

DIVISION[®] MockUp[™] Design Review and Virtual Reality Solutions

Virtual Reality (VR) is now a well-established technology used in the manufacturing industry for broad and focussed applications. PTC's DIVISION MockUp provides world class industrial solutions, with installations at many of the worlds leading manufacturing companies. Visual Advantage's RapidVRM and RapidManikin products extend MockUp by adding key virtual reality capabilities.

VR provides a sense of true-scale immersion that can have a huge impact on people's understanding of designs and can provide a strong sense of insight into problems and new innovations.

Purposes	Benefits
Human Factors - operations analysis - maintenance analysis	Reduce the number of prototypes
Design Reviews	Increase Innovation
Effective presentations to technical and non-technical people	Resolve Issues quickly
Interactive Instructions	Improve Design Communications
Walkthroughs	

DIVISION MockUp

DIVISION MockUp is a robust and powerful high-end visualization and digital mock-up tool for manufacturing industries. It can be used with great impact throughout the product lifecycle from concept design through to design integration and support services. MockUp integrates, leverages, and adds to existing 3D CAD data – returning value again and again with little additional investment.

MockUp is much more than a graphics tool. It based on a real-time multi-processing kernel that allows a number of discrete functions to operate in parallel. All MockUp functions have been developed to provide extremely rapid response times. This is especially important in VR applications.

RapidVRM[™]

With a tight integration to MockUp, RapidVRM provides a flexible interface to a large range of tracking devices and other forms of user input. RapidVRM can also interactively control the level of visual detail shown and the tracking of parts such as steering wheels etc. in addition to tracking the user.

VR applications usually track the user's head and one or two hands. To track more parts of the body correctly, a more sophisticated approach is required - RapidManikin.

RapidManikin[™]

The RapidManikin solution supports the accurate tracking of many parts of the body. Advanced human factors tasks such as **ingress/egress**, **reach-ability**, and **multi-operator interactions** may be quickly and accurately analysed. This further leverages the full set of advanced real-time features provided by MockUp.

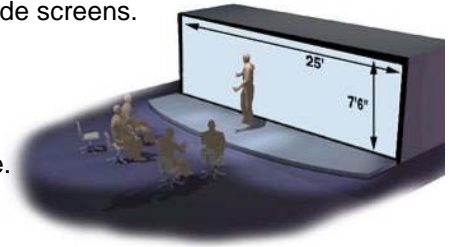


Solution Configurations

MockUp with RapidVRM and RapidManikin can be configured in many ways. Where multiple displays are used please see the next section for further details. Here are some example configurations.

Single and Multi-Projection environments

Designed for groups to view and participate in the visualization of a model, this type of facility strongly supports localised teamwork and design presentations. The visualization may be presented in mono or stereo and may be front project (projectors located over the audience) or back project (projectors set up behind the screen). Multiple projectors may be used to project across wide screens. Two projectors may be driven from one PC graphics card.



Head and hand tracking devices may be used by a single user with projections systems where the user is forward facing. This is ideal in some situations, such as the view of controls from the inside of a vehicle. The stereo image will appear to come out of the screen so the user may interact with objects (pickup and move etc).



Image courtesy of Fernando Faria de Toledo, National Institute for Aviation Research at WSU. Using MockUp with RapidVRM

Head-Mounted Display (HMD) environments

HMDs with head and hand tracking provide a very flexible environment as the user may look anywhere they like and feel totally immersed in the model. The user will see a stereo view through two displays incorporated into the HMD itself.

As an extension to this environment a full body tracking system can allow all the major parts of the body to be accurately tracked and represented in the 3D view.

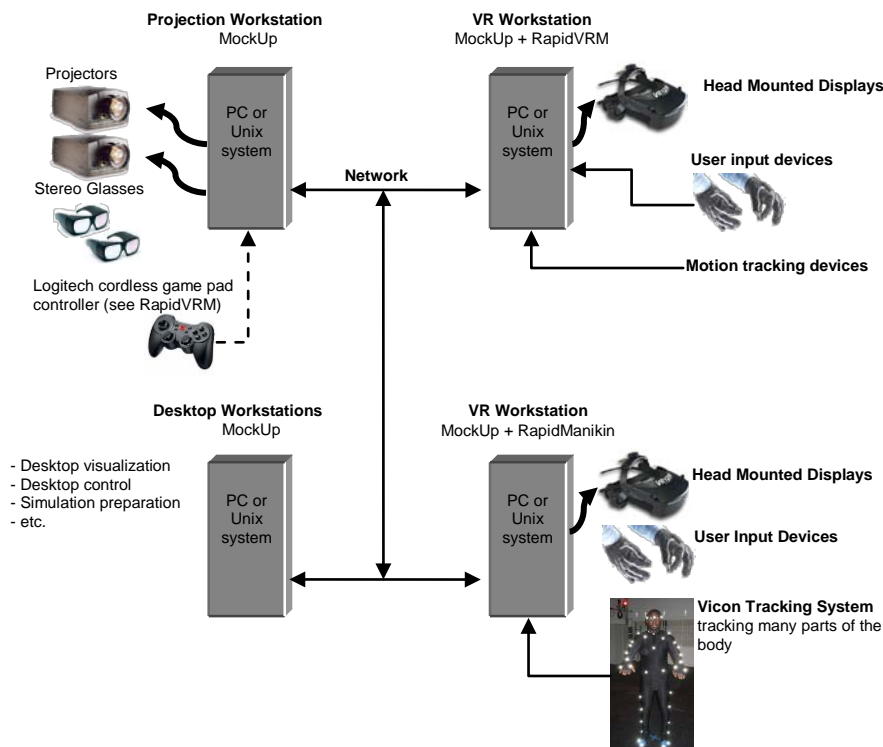
CAVEs

CAVEs are formed from between 3 and 6 back-projected displays that are configured as a cube so that a user can be totally surrounded by high-resolution stereo displays. These can provide the ultimate VR display environment as the user only needs to wear light-weight stereo glasses and

yet see images at a very high resolution. The sense of immersion in a model can be extremely compelling.

A networked configuration for true multi-user real-time collaboration

In example below all MockUp sessions may be connected to share and interact with one model or they may be run independently.



Either of the VR user's views may be shown through the projector workstation in front of an audience, or the projection workstation may have an independent view. Meanwhile, the 3D models and scenarios experienced by the VR users can be controlled from the desktop or projection workstations.

Tracking system and user input devices may also be connected to projection environments in which a single user would typically interact with a model using the screen as the visualization device rather than an HMD.

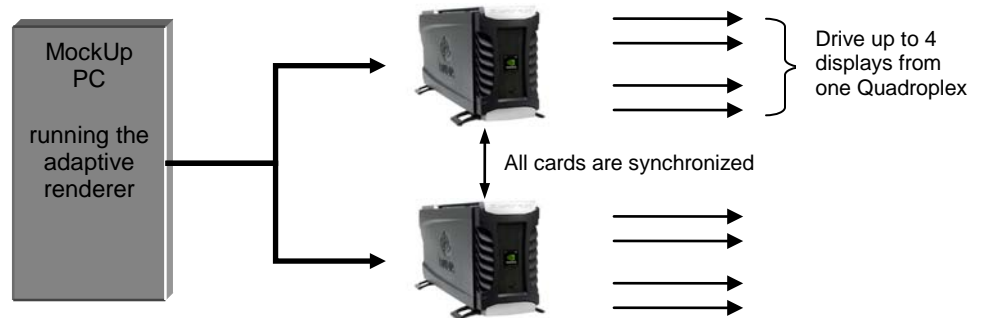
Multi-projection displays with MockUp

The MockUp Adaptive renderer and the NVIDIA Quadroplex

MockUp supports synchronized multi-projector displays for Design Review Centres and CAVEs using its powerful **adaptive** rendering software in conjunction with the NVIDIA Quadroplex graphics system.

The adaptive renderer can be configured to provide a single synchronized view across several flat screens or can be configured with multiple (dynamic) views to support CAVEs and other projection formats.

One or two NVIDIA Quadroplex systems can be connected to one PC running MockUp with the adaptive renderer, distributing render commands to 2 or 4 high-end NVIDIA cards simultaneously. All cards are synchronised to ensure that the total display acts as one 3D display. Each card may drive 2 displays, in active stereo if required, to support up to 4 displays per Quadroplex.



The standard MockUp adaptive renderer can maintain a fixed frame-rate and achieves optimal

performance under many different conditions. This adaptive renderer comes as standard with MockUp, although it does need to be configured and optimised for the projection environment it is to be used with.

It is well suited for "immersive" multi-view operations, where the adaptive nature is superior over any purely distance based level of detail solution - it dynamically modifies its rendering selections automatically to deliver the frame-rate requested with the highest quality rendering possible.

The adaptive renderer makes the solution very effective for large assemblies where there is often considerable detail in parts of the model and much less in others. Using a classic distance based level-of-detail solution frame-rates can jump considerably in such environments making VR head-tracked navigation very difficult.

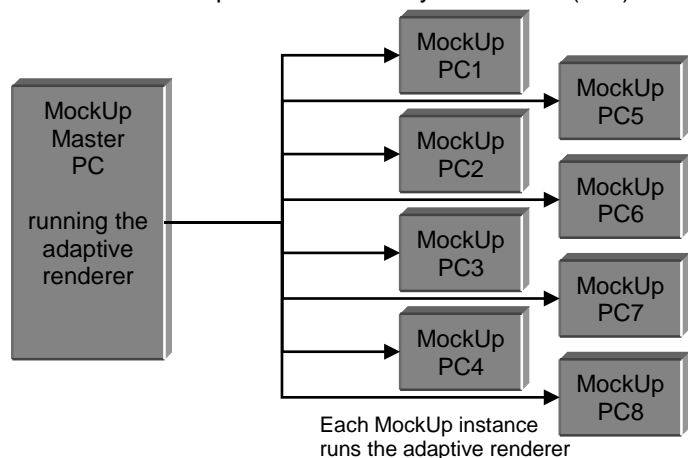
When used with RapidVRM, it is also possible to control target frame-rates and other factors to optimise the overall interactivity, while immersed.

RapidGC (General Cluster)

RapidGC is a Visual Advantage cluster solution for DIVISION MockUp. This is an un-synchronized (fast) multi-PC solution for design review environments where multiple PCs connected over a local area network each drive one or two projectors (without using the NVIDIA Quadroplex hardware).

Each instance of MockUp drives one tile in the total projection environment. Each tile may form a part of a larger view or may form an alternative picture in picture view inset into the main view.

The Rapid Application Hub can be used with RapidGC to deploy and synchronize large models very efficiently across a RapidGC cluster.



One example installation is at Volvo Group design centre in Gothenburg, where there are 16 PCs/Projectors driving a 7M X 5M display. Please see http://www.nanco.se/case_studies/volvo.shtml.

Please note that combinations of the NVIDIA Quadroplex and RapidGC can also be deployed. Please contact Visual Advantage for details.

The MockUp/RapidVRM Feature Set

Features	Details
Visualization	<p>MockUp has a very high-performance and high-quality renderer that can be configured to provide stereo visualization for a wide variety of display devices, including head-mounted displays and projection systems - all from a single PC graphics card.</p> <p>The graphical performance may be optimised for real-time VR displays or for very large models (DIVISION Reality provides 64-bit scalability).</p>
Body Tracking & User Input	<p>RapidVRM for MockUp provides support for a broad range of tracking devices and 3D mice/wands/fly-sticks etc. Many input devices may be configured for very flexible usage.</p> <p>Leading edge, full body tracking, in which all parts of the body are accurately tracked, can be provided by the RapidManikin solution.</p>
Immersive User Interaction	<p>MockUp provides mechanisms for interacting with 3D models, such as real-time Collision Detection combined with specific behaviors to interact with and pick and move 3D parts.</p>
Behavioral Simulation & Constraints	<p>MockUp provides a comprehensive library of event-driven behaviours to enhance presentations, user interactions, and the simulations of 3D models. Constraints such as joints can further enhance the interactive environment.</p>
Animations & Walkthroughs	<p>MockUp provides a powerful multi-track part sequencing and user walkthrough recording/editing/replay toolset. With RapidManikin, a user's whole body may be accurately recorded, and replayed and analysed later without the need for any tracking.</p>
Real-time Multi-user / Collaboration	<p>MockUp supports many immersed, projected or desktop users may be connected to simultaneously share and interact with one MockUp environment, over a local or wide-area network.</p>
Scene Management	<p>MockUp provides Landmarks to easily manage user defined scenarios.</p>
Other DMU features	<p>MockUp provides a set of high-performance DMU functions to support real applications: Sectioning, Interference Analysis, Measurements, etc.</p>
Direct, heterogeneous CAD data conversion	<p>MockUp leverages the latest ProductView CAD adapters, providing access to a wide range of 3D CAD data formats. Multiple models from different CAD sources may be combined within one MockUp environment.</p>
High Performance Architecture	<p>MockUp leverages modern processor technologies to ensure all aspects of the system operate at their full potential. This is especially important when tracking and visualization must not be held up by other intensive simulation tasks.</p>
Integration & Enhancement	<p>MockUp may be enhanced to extend its functionality or to integrate it within other systems. Please contact Visual Advantage for more details.</p>

Please note: MockUp is formed from a number of modules from which these features are derived. These are not shown here. Please contact Visual Advantage or PTC for further details where required.

Further Information

Please see [RapidVRM](#) and [RapidManikin](#) for further information.

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