VISUAL QUALITY INSPECTION FOR INDUSTRIAL MANUFACTURING

Using Augmented Reality with Twyn

SUMMARY

Shorter product life cycles, increasing complexity, and rapid innovation in product development demand a high level of flexibility in manufacturing processes and efficient resource management. Avoiding production failures and preventing costly downtimes and rework are crucial. This is where quality control takes center stage.

Twyn is Visometry's mobile Augmented Reality (AR) software platform that empowers organizations to create inspection plans and conduct real-time inspections using tablets right on-site, wherever parts are manufactured or stored.

AR overlays CAD specifications onto manufactured items, enabling inspectors to visually verify whether parts match the CAD design and are produced correctly.

INDEX

DIGITAL TRANSFORMATION WITH INDUSTRIAL AR

Augmented Reality (AR) is transforming the way enterprises operate, bridging the divide between the digital and physical realms. Whether it's in production, maintenance, or marketing, AR has firmly established itself as a vital component of industrial solutions.

With Twyn, Visometry harnesses the power of AR and digital twins to facilitate Visual Quality Inspection in industrial manufacturing.

A standard tablet transforms into a dependable inspection tool for operators. As it captures the features of inspected objects from various perspectives, the tablet's camera images are augmented with 3D CAD data in real time. These precise AR overlays enable immediate detection of any disparities between the actual manufactured objects and the CAD models (target) .

Mobile quality control, facilitated by AR and Twyn, streamlines previously manual inspection tasks and accelerates processes that have often relied on traditional measurement methods. Too frequently, high-precision yet time-consuming metrology technology is employed when an initial visual inspection would suffice for identifying deviations.

Avoid costly downtimes and rework

Ensure precision and speed in inspection

Document your findings for re-producibility

Inspect your parts, anywhere, anytime

Enhance your throughput

Keep it simple: intuitive solution

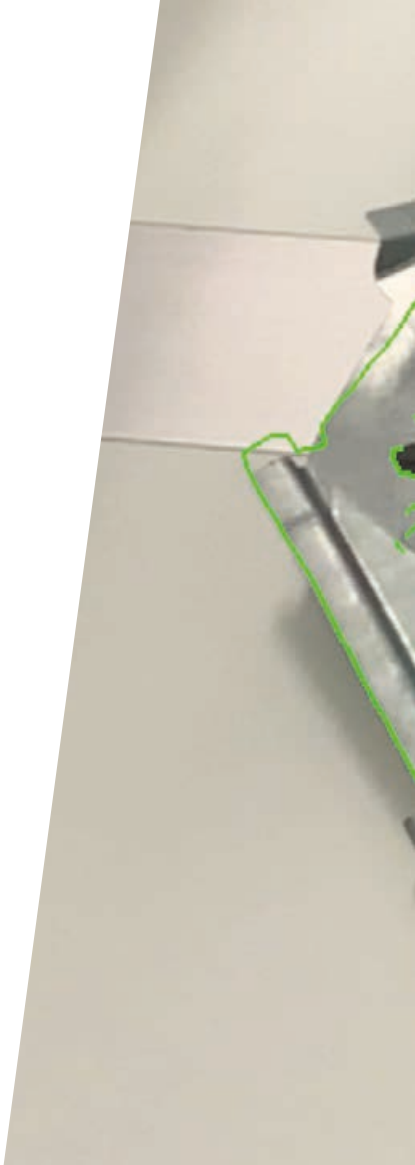
CAD-BASED TRACKING WITH VISIONLIB

Twyn's object detection and tracking are powered by Visometry's VisionLib Engine. This software development Kit (SDK), already chosen by leading international companies in various sectors such as automotive and mechanical engineering, serves as the foundation for a wide range of AR applications that demand high-performance object recognition and precise tracking.

Using CAD data, VisionLib provides reliable and stable position determination of objects in camera images, enabling Twyn to achieve precise, marker-less, real-time detection of inspected items. Thanks to this automatic object registration, Twyn supports on-site part inspections without the need for additional preparations.

While AR technologies in consumer applications determine the camera pose in static environments, VisionLib can also track moving objects in dynamic scenarios and under varying lighting conditions—regardless of the object's surface properties (whether light or dark, matte or reflective).

Moreover, VisionLib is not limited to registering a single part ("standard model tracking"); it can track multiple objects independently and synchronously ("multi-model tracking"). This capability allows Twyn to automatically check and verify different sub-components of an assembly relative to each other.

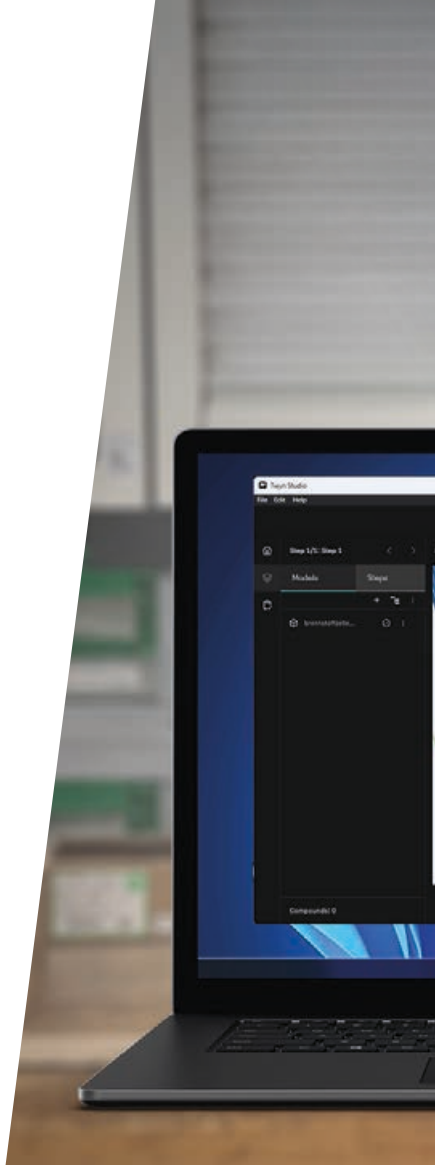


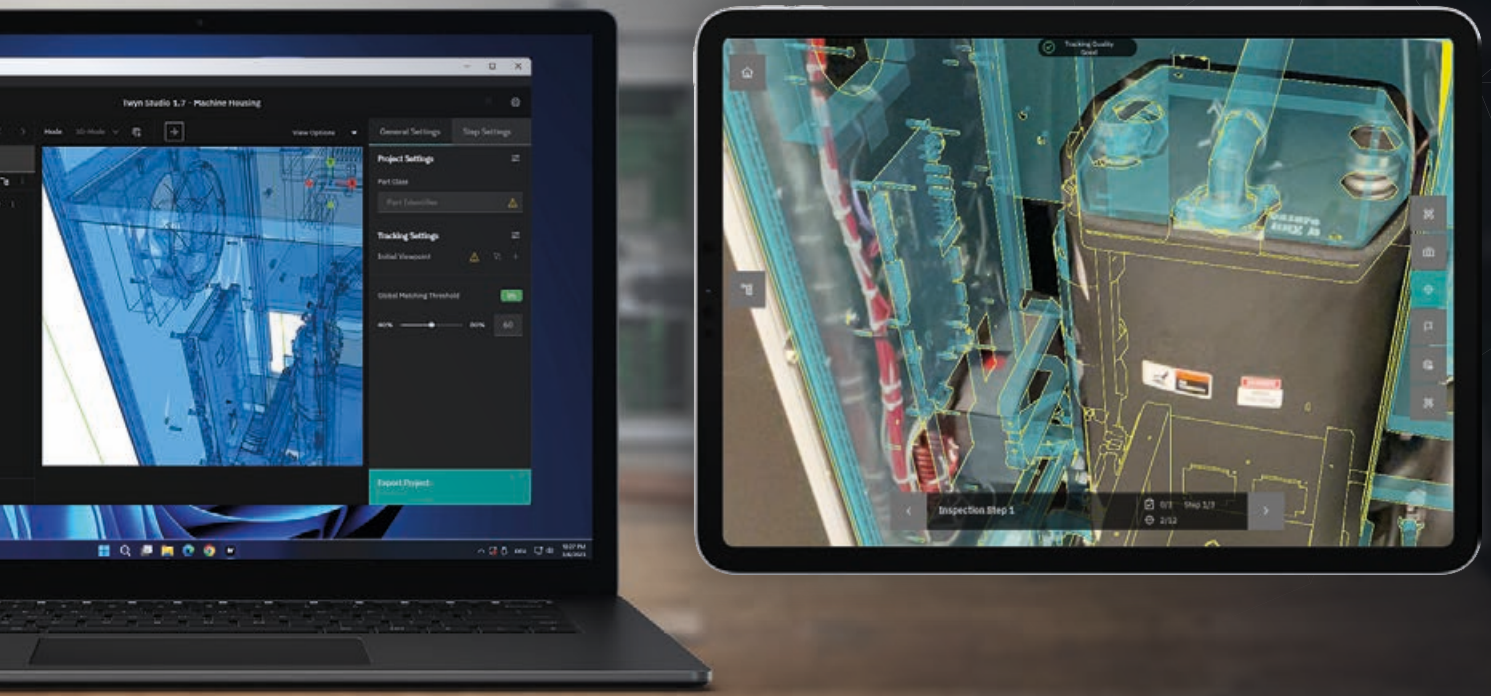
TWYN SOFTWARE PLATFORM

Twyn is the ideal solution for companies looking to simplify and streamline their quality control processes using an intuitive and forward-thinking technology that requires minimal setup time while delivering trusted results. It comprises two integrated components: Twyn Studio and Twyn View.

Twyn Studio is the desktop tool for engineers. Installed on a computer, it is used to set up new inspection cases and design and edit inspection routines. The intuitive user interface allows users to define inspection procedures structured into different steps, which will then be executed by quality inspectors on-site. For each step, a viewing or inspection area can be defined, precisely indicating the position where the operator should move the tablet in relation to the assembly being inspected.

The **Twyn View** mobile app transforms iOS tablets into powerful mobile quality control tools. Once created in Twyn Studio, operators can easily load and run inspection routines on their mobile devices. During inspections, annotations and remarks can be added and further processed as comprehensive reports in Twyn Studio once on-site sessions are completed.




Project Settings
Tracking Settings
Inspection Step 1

FEATURES

Twyn offers a range of key features and functionalities designed to support various industrial quality inspection applications.

Interactive variance analysis in AR

AR accurately and consistently overlays the CAD directly onto the inspected object, providing access to 3D geometry data and additional details, such as production notes or material properties. This allows deviations between the target and the actual object to be immediately visible.

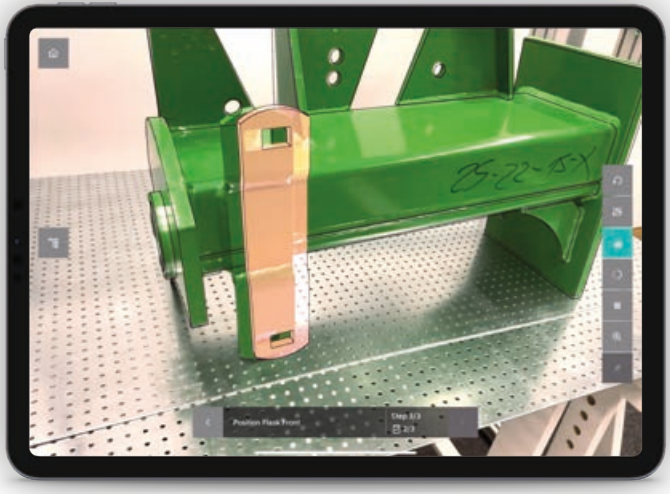
Automatic, real-time tracking & registration

Twyn utilizes the tablet's camera to automatically register and track manufactured items in real time. It provides precise marker-less detection and tracking of inspected items based on CAD models. This forms the foundation for swift yet accurate visual comparisons, eliminating the need for pre-preparations or markers when analyzing parts.

Optimized workflow
Load CAD model, set inspection start point, transfer to iPad — three clicks are all it takes to begin inspections. The setup based on CAD twins and the automatic optical recognition enable immediate use of the system directly on-site.

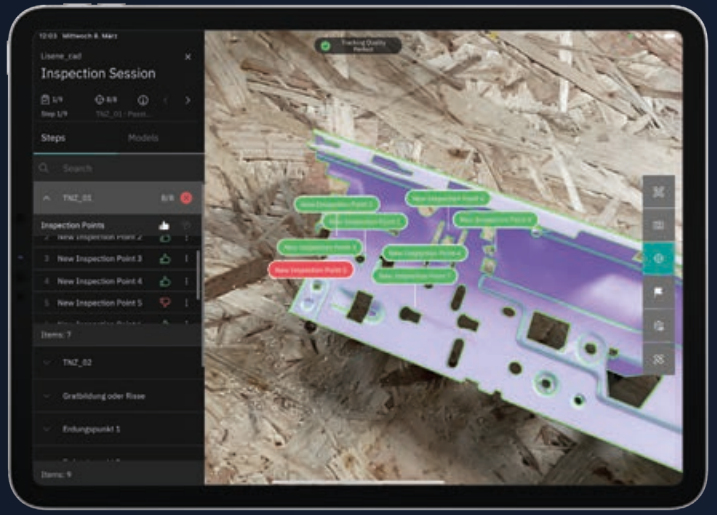
Camera-based automatic deviation detection
Leveraging the capabilities of the tablet camera, the vision-based automatic deviation detection assists users during inspections. In AR, deviations are automatically highlighted with different colors, such as when attachment parts are displaced or drill holes are not in their target position.

Interactive zooming & clipping
The lens tool empowers users to conveniently examine large or complex objects by magnifying specific areas, facilitating detailed inspections of small features or hard-to-reach points. Interactive clipping and other viewing options provide a straightforward visual comparison between the target and the actual object in AR, ensuring a rapid yet thorough inspection.



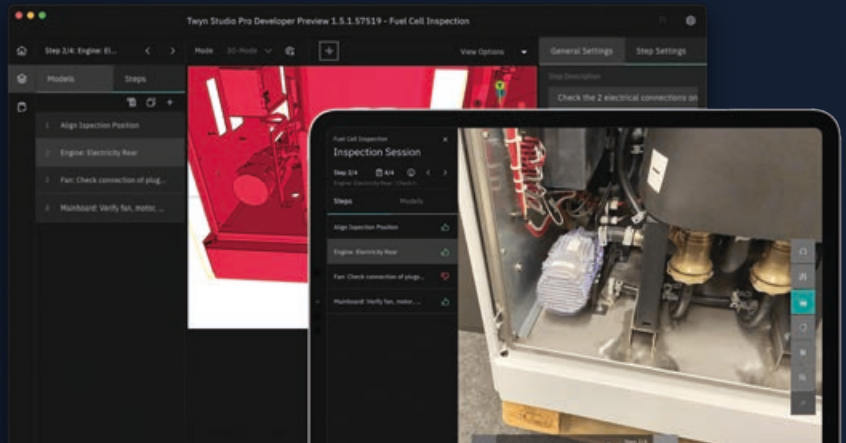
Inspection points for complex parts

Twyn's spatial "inspection points" enable you to pinpoint specific areas that require special attention. Instead of relying on a broad overview of the entire object, multiple features can be categorized and consolidated. This approach ensures a precise, intuitive, and faster way to conduct inspections and document observations and results. Once verified, inspection points are highlighted with dedicated indicators and visualized with distinct colors, allowing you to easily track the status of each inspected feature.



Inspection plans

For recurring inspections or complex inspection routines, Twyn provides valuable guidance to operators through step-by-step instructions presented as comprehensive checklists. This ensures consistent procedures, results, and documentation, irrespective of the users or their level of experience.



Inspection viewpoints

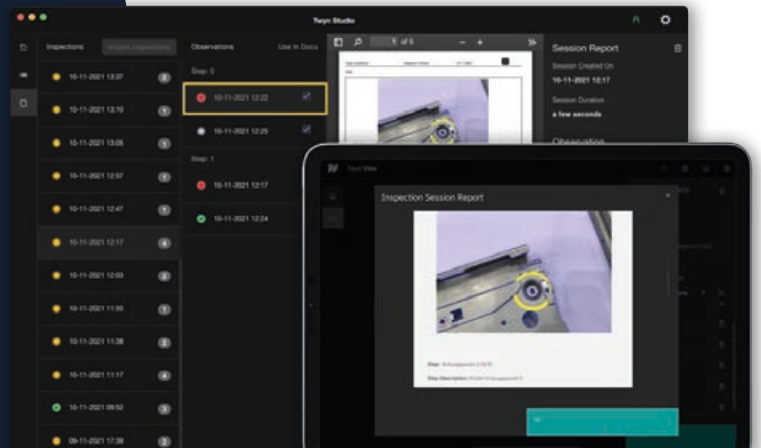
Visual indicators utilize 3D pointers to mark and highlight points of interest, simplifying inspections of complex assemblies by guiding users to critical features. This approach guarantees consistent results and standardized inspection documentation.

Comprehensive inspection data

Twyn facilitates the thorough documentation of quality inspection results. Markups and annotations enhance traceability and streamline communication between quality, production and construction teams. Additionally, with a camera always in place, Twyn enables the capture of images of relevant features, underpinning efficient and comprehensive reporting.

Customizable digital reports

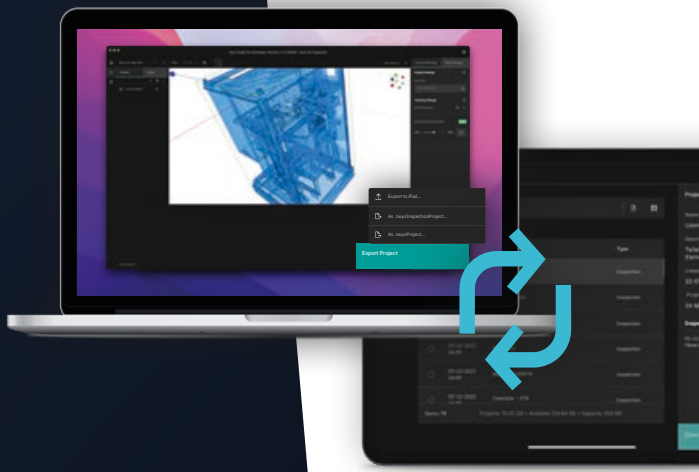
Branded and customizable reports provide concise summaries of inspection results. They can be exported in various formats (e.g. XLS, CSV, or PDF) and easily shared with quality and production teams, as well as suppliers.



Flexible import & export — wireless and across locations

With Twyn Studio, quality managers and inspectors working remotely at different Twyn workstations can access a shared database and exchange individual project files. This eliminates redundancy and duplication. Inspection data can be seamlessly exported from Twyn Studio and imported into Twyn View remotely, ensuring smooth project transfer and consistent procedures across various locations.

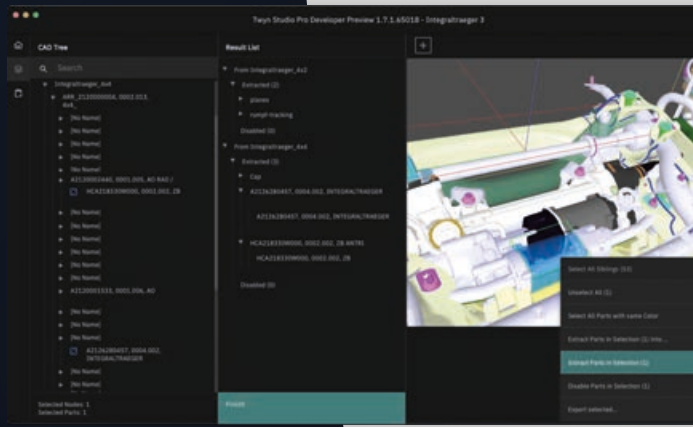
What's more, Twyn not only enables organizations to share inspection results in various formats but also supports multiple channels, including Cloud, Microsoft Teams, and email. Different stakeholders can share data regardless of their IT infrastructures, offering maximum flexibility and control over content sharing.

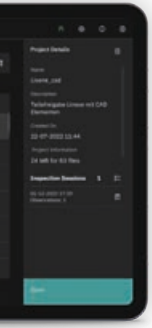


CAD model preparation in Twyn Studio

Because of complex CAD models, inspections can be time-consuming, costly, and challenging, often requiring the use of multiple software platforms. Twyn offers the capability to prepare, simplify, and optimize CAD structures by eliminating irrelevant details for inspection routines. This streamlines and expedites quality inspections, particularly for very complex parts.

CAD data provided by Twyn is optimized for mobile devices: requiring minimal setup time, quality inspectors can immediately focus on their inspection tasks as procedures are directly managed within Twyn Studio, eliminating the need for additional software.





CAD/3D support
Twyn supports the standard and most relevant 3D CAD formats for industrial and manufacturing applications — eliminating the need for prior conversion. These formats include JT, STEP, and IGES, among others.

CAD optimization and visualization
A best-in-class CAD optimization algorithm automatically prepares models for AR. This enables users to work with their original CAD files without the need for compression, all while ensuring unambiguous and high-quality rendering tailored for industrial applications.

Markup tool
Users can utilize a pen tool to highlight and categorize deviations and aberrations and add annotations. This facilitates comprehensive reporting and enhances communication between the quality and production teams.

Code scanner
Twyn enables operators to link parts with inspection procedures and documents using their IDs. Regardless of the user conducting the quality check, simply by scanning the ID, the corresponding inspection process and proof plan are accessed and executed instantly.

Session recordings
Users can record images and sensory data during inspections and later replay them on their computers from remote locations. This allows for detailed inspection analysis at any time, freeing them from the constraints of a specific location or time.

Codeless augmented reality
Twyn allows users to author quality inspection workflows without writing a single line of code, making it easy to define and conduct visual quality inspections even without any AR expertise.

INDUSTRIAL APPLICATIONS

Twyn's design and features make it ideal for various industrial applications, improving the overall production life cycle.

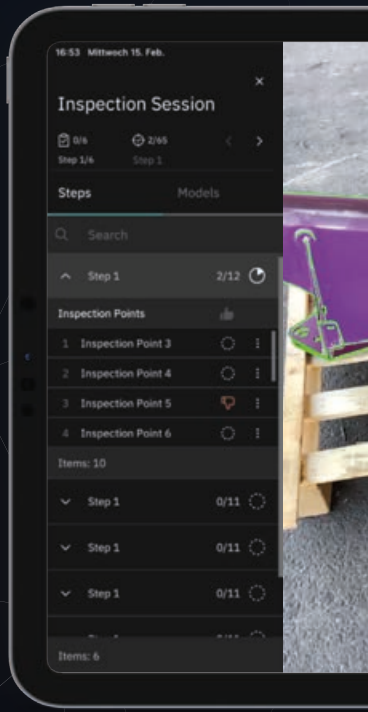
Outgoing & incoming inspection

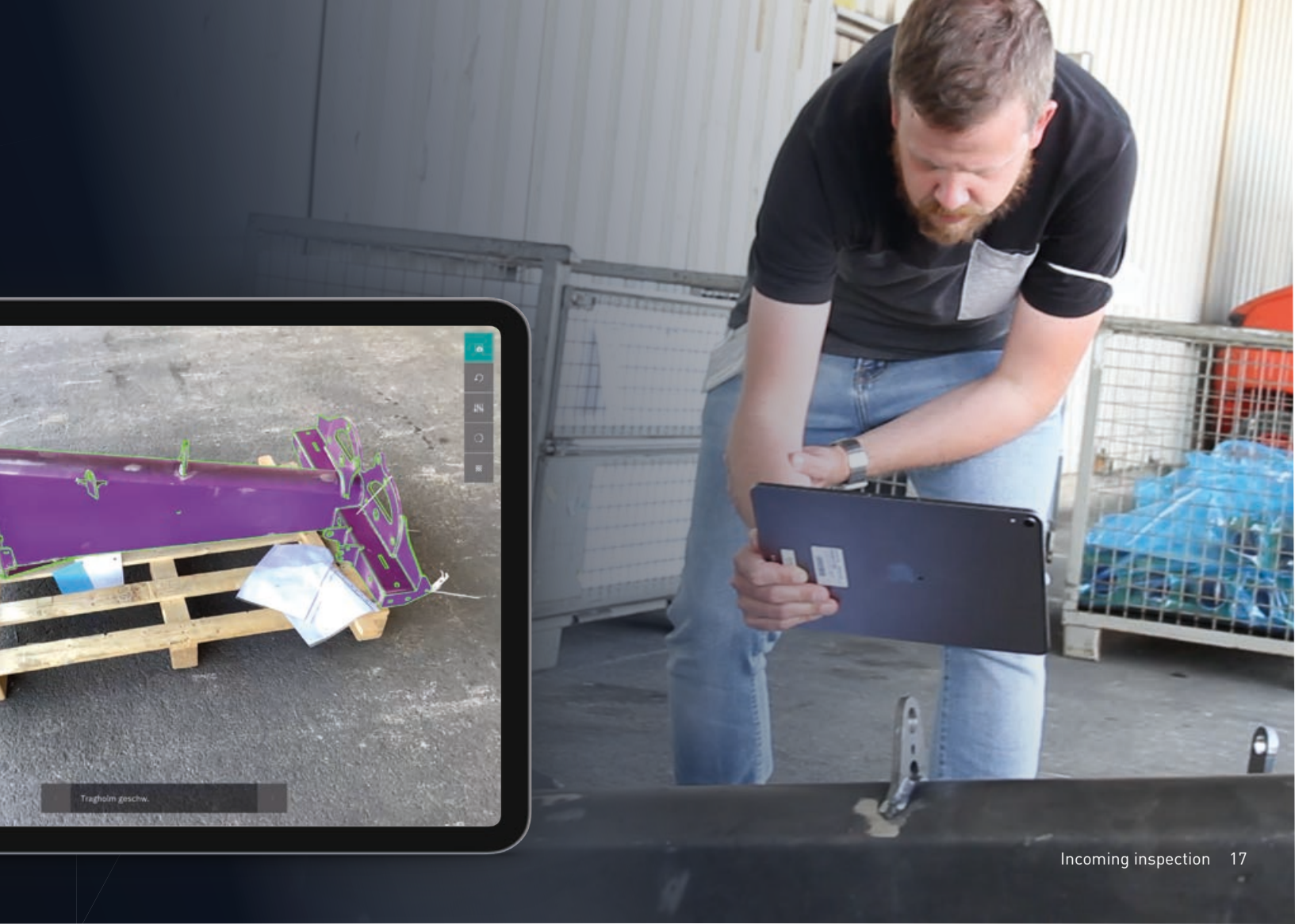
Efficient quality inspection with Twyn optimizes cross-company collaboration, guaranteeing that manufactured components comply with CAD specifications before they are shipped (outgoing inspection). Likewise, organizations can promptly identify parts from suppliers that do not align with CAD specifications (incoming inspection). Production errors are thus detected at an early stage.

First article inspection

Deviations from product specifications and faulty machining can result in delays, failures, and costly returns.

Twyn can systematically inspect components according to specific plans before they go into mass production. Defined checklists enable the digital documentation of inspection results and part conformity. This ensures that a new or modified manufacturing process consistently produces parts that meet requirements.

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Assembly check

AR and Twyn enable inspectors to digitally verify whether add-on parts are complete or whether engineering design drafts will fit into an assembly. They can identify errors before proceeding to the next production stages, preventing costly delays, downtime, and rework. In addition, different variants can be evaluated without the need to create physical prototypes, saving companies both time and materials.

Large part on-site inspection

With Twyn, operators can perform quality inspections at any location, right where components are manufactured or stored. This capability is particularly crucial for large parts and components, as they cannot be easily transported to measurement rooms or test areas or inspected using fixed inspection solutions.

Jig and fixture construction

Jigs and fixtures are essential tools for establishing manufacturing, requiring precise positioning and alignment to facilitate reliable machining. Twyn streamlines this process by allowing real-time, digital verification and adjustment of alignments. This way companies can avoid costly errors and rework during machining operations.

Toolmaking

Tools for efficient part processing and assembly are crucial in industrial manufacturing. They ensure that components are produced to specified requirements. Often custom-made, they are complex and expensive to create and need to be optimized through multiple iterations before the final tools can be built.

Twyn's flexibility and the ability to virtually simulate various configurations in AR streamline these processes digitally, significantly reducing the number of required iterations.

Body-in-white construction

Twyn is used to verify that car body frames have all their geometric features, including welding points and studs, correctly positioned. This step is critical and serves as a pre-requisite for the seamless integration of trims (e.g. door locks and handles, electronic components, and seats), chassis sub-assemblies, and the engine.

Product design and development

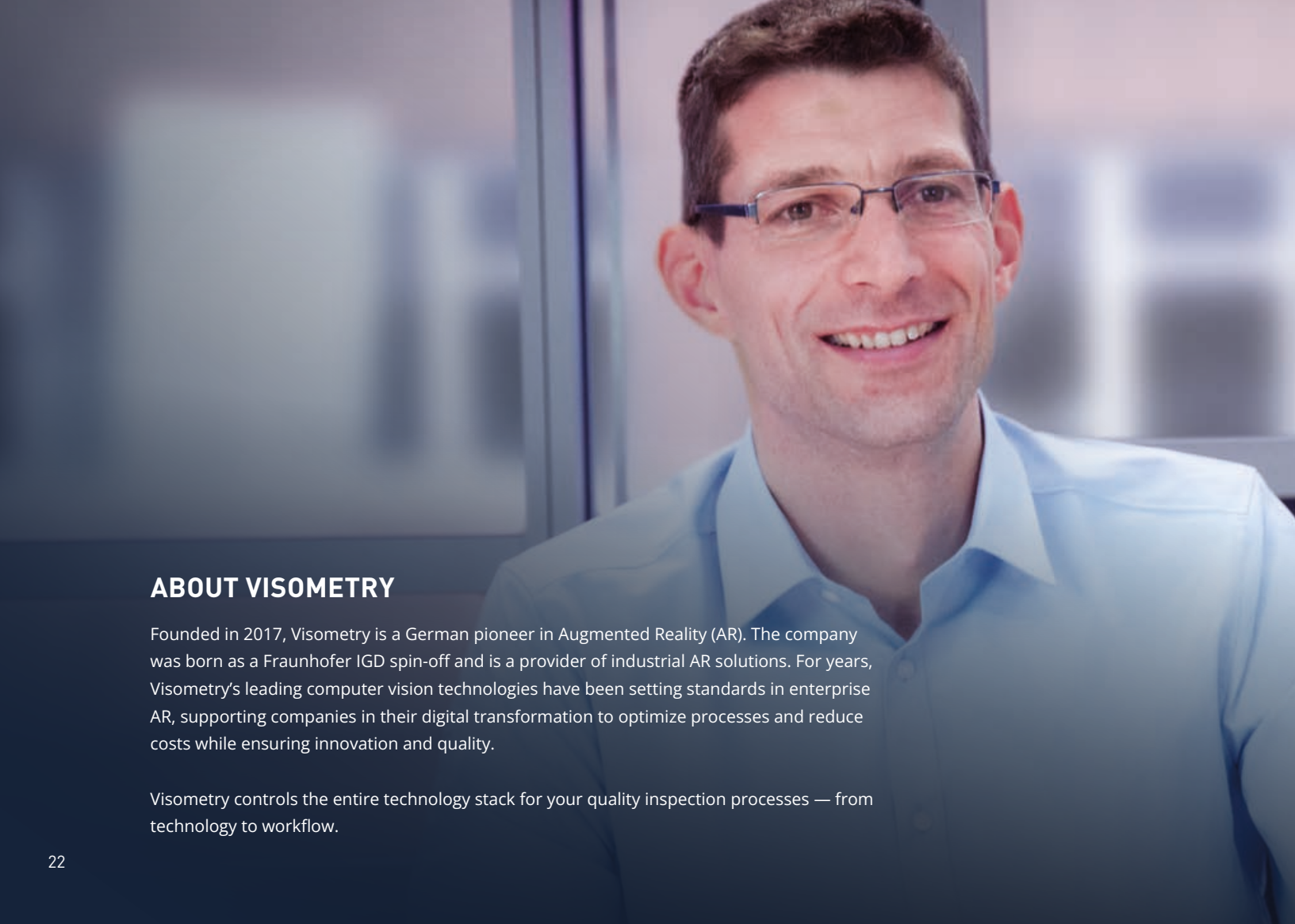
Twyn facilitates both the visualization and assessment of ideas and prototypes before they become final products. This enables manufacturers to minimize unnecessary iterations, saving both time and money associated with producing physical prototypes and products.

Quality gates in »manufacturing to order«

Twyn's ability to verify parts against their CAD specifications simplifies the establishment of quality gates throughout the production process. This helps identify errors as they arise, preventing costly downtimes and rework.

Maintenance and repair

Twyn is used to support various maintenance practices and audit requirements aimed at keeping equipment, devices, and machinery operational. By comparing the target state with the actual state, it is possible to directly and intuitively identify errors for repair, replacement, and servicing.



ABOUT VISOMETRY

Founded in 2017, Visometry is a German pioneer in Augmented Reality (AR). The company was born as a Fraunhofer IGD spin-off and is a provider of industrial AR solutions. For years, Visometry's leading computer vision technologies have been setting standards in enterprise AR, supporting companies in their digital transformation to optimize processes and reduce costs while ensuring innovation and quality.

Visometry controls the entire technology stack for your quality inspection processes — from technology to workflow.

VISOMETRY

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