



PRODUCTION LAYOUT EXPERIENCE

The **Production Layout Experience** builds on the Theorem Solutions Visualization Experience, further enabling a planning or layout engineer, working independently or together with a group in local or remote locations, to optimize production layouts through the immersive experience of XR technologies. This closes the cognitive distance for all involved, and can provide a unique collaborative workspace.

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.

Recent trends in the manufacturing industry suggest that existing layout configurations do not meet the needs of multiproduct enterprises and that there is a need for a new generation of factory layouts that are flexible, modular, and easy to reconfigure. With increased flexibility, modularity, and reconfigurability, factories could avoid redesigning their layouts each time their production requirements changed. Modern manufacturers value layouts that retain their usefulness over many product mixes and can easily be reconfigured. Equally important are layouts that permit shorter lead times, lower inventories, and a greater degree of product customization.

However, creating new layouts can be expensive and disruptive, especially when factories must shut down. When planning and making changes, it is therefore essential to get it right first time.

Production engineers need to evaluate conventional layouts (such as product, process, and cellular or overlapping

cellular layouts), versus functional layouts (all resources of the same type in one location), versus alternative concepts (such as distributed layouts with 'virtual' temporary cells) when considering flexible manufacturing scenarios.

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 layout reviews, it can prove difficult to apply physical context to digital data, and the performance of the event, particularly as it pertains to issue detection and the quality of the associated dialogue between peers, suffers as a result.

Spatial computing technologies, blending digital assets into the physical world, represent an opportunity to bring engineers closer to their models, and engineering teams closer together.

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. A new generation of low cost, widely available ‘consumer’ technologies, beginning with wearable VR technologies, has evolved to include Augmented Reality (AR), and Mixed Reality (MR) solutions (see side bar).

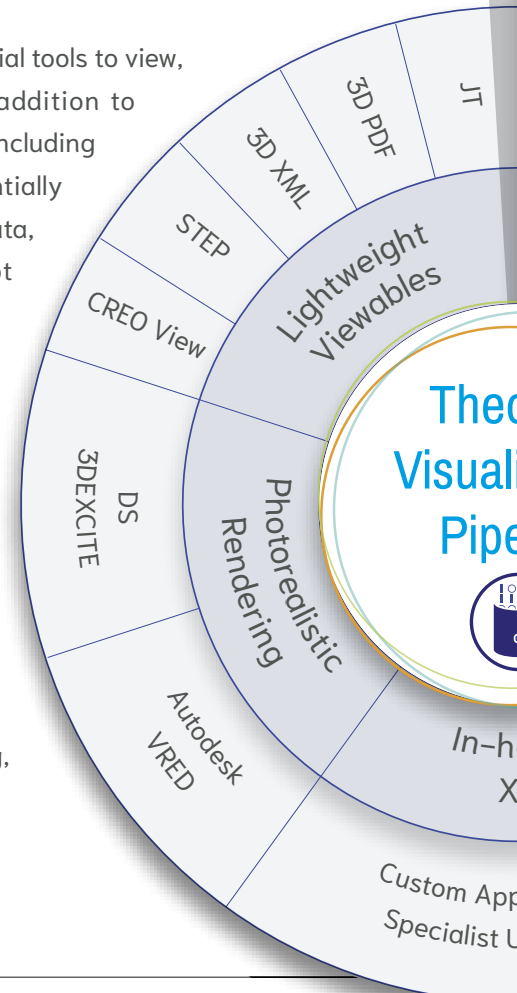
Theorem Solutions Digital Realities Closer | Better | Together

‘Theorem Solutions provides enabling technologies for engineering and manufacturing businesses to improve their design, engineering and manufacturing processes, by utilising existing digital assets to collaborate within innovative Virtual, Augmented and Mixed Reality Experiences’. Our goal has been to produce a technology agnostic collaboration platform for businesses of all sizes.

The **Production Layout Experience** leverages the Visualization Experience, building on this world-class visualization toolset to enable a planning or layout engineer, working independently or together with a group in local or remote locations, to optimize production layouts through the immersive experience of XR technologies. The result closes the cognitive distance for all involved, and 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 Layout Experience focuses on the needs of the planner, with essential tools to optimise the layout of equipment, production plant, stillages, and machinery. Organisations can now plan their production and assembly processes using full scale digital representations of their CAD and PLM data in a real world or immersive environment, accelerating planning, commissioning and operation.



Out-of-the-box

Out of the box, the Production Layout Experience can be seamlessly integrated into existing business processes, using proven and robust XR technologies. Scenes can be preloaded with existing CAD or scanned factory data. Existing or new library components can be imported and repositioned using 'grab and move' capabilities and simple snap-to functionality for easy and accurate positioning.

Alternative scenarios can be rapidly explored to optimise layout (maximising productivity and efficiency), understand potential clashes, evaluate ergonomic issues or access problems, and prepare infrastructure options. Promising outcomes can be saved for future review or cascade, or they can be exported to update source CAD data. Similarly, staff can learn and rehearse operation and handling of virtual lines, accelerating readiness and quality improvement.

Today's products are rarely developed with the luxury of co-located teams. The reality often involves collaboration across international borders. Globally

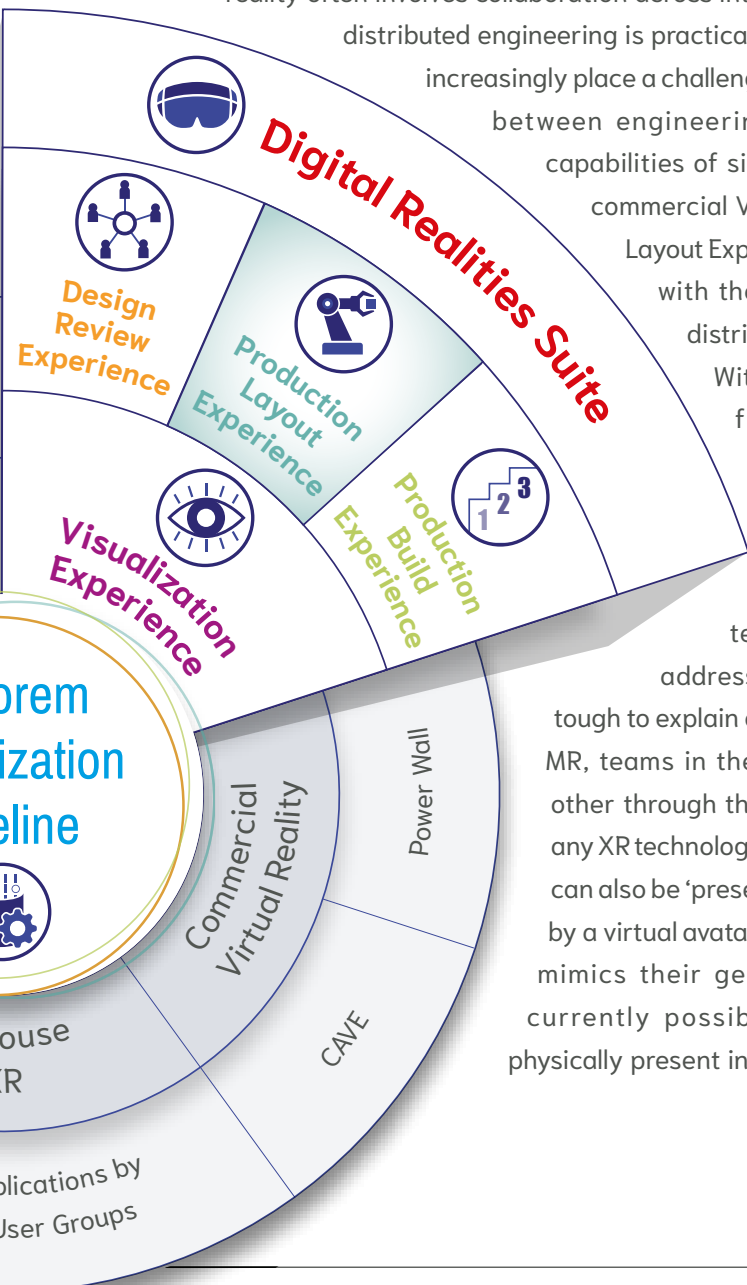
distributed engineering is practically unavoidable, and this will increasingly place a challenge on effective collaboration

between engineering teams. Exceeding the capabilities of significantly more expensive commercial VR solutions, the Production

Layout 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

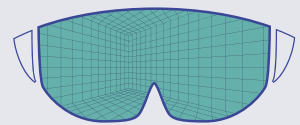
address a problem that would be tough to explain out-of-context. With AR and MR, teams in the same room will see each other through their devices. However, using any XR technology, distributed team members can also be 'present' in the room, represented by a virtual avatar that moves as they do, and mimics 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



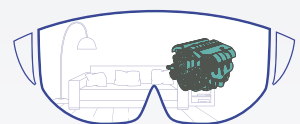
VR places the user into an entirely simulated (computer generated) environment, by standing in a CAVE or using a headset (e.g. HTC Vive). It entirely occludes the user's natural surroundings.

AR



AR presents a view of the natural world overlaid with a layer of digital content. This 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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