PRODUCTION BUILD EXPERIENCE

The **Production Build Experience** builds on the Theorem Solutions Visualization Experience, presenting the opportunity for production operatives, working independently or together with a group in local or remote locations, to optimize production processes and accelerate production readiness through the immersive experience of XR technologies.

Theorem Solutions has invested significantly to understand how **Spatial Computing**, or **'XReality' (XR)** technology can be exploited today to bring real business benefits to product development and manufacturing businesses. We have created a suite of task-orientated **'Digital Realities Experiences'** that get the most from the XR toolset, embedded with a suite of targeted tools to deliver the greatest gain.

The application of XR in a production context continues to attract media attention. The earlier versions of Google Glass for instance showed great promise in making it easy to manage machines, materials, and people on the shop floor. Cyber-physical systems are growing, and they are a significant part of the industry 4.0 evolution. Despite this, there is widespread confusion and scepticism regarding the potential XR represents, and the most effective adoption strategies. Most manufacturers are focused on value-added activities, and often have little resource for technology research or development exploration.

As a result, XR technology has yet to reach anything close to critical mass in many smaller manufacturing businesses. However, there are lessons that can be taken from larger manufacturers that have begun to embrace this opportunity, such as driving efficiency through hands free access to information, the provision of quality data, and safety enhancements through warnings presented in the field of view.

Advances in computer aided engineering have helped to accelerate development, making digital models available to manufacturing and production engineers much earlier in the product development lifecycle, but arguably the downside is an increased gap between engineers and their creations – a disconnect between the digital data and the physical world. Psychologists refer to this gap as **'cognitive distance'**. This is both inefficient and introduces the risk of quality related problems downstream.

When it comes to production preparation activities, such as operator training, it can prove difficult to apply physical context to digital data. Despite the existence of useable and representative 3D data relatively early in the product development process, the opportunity to prepare production staff, and benefit from valuable insight regarding potential issues, suffers as a result. The opportunity for faster and more powerful decision-making is being lost.

Theorem Solutions

Spatial computing technologies, blending digital assets into the physical world, represent an opportunity to bring engineers and operatives closer to the digital assets that support accelerated deployment and improved quality and productivity.

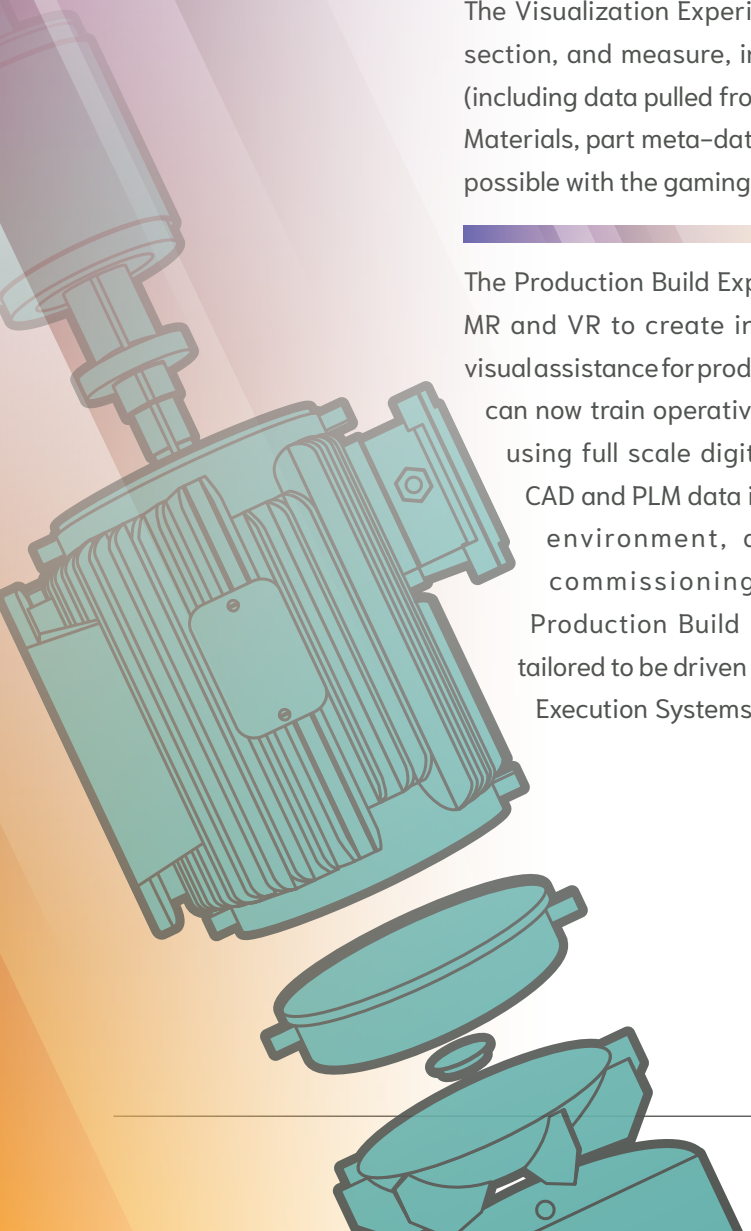
Commercial applications of **Virtual Reality (VR)**, such as CAVES and Powerwalls, both expensive to deploy and operate, have helped larger organisations to close the cognitive gap. To date however, spatial computing, typically deployed in gaming and retail applications, has seen little application in product development. The proliferation of consumer grade technology, beginning with wearable VR technologies, but now also including **Augmented Reality (AR)**, and **Mixed Reality (MR)** solutions (see side bar) is making it both easier and cheaper to adopt.

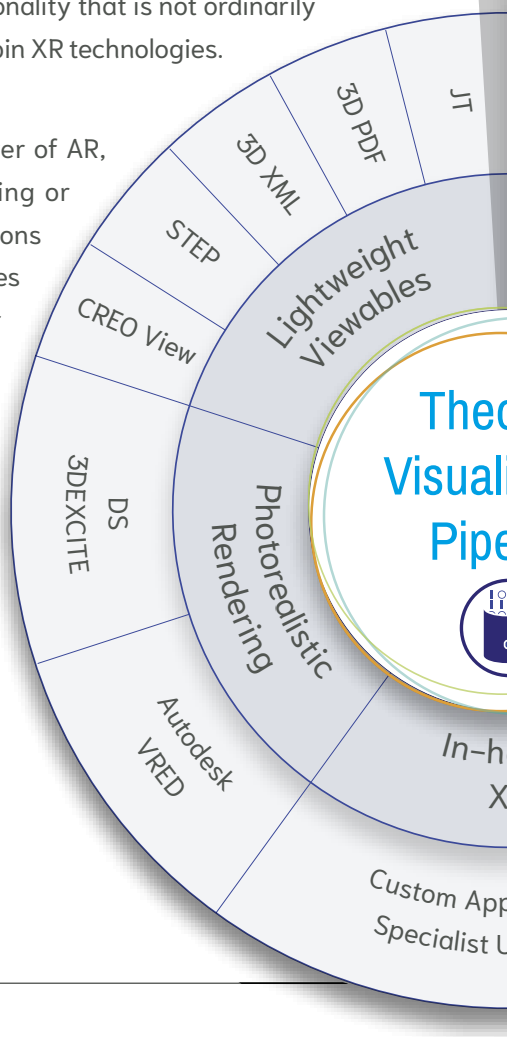
Theorem Solutions Digital Realities
Closer | Better | Together

Theorem Solutions has set out to develop a technology agnostic collaboration platform for businesses of all sizes. The **Production Build Experience** leverages the Visualization Experience, building on this world-class visualization toolset presenting the opportunity for production operatives, working independently or together with a group in local or remote locations, to optimize production processes and accelerate production readiness through the immersive experience of XR technologies. The result closes the cognitive distance for all involved, and also provides a unique collaborative workspace.

The Visualization Experience provides the essential tools to view, navigate, explode, section, and measure, in addition to interrogating materials and other information (including data pulled from external databases, and essentially maintaining the Bill-of-Materials, part meta-data, and motion replay; functionality that is not ordinarily possible with the gaming graphic engines that underpin XR technologies.

The Production Build Experience harnesses the power of AR, MR and VR to create interactive, immersive training or visual assistance for production operatives. Organisations can now train operatives in complex build processes using full scale digital representations of their CAD and PLM data in a real world or immersive environment, accelerating planning, commissioning and operation. The Production Build Experience can also be tailored to be driven directly by Manufacturing Execution Systems.

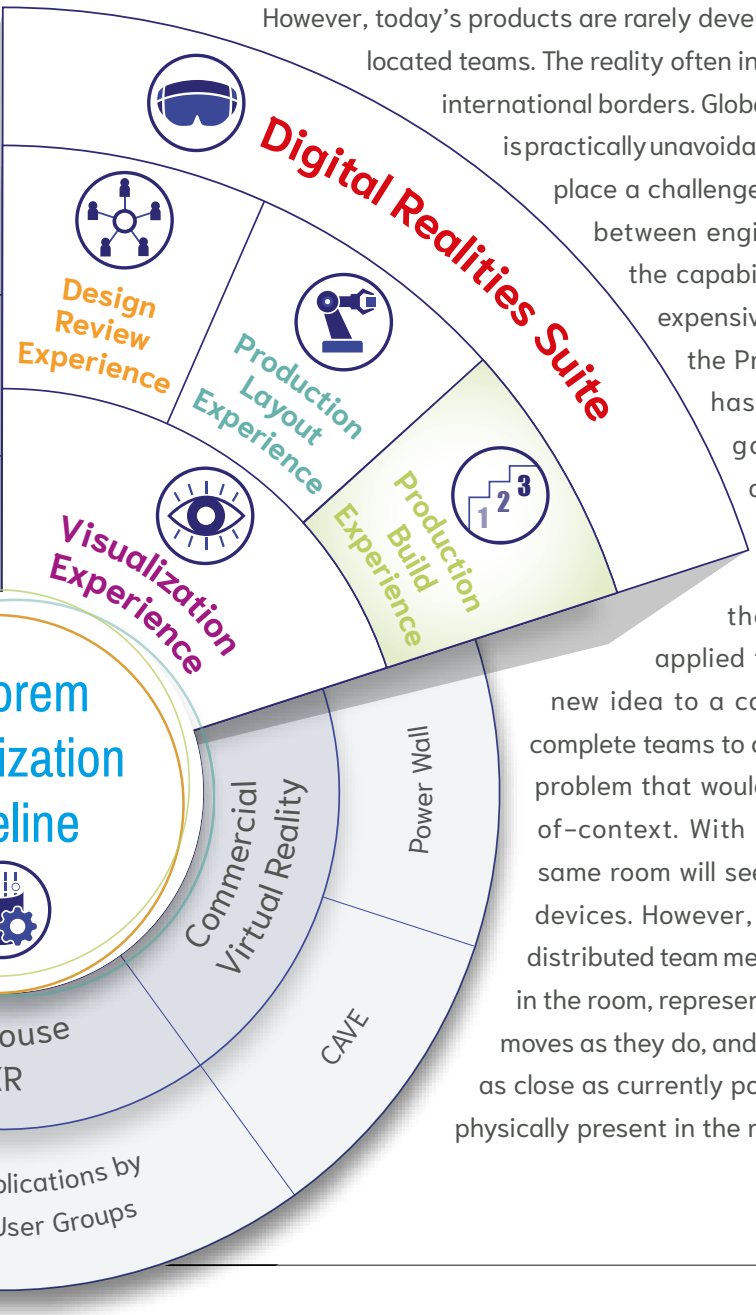




Out-of-the-box

Out of the box, the Production Build Experience can be seamlessly integrated into existing business processes, using proven and robust XR technologies, to better understand the stages and complexities associated with product manufacture and assembly build.

Operators can be trained without a requirement for physical assets, or without the need to utilize production assets that have already been deployed; reducing downtime and avoiding risks such as exposure to environmental dangers in a physical location. Staff can learn and rehearse operation and handling of virtual lines, accelerating readiness and quality improvement. Using AR or MR, key production features such as interface features, master locators or space envelopes can be highlighted to bring context to the instruction, or to identify assembly sequences that should already have been completed. Using the spatial benefits of MR, operators can identify access, movement or reach issues.

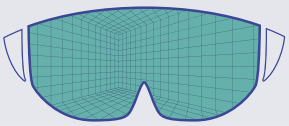


However, today's products are rarely developed with the luxury of co-located teams. The reality often involves collaboration across international borders. Globally distributed engineering is practically unavoidable, and this will increasingly place a challenge on effective collaboration between engineering teams. Exceeding the capabilities of significantly more expensive commercial VR solutions, the Production Build Experience has been developed with the goal of bringing globally distributed teams closer together. With the built-in collaboration functionality, the spatial context can be applied to the demonstration of a new idea to a colleague, or it can enable complete teams to come together to address a problem that would be tough to explain out-of-context. With AR and MR, teams in the same room will see each other through their devices. However, using any XR technology, distributed team members can also be 'present' in the room, represented by a virtual avatar that moves as they do, and mimics their gestures – it's as close as currently possible to having colleagues physically present in the room.

DIGITAL REALITIES

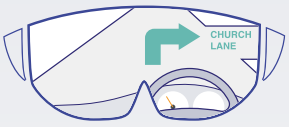
Digital Realities is a suite of client/server based applications that streamline the delivery and interactive manipulation of 3D CAD and PLM data on Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) devices.

VR



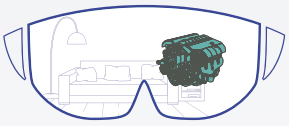
VR places the user into an entirely simulated (computer generated) environment, by standing in a CAVE or using a headset (e.g. HTC Vive). It entirely occludes the user's natural surroundings.

AR



AR presents a view of the natural world overlaid with a layer of digital content. The can be viewed through the screen of a smartphone or tablet (e.g. Apple's ARKit), or limited information presented using a helmet device (e.g. Google Glass).

MR



MR places a holographic projection of digital data into, and in some cases responsive to, the physical world (e.g. Microsoft HoloLens, or Magic Leap). An MR head mounted 'visor' is clear, providing a comfortable view of the natural world (rather than viewing through a device screen).

About Theorem Solutions

Theorem Solutions have been helping engineering and manufacturing users leverage the value of their CAD and PLM assets for over 25 years. We help the world's leading Automotive, Aerospace, Defense, Power Generation, Transportation, and White Goods manufacturers and their end-to-end value chains to optimize the use of their Digital assets. Our solutions enable product development and manufacturing businesses to compress design and manufacturing lifecycles, whilst improving product quality. Our core strength is in the visualization and utilization of data across complex organizations to maximize efficiency.

Theorem Solutions offers a consultative approach to help customers get the most from technology. We advise on optimum use cases, deployment strategy, and custom development as required to maximize the Return on Investment.

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