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All the Rumors Are True: How AR Transforms Construction Delivering 9x ROI

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Learning Objectives

- Discover current augmented reality for quality (ARQ) workflow processes and learn how to implement better practices.
- Learn about overcoming the challenges of eliminating costly rework on complex mission-critical projects.
- Learn about key strategies to reduce rework using advanced technology.
- Discover the benefits of utilizing Autodesk with augmented reality to support the digitization of projects.

Description

When it comes to construction, accuracy is key. A recent study revealed that up to 80% of all construction work is built out of tolerance. This means that errors are only identified after the work has been completed and the costs incurred. To avoid these costly mistakes, it's important to adopt technology that supports speed and efficiency while also ensuring accuracy. In this class, Coral Butler from PM Group will explore how XYZ Reality's engineering-grade augmented reality (AR) platform saved £2.5 million on a large, hyperscale, data-center project. As building it right, first time becomes a major objective, discover how the world's first augmented-reality-for-quality (ARQ) workflow was plugged into BIM 360 software to allow for real-time verification, making engineering-grade AR an invaluable tool.

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Contents

Speaker(s)

Coral Butler is the Group Head of Digital Project Delivery with PM Group. Coral is responsible for the delivery of the organization's Strategic Digital Plan 2025. She leads the management direction and technical leadership for digital project delivery across PM Group's international office network. Coral specializes in ConTech and is a BIM and digital expert. During her career, she has implemented major projects including BIM 360 and Assemble, a first-of-its-kind Augmented Reality (AR) service and automated auditing of model content. Coral has a strong focus on innovation and the development of products and solutions to enhance digital project delivery. Her extensive experience has been developed working on major capital projects for blue chip clients across the digital, pharma and mission critical sectors.

Follow Coral on LinkedIn: https://www.linkedin.com/in/coralbutlerbim/

David Mitchell is Founder & CEO of construction technology company, XYZ Reality, the company behind the Atom – the world's first Engineering-Grade Augmented Reality headset. Before founding XYZ Reality, David had worked as a digital construction manager on some of Europe's largest projects including: The Shard, Battersea power station and hyper-scale data centres. David is a leading expert in digital construction and has been recognised for his innovation in this space.

Follow David on LinkedIn: https://www.linkedin.com/in/david-mitchell-xyz/

About PM Group

PM Group is an international project delivery company operating across Europe, the USA and Asia.
A team of 3,500+ people manage the design, construction and commissioning of high-tech facilities. Over 49 years, the company has built its expertise working for the world's leading pharma, food, data centre and medical technology companies with an excellent track record in the advanced manufacturing and energy sectors.

About XYZ Reality

XYZ Reality is on a mission to eliminate rework and is pioneering the AEC sector with the world's most accurate Augmented Reality (AR) headset, the Atom.

Harnessing the power of the Atom, construction teams can now view and position 3D BIM models on-site to 5mm accuracy, validate in real-time and make immediate decisions in the field during all phases of construction. This cutting-edge tool makes the entire construction journey safer and more efficient, reducing waste, de-risking processes, and allowing construction teams to build it right, first time.

Winner of the prestigious award for 'Digital innovation in on-site productivity' at the Digital Construction Awards and named one of the top five construction technology firms, XYZ Reality is focused on making the lives of all construction workers easier by boosting productivity, reducing construction waste, and bridging the skills-gap.

Introduction

In 1998, the Egan Report revealed around 30% of construction activity is rework. Unsurprisingly, these findings were met with alarm and the industry sat up to take notice of the report's recommendations. Over the following 20-odd years, huge efforts were made to put things right, with a particular focus placed on reducing rework amongst industry leaders, creating integrated processes, and establishing a quality-driven agenda. Despite efforts, the demand for construction, tightening of budgets, and a push to speed up works show the industry hasn't made much progress. According to Autodesk Construction Cloud, 35% of construction professionals' time is spent (over 14 hours per week) on non-productive activities including looking for project information, conflict resolution, and dealing with mistakes and rework.

These figures are stark in contrast to our growing dependency on data centers. As this escalates leaders in the field require facilities that are efficient, secure, and meet the evolutionary demands associated with these critical assets. Those in charge need trusted partners who can deliver resilient infrastructure that can stand the test of time. As such, both asset owners and the design and build team strive to ensure facilities are operational as soon as possible, with no issues which will impact performance or affect the environment. **Building it right, first time** has become a non-negotiable objective in the project brief. Any construction errors will lead to significant costs to the contractor through remediation, and to the owner through delays in bringing the facilities online.

As we encounter these shorter timeframes to meet the growing demand for data centers, the question many are facing is 'how can we ensure build success, against the backdrop of project complexity and time constraints?

With the introduction of a new era of game-changing technology, we can right the wrongs of the past. In this session, we'll explore how advanced Engineering-Grade Augmented Reality (AR) technology enables real-time validation, delivering proactive processes on-site, eliminating the need for rework, boosting productivity, and helping deliver mission critical assets on-time and on budget.

Take control of project quality with Augmented Reality

The ability to deliver high-quality projects on time and on budget is at the core of a contractor's success. This is particularly true for mission critical projects, where tolerance margins can be as tight as 5-10mm, and project schedules leave little room for delays and rework.

Traditionally, reality capture tools have only been able to identify structural defects after the works have been completed, providing a fragmented inspection of the data center. It's a slow, laborious task that prompts an expensive and time-consuming rework program. Historically a frustrating solution, it's now becoming avoidable. This is where selecting the right technology plays a vital role.

Data center leaders require technology that allows them to proactively identify any errors at the lowest value stage. Engineering-Grade Augmented Reality (AR) allows construction teams to visualize 3D hologram models to millimeter-accuracy, enabling them to penetrate deeper into the build process and correct any potential mistakes before they happen and before the cost has been incurred.

Taking advantage of Augmented Reality for Quality (ARQ) workflow processes enables the following:

1. **Greater visibility/transparency across teams** (on-site and in office) of any errors/required rework.
2. **Streamlined workflows** – create, visualize and manage issues and tasks, and instantly assign them to project stakeholders in BIM 360.
3. **Superior information flow** – remove the need for laser scanning which takes up to 2 weeks to get results, with AR get data in minutes and feed this back to teams.
4. Remove reactive approaches and enable **proactive processes.**
5. **Build it right, first time.**

Overcoming complex challenges

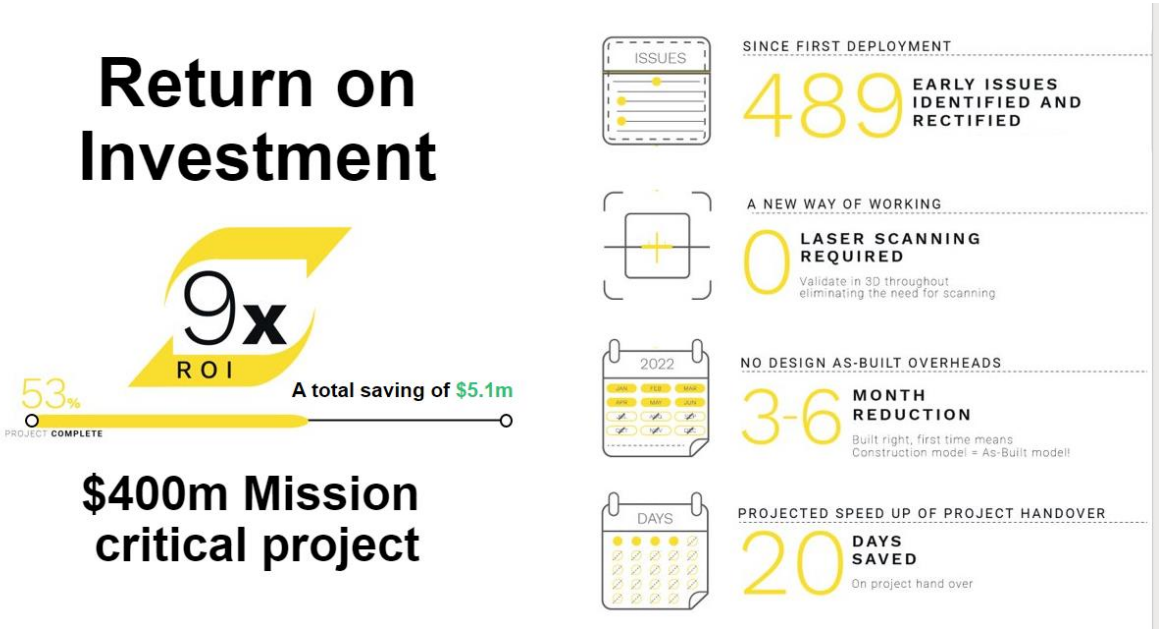
A recent study revealed that up to 80% of all construction work is built out of tolerance. This means that errors are only identified after the work has been completed and the costs incurred.

Across the project lifecycle – from design, construction, project management through to handover – digital tools are massively impacting the way we work. The benefits include the ability to be faster, more accurate, visualize in real-time and deal with issues before they actualize as time or cost concerns. The benefits are endless if you adopt the right tools.

As project delivery specialists and digital integrators, PM Group manage huge data sets and models. Given their multiple contract options, PM Group provides various levels of digitally enabled projects and is constantly exploring ways to work smarter and faster. The Company looks for new technologies that allow them to be more **proactive**, **reduce rework** of design and **improve communications** with the project team and clients. The more technologies can fit seamlessly into its business, the easier they can deliver real benefits to its clients. Ease of use is key to adoption and empowering teams to champion digital technologies over traditional methods.

PM Group uses a range of technologies including AR, VR, MR, Robotics, AI, and Data Analytics. They collaborated with XYZ Reality to enable proactive processes and eliminate rework using Engineering-Grade AR. Using the Atom across some of their construction sites in Europe is significantly quicker than traditional laser survey methods. The high level of accuracy removes the need for constant laser surveying with significant cost and labor savings.

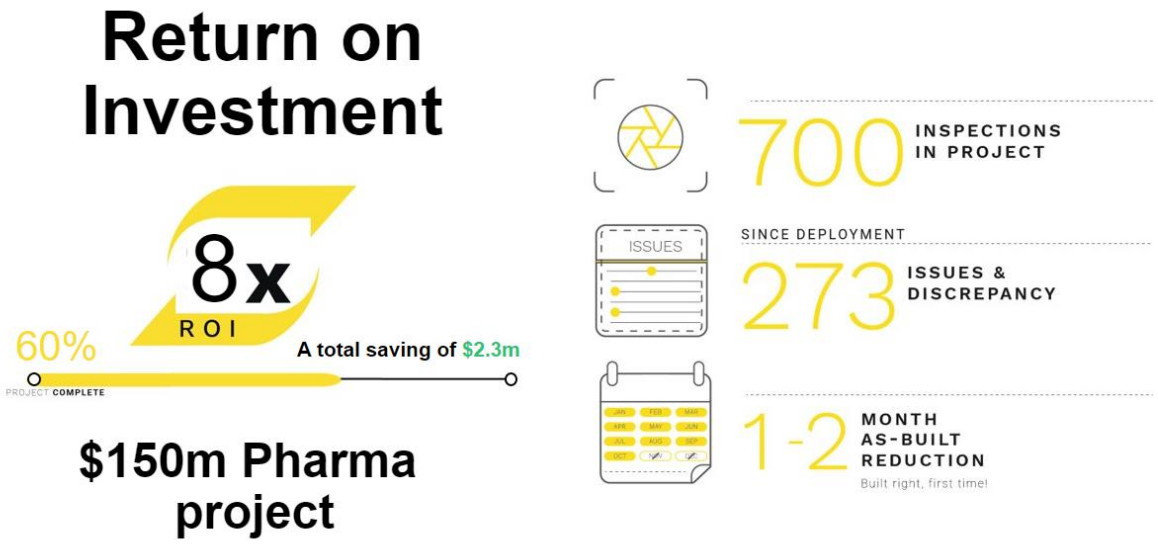
On PM Group's $400m Mission Critical project, the revolutionary technology demonstrated a 9X return-on-investment (ROI) after 56% of the project's completion, delivering huge time and cost savings by identifying errors early and reducing the need for as-built updates.



489 on-site issues were identified early and rectified in real-time. Based on calculations the technology has avoided $5.1 million in variations or change requests and saved 20 days off the project schedule.

Also benefitting the data centre client, this approach captures as-built data about the facility, eliminating the traditional 3-6 months long end-of-project process of updating design information.

On a separate $150 million pharmaceutical project, the Atom has demonstrated 8X ROI, after 60% of the project's completion. 700 inspections caught 273 issues and design deviations on-site. If these errors were identified at a later stage, they would have had a huge impact on the project's delivery schedule and budget.



Case study: ELECTRICAL WORKS

LOCATION: DENMARK
INDUSTRY: DATA CENTRE
SIZE: 40MW
PROJECT VALUE: €300M
PROJECT STAGE: Internal Fit-Out

PROBLEM: Internal works carry a much greater burden on mission-critical projects when compared to external works. Any discrepancies can have a knock-on effect on other contractors. Subsequently leading to costly rework and project delays. Therefore, it is critical that contractors do everything they can to ensure the up most accuracy of their work.

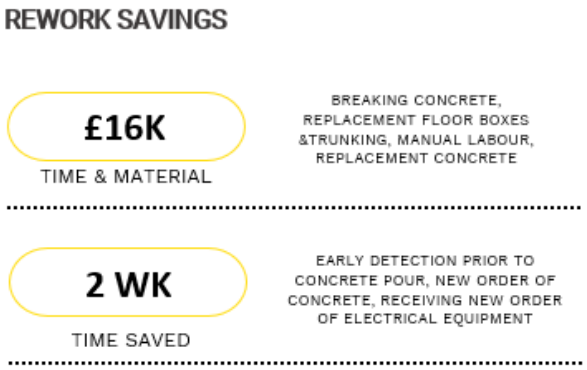
SCOPE OF WORKS: PM Group partnered with XYZ Reality in order to allow their site team to take a proactive approach to the construction of this Data Centre Project. This case study reviews the implementation of XYZ's Field Application Engineer and Atom which worked together to prevent a potential issue that could have hindered the project further down the line.

REQUEST FOR INSPECTION: XYZ Reality was asked to conduct a ***during-Installation*** inspection of several electrical floor boxes and under-floor duct trunking whilst the contractor was installing these elements. This request was placed as these electrical elements were to be covered in concrete in the coming days and fixed in their position.

ISSUE IDENTIFIED: Upon XYZ's Field Application Engineer commencing the inspection with the Atom, it was evident several the items included in the inspection had been installed in a different position to the BIM Model. All these items were significantly out of tolerance. One of which had a 3 meter discrepancy to the BIM Model. After loading the architectural model, we could see the discrepancy was so great that it was situated in the wrong room.

RESULTS

Following XYZ's intervention, all the underfloor electrical services were fixed in the correct position before the concrete was poured. This prevented a number of potential outcomes. It is possible that this problem would have gone unnoticed until the walls were installed on site. This could have lead to a number of project delays as well as the costly rework that would be associated with breaking the concrete floor before replacing the electrical equipment. All these possible issues were negated by using the Atom.



Integrating BIM 360 with Engineering-Grade Augmented Reality (AR)

Visualise and manage issues and tasks in BIM 360. Inspect the model on-site and share details, pictures and videos linked to precise locations. Identify clashes before they take place. Verify works during installation directly from the coordinated model, validate, and sign-off works in real-time.

Atom is the world's first Engineering-Grade AR headset. Combining a construction hardhat, AR displays and an in-built computer, construction teams can view 3D models to millimetre accuracy on-site, eliminate rework, and Build it Right, First Time.

Context of mm accuracy
XYZ Reality's integration with Autodesk® BIM 360® delivers millimetre accuracy on-site. The Atom extends BIM 360 to the field to precise locations.

Workflow management
Identify, organise and co-ordinate particular tasks within The Atom and send this information to BIM 360 – streamlining workflows and delivering time savings for those in the field.

On-site visibility
The integration brings unparalleled visibility to all - managers get an abundance of real-time, accurate information from the field, directly to the office. It gives users an 'eye in the field'.

Federated model
The integration allows users to feed into the large, multi-layer federated model. Here, you can manage all of the possible disciplines within the field. Whether it be, one-to-one models or large complex projects, where several models need syncing, it offers the full picture of the entire model. Issues raised here can be directed to individuals and specific models.

Issue management
Visualise, check and manage issues by assigning tasks, updating workflows, sharing pictures and videos with team members through BIM 360 and the Atom. BIM 360 users can now visualise the precise location of where an issue is taking place in the field with ease, which has, until now, never been possible. A multitude of context, in the form of images, videos and descriptions, can now be provided from the Atom and raised within BIM 360.

Increased productivity
By eliminating the need for manual reporting processes, this integration offers productivity savings of 70-75%. It reduces time spent in the office, so more time can be spent in the field.

Dynamic working
The dynamic nature of working means anything raised within the field is entirely compatible with what users can see in the office. Those in the field can immediately react to, and action, any queries put forward by BIM 360 project members.

What is the Atom?

The Atom is a powerful, custom-built engineering tool combining a construction safety headset, augmented reality displays and in-built computing power. With the Atom, construction teams

can view 3D models to millimetre accuracy on-site. The Atom taps into the site coordinate system, giving the user absolute positioning and confidence that the model you are viewing is to millimetre accuracy. Users can walk through construction sites viewing holograms of models positioned within construction tolerances.

The Atom meets all construction safety standards today so replaces your traditional hardhat and visor, it's 1TB of RAM and i7 intel core processing power means the user can seamlessly load hyperscale models. The Atom works with all the latest BIM solutions including BIM360 and can work both on and offline.

No more 2D

Consider the current process – we design in 3D, and convert this into thousands of 2D drawings in order to construct a 3D asset. On average there are more than 5,000 2D drawings on a complex construction site and these quickly ramp up once revisions are included. With multiple construction teams and individuals, it's unnatural to decipher all these 2D drawings.This leads to compounding errors propagating through your build and ultimately costly rework.

Design in 3D, build in 3D and validate in 3D

The Atom positions hyperscale 3D models out on-site to within construction tolerances, to the site coordinate system. Now all construction teams can build straight from the same source – the building model itself – therefore removing the possibility of misinterpreting the thousands of 2D drawings and significantly reducing the margin for error across the project.

This takes construction into a whole new digital era, bringing digital on-site and equipping construction teams with site-wide situational awareness. But it doesn't end there.

Build it right, first time

Currently deployed on sites around the world, the Atom is enabling proactive processes during all phases of works. Our customers are out in the field at the pre-installation phase, ensuring design verification, eliminating hard clashes, and delivering advanced coordination.

During installation it's a world first where any user can go out on-site and use this equipment to build it right, first time, enabling rigorous quality processes where the as-designed model becomes the as-built model.

Post-installation, the technology is enabling remote handovers, remote inspections, and improving health and safety on-site. It's reducing the need for everyone to attend site inspections, and team members can be anywhere in the world monitoring progress.

How PM Group deployed Engineering-Grade AR

The Atom was deployed by the project site team, initially as a BETA trial, in November 2020. Within the first week of deployment the XYZ Field Application Engineer*[1] identified several significant discrepancies between what had been installed (as-built) and what was designed (as-designed). Following this, the Atom was fully deployed on-site and in 2022 the key decision was made to integrate PM Group's Project Management system, Autodesk BIM 360 with the Atom's cloud platform. This doubled the number of inspections and issues raised on-site and created seamless links with the project teams current processes, enabling superior project management capabilities.

PM Group saved £2.5 million and reduced project handover time. The construction team used the Atom to visualise designs on-site and to check in real-time that constructed works were accurately positioned. It helped identify and prevent early-stage construction inaccuracies, avoiding inefficient rework.

The complexity of the facility's mechanical and electrical (M&E) engineering works, coupled with a tight programme, demanded efficient delivery. PM Group deployed Engineering-Grade AR to identify potential out-of-tolerance construction, reduce the need for rework and thus eliminating the time delays and additional labour and materials costs.

Testimonials:

Diarmuid O'Sullivan, Construction Director, PM Group, said: "We've been using the Atom since the beginning of the Danish project, and it is unlocking significant productivity advancements on-site. It has allowed us to move away from a reactive approach to tackling errors, to a more proactive way of working, solving problems before they actualise as a cost."

Philip Hedigan, Project Manager, PM Group, said: "We've seen huge value XYZ on board at a very early stage in the project. What we would work towards with all our trade partners is for them to understand the benefit it brings and for people then to look at it more of an added value than an added cost."

Barry Madden, Chief Field Engineer, PM Group, says: "The cost saving potential of getting it right first time are huge. It will be evident from an early stage if there is something wrong. There is no time lag between what you actually see and getting results."

Paschal McErlean ,Construction Manager, PM Group, added: "It is a gamechanger. It helps us with constructability, it helps us build safer and fast."

Useful links

Introducing the Atom

[1] XYZ Reality FAEs provide full-time on-site support and training enabling superior data/information flow by capturing any issues and errors in the field and feeding these back to the office or anywhere in the world.

- https://www.youtube.com/watch?v=cTVtrfEQGtU

The Atom in action

- **PM Group | XYZ Reality -** https://www.youtube.com/watch?v=5VtUJvmuXkg&t=4s
- **Dornan Engineering & Georg Fischer | XYZ Reality -** https://www.youtube.com/watch?v=c6POD3idbQk&t=18s
- **Cundall | XYZ Reality -** https://www.youtube.com/watch?v=6gKpP8Pzl2I&t=2s

BIM 360 integration

- https://www.youtube.com/watch?v=PcwWqeiLtkE