedures to be accurate and timely, technicians must be trained effectively.

**Why this is important:** It is expensive to train new employees or upskill existing employees – especially in high turnover industries. The longer it takes someone to get up to speed – the lower the throughput.

**Automotive example:** Training technicians to inspect complex parts like the cylinder head takes 1 week in classroom: Need to reduce in-classroom training (partly forced by social distance limitations) and provide more effective on-the-job-training (OJT) to reduce training cost and enable worker agility through cross-training, so that all technicians can carry out inspection.

### INCOMING PARTS INSPECTION

The manufacturer verifies that parts or sub-assemblies coming into a factory from a supplier meet the required specification.

**Why is this important?** This helps to identify issues before the parts go into production. Issues identified during production can result in interruption and lost production particularly when it is necessary to wait for replacement parts.

**Industrial Equipment example:** If an incorrect part is installed into motor assembly, it can result in production and delivery delays and warranty costs. Defective incoming parts can result in hundreds of thousands of dollars in costs at a single plant.



## INLINE INSPECTION

In-line Inspection is carried out on products during production to ensure they are correct and meet specifications.

**Why this is important:** This allows manufacturers to identify problems during the production process to prevent higher cost attributed to finding defects later in the process, thus reducing scrap and re-work.

**Automotive example:** There are multiple machining steps on the complex cylinder head part. The part is inspected after each step and before it moves to the next machining station. This allows defects to be identified earlier when they are less expensive to resolve. A final inspection is also carried out before the part goes to assembly.

## END-OF-LINE INSPECTION

End-of-line Inspection, sometimes known as final audit, takes place at the end of the production process to verify the quality of the product before shipping to the customer.

**Why this is important:** This final inspection ensures that quality products are delivered to end-customers, thus reducing costs of recalls, and warranty claims and ensures high customer satisfaction.

**High-tech example:** Perform detailed inspection during new product introduction at end of assembly which can take 30-60 minutes. These inspections include visual inspection for scratches, and detailed inspections to ensure all parts have been assembled, as well as checks that the product is functioning properly. Final production takes place at a contract manufacturer, where high staff turnover is common. End of line inspections are carried out on samples and should take 10 minutes. The OEM goal is to reduce time to create inspection instructions and improve inspection execution by reducing ambiguity even when technicians are inexperienced.

## Vuforia use cases leverage 3D CAD

But what happens when the equipment is at the customer site? Now we will look at Field Service Maintenance Inspections.



## ROUTINE MAINTENANCE INSPECTION / PREVENTATIVE CHECKS

In-line Inspection is carried out on products during production to ensure they are correct and meet specifications.

**Why this is important:** Inspections ensure machines and equipment are working correctly and helps prevent equipment downtime for the end customer. This could be very expensive if the product is critical to daily operations. (as downtime = time not producing units or being operational).

**Example:** For some customers the cost is \$300/minute if the line goes down.

## POST-MAINTENANCE/ RETROFIT / REFURBISH INSPECTIONS

These take place after these periodic maintenance jobs are completed (usually around 4-6 times a year) to ensure that the work was carried out correctly. (Maintenance procedures delivered via paper-based, digital or augmented (VEC) work instructions)

**Why this is important:** It is extremely important that this be done correctly because if the procedure is not done properly - the machine fails, and the customer is now facing a downtime situation.

**Machine builder example:** At every stage of the rebuild process they need to inspect and verify. If you don't inspect, it is so costly. The huge issue is that a lot of that information doesn't exist outside the technician brain. The cost of rework is so high. The downtime is \$47,000 per hour if the customer tool goes down.

## MAINTENANCE INSPECTION TRAINING

This is necessary to ensure maintenance staff is educated and trained in basic inspection processes.

**Why this is important:** It is costly for field service orgs to train new employees or end-customer employees - especially in high turnover industries. New hires or technicians working on unfamiliar products have a higher likelihood of making errors which can have both safety and machine failure consequences.

**Machine builder example:** Each product has a specialist inspector that holds the expertise on that product inspection process. This machine builder wants to improve worker agility so that all technicians can inspect across all their product lines, so that they can be more responsive to customer needs.

## Vuforia use cases leverage 3D CAD

But what happens when the equipment is at the customer site? Now we will look at Field Service Maintenance Inspections.



# How Vuforia Instruct works

Providing you with the ability to Author, Execute and Analyse, there are three main components that comprise Vuforia Instruct: **Vuforia Editor**, **Vuforia Vantage** and **Vuforia Insights**.

## AUTHOR

**Vuforia Editor** is a secure, web-based environment that is always up to date for easy access anywhere - any time. It provides the capability to bring in 3D data to create instructions or to specify what should be done, and is where you will define your steps.

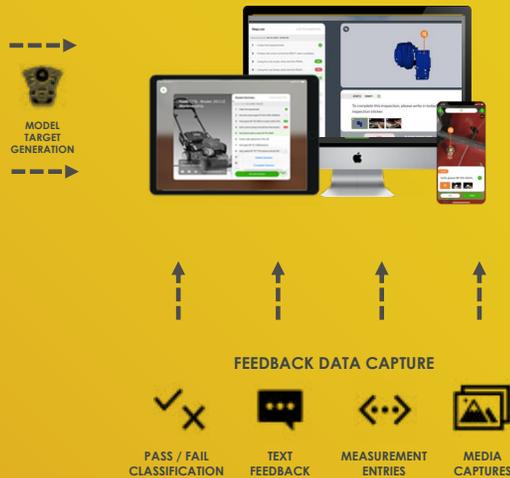
Customers can extend the value of the digital thread all the way to the front-line workers by leveraging their 3D CAD, which can easily be imported into Vuforia Editor to simplify the creation of augmented contextual guidance and proof of work support for Inspection use cases. The content can be enhanced using images and videos to streamline authoring.

As part of the Vuforia Work Instructions offering, Vuforia Instruct is enterprise ready with Access Controls to support scaling and driving meaningful value. Further enhancements such as Content Management and Approval Workflows will follow.

## vuforia editor



## vuforia vantage



## vuforia insights



# How Vuforia Instruct works

## EXECUTE

Work instructions are published and executed in **Vuforia Vantage**. Procedure delivery is optimized through Vuforia Vantage, which delivers a, personalized user experience for accessing, discovering, and consuming procedures created with Vuforia Instruct.

Vuforia Vantage can also facilitate data capture from the front-line with added functionality for step completion confirmation and pass/fail classification, with measurement logging, and text and image capture to follow post GA. Instructions are no longer just a one-way communication.

Furthermore, all of that information that is being captured during execution is being aggregated and what that means is the management team can analyze this information. They can gain insights and spot patterns or areas of concern.

## ANALYZE

**Vuforia Insights** is a secure, built in reporting and analytics portal which provides access to centralized execution data into tasks completed at the frontline. These analytics facilitate follow-up corrective action and improve traceability and compliance.

**These three powerful components combine to provide an easy way to create digital/augmented 3D guided tasks, checklists and data capture to improve inspection and quality use cases.**

**There is clear value** delivered by Vuforia Instruct on product quality, speed of inspection, workforce efficiency and on reducing the cost of poor quality.

**Some of the key benefits include:**

- Improved quality and compliance
- Increased frontline worker safety, efficiency and accuracy while doing manual, high-value inspections
- Reduced cost associated with quality and inspection
  - Defects and recalls
  - Scrap and rework
  - Safety and liability
  - Poor customer satisfaction
  - Reduction in warrant claims

In addition, the benefits of Vuforia Instruct for Industrial Enterprises include, but are not limited to:

- Faster time to value – easy-to-use interface that simplifies and accelerates creating and publishing content
- Inspection instructions are always up-to-date for easy access anywhere – anytime
- Mitigates risk by increasing process transparency and documentation.
- Analytics improve traceability, compliance and continuous improvement



**Vuforia Instruct benefits:**

- **Higher quality**
- Improved workforce **safety, efficiency** and **accuracy**
- **Reduced cost** associated with quality and inspection
- Improved **traceability, compliance** and **continuous improvement**

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