Volvo Group Delivers Digital Thread Through the Lens of Augmented Reality

Rapidly shifting customer demands in the trucking market means the Volvo Group must continuously increase flexibility and agility across their business and differentiate their products through custom configurations and engineering excellence. The OEM created a digital thread from engineering to manufacturing, utilizing industrial internet of things (IIoT) technology to synchronize their CAD, PLM, and manufacturing operations technologies, enabling downstream access to up-to-date product design and configuration data in real time. Leveraging augmented reality to deliver this custom configuration data to their quality assurance technicians, Volvo Group is poised to generate significant cost savings, reduce new operator training time, and improve quality KPIs.

Leveraging a suite of PTC solutions for its own digital transformation, Volvo Group aims to improve workforce productivity, reduce training time, and increase quality control.

Volvo Group is one of the world's foremost manufacturers of trucks, buses, construction equipment, and industrial engines. Employing about 100,000 people and operating production facilities in 18 countries, this global enterprise requires stringent supply chain optimization and endless pursuit of operational efficiencies. Flexibility and agility are increasingly important manufacturing tenets to accommodate custom configurations and shifting customer requirements.

This is especially true for the Volvo Group, who had a nearly 260,000 order in-takes for trucks in 2018. To adapt to this changing landscape, Volvo is undertaking significant digital transformation and industry 4.0 initiatives, rethinking how it improves its physical processes, products, and people with current and emerging technologies.

> We're using ThingWorx and PTC solutions in order to route our data from the physical world to the decision-making in the digital world and back."

VOLVO GROUP

Bertrand Felix
Manufacturing Innovation and Technology Manager, Volvo Group

THE CHALLENGE

Volvo prides itself on strategically differentiating its vehicles on quality and engineering excellence. In today's rapidly changing market, customization has become the new normal. This presents new quality assurance challenges as product complexity and unique configurations increase in volume and rate of change.

"Volvo's engines are very sophisticated with 4,500 different engine information variants for just one plant and for 13,000 variants for the full plant for referencing," explains Geoffrey Blanc, Manufacturing Technology Manager at Volvo.

Engine quality control and assurance in Volvo's manufacturing plants are subject to rigorous quality checks, a task reserved for Volvo's most experienced technicians. In one plant, each engine requires 40 checks, with 200 possible quality assurance (QA) variants, which must be completed at the QA station in only eight minutes.

Training new operators on these complex inspection procedures takes five weeks, which adds to the overall cost of quality. The laborious process is paper-based, not only creating extraneous cognitive load for the operators, but also mobilizing time and resources to update, print, and distribute QA materials regularly.

Indeed, the challenge is to establish and maintain a consistent data flow and systems connections to create operational efficiency across the value chain. "As we know, the trucking market is subject to significant variations. To us, flexibility in the plants means how fast we can implement new shifts in production to follow the market," says Bertrand Felix, Manufacturing Innovation and Technology Manager, Volvo Group.

Volvo piloted an incumbent augmented reality (AR) provider to improve engine quality control processes but found the offering incapable of scaling and integrating across applications, processes, and desired use cases.

As they looked at alternate solutions, agile support for the increasing product complexity and custom configurations coming out of engineering and upstream manufacturing processes and scalability across global operations were critical requirements.

THE SOLUTION

Utilizing PTC not only for its leading Vuforia enterprise Augmented Reality suite of capabilities, but also for its end-to-end solution for creating and scaling a digital thread. The ability to integrate product and manufacturing lifecycle solutions across the value chain was a key differentiator for PTC.

Volvo also utilized the ThingWorx Industrial Internet of Things platform, engineering updates from Creo engine computer-aided design (CAD) iterations, downstream Windchill product lifecycle management (PLM) and manufacturing operations technology, and business systems were able to be rapidly integrated for real-time synchronicity.

> At Volvo Group Trucks Operations, we have a lot of homemade execution systems, so we had to integrate everything, and we have decided to use ThingWorx as much as we can to make critical connections and ultimately achieve a digital thread across our operations," says Blanc.

Finally, this single source of truth created by the digital thread will be delivered through the lens of augmented reality, ensuring QA workers can access and view the latest engine configurations and supporting materials in near real time.

Using a Vuforia augmented reality experience, operators can quickly recall the most up-to-date configurations in 3D to ease the burden of sorting through stacks of paper, creating gains in productivity, quality control, and overall process efficiency. The AR solution is delivered using mixed reality, which overlaying 3D data and QA details directly on to the physical engines and utilizes computer vision to track and anchor the content.

In addition to removing the cost and risk of the paper-based approach, the solution also enables the QA technician to capture specific defects through the AR experience, which can be sent upstream to improve engineering and manufacturing processes.

This bi-directional data sharing can help to analyze defects in real-time, further improving Volvo's quality and throughput. The feedback loop created by the establishment of a digital thread provides timely operational insights and captures vital feedback to improve future engine designs and further differentiate Volvo on quality and engineering excellence.

THE OUTCOME

Volvo's pilot adoption of augmented reality integrated with other PTC technologies by a digital thread is poised to have a transformative impact across the enterprise, from replacing paper-based procedures to revolutionizing how their people are empowered and trained. As a result, with an average of five quality stations per plant across 20 plants, Volvo anticipates savings of thousands euros per station per year, creating competitive recruitment advantages from leveraging AR, and enabling Volvo to get even closer to their 0 Part Per Million (PPM) quality goal.

With this digital thread and PTC solutions in place, Volvo will unlock countless other use cases with minimal effort, and several business outcomes are driving this broader digital transformation initiative:

Operational effectiveness and cost savings with the digitization of the QA process:

It previously took Volvo more than a day to update and validate the configuration and QA checklists with new engine iterations across workstations and facilities. With the implementation of a digital thread and augmented reality, this time is reduced to less than an hour.

Significant reduction in training time to close the skilled labor gap:

With the AR technology, the training of quality operators will be reduced to less than two weeks. Quickly onboarding key personnel enables Volvo to be more flexible and agile in response to shifting market and customer demands.

Establishment of digital thread unlocks additional use cases with AR:

Volvo plans to roll out an AR-driven QA process across multiple facilities in the near future and is actively developing new use cases across the value chain. Among them are step-by-step assembly instructions on the manufacturing line, service instructions for maintenance of factory equipment, and the enablement of real-time operational insights and KPIs across the value chain.

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