GAME, SET AND MATCH

ORGANISATIONS ARE INCREASINGLY USING 'GAME-BASED LEARNING' TO TRAIN THEIR STAFF IN REAL-WORLD ACTIVITIES. STUART WOODS DISCUSSES HOW SCANS OF THE REAL WORLD CAN BE USED TO CREATE 3D VISUALISATIONS IN THE VIRTUAL WORLD OF GAMES

A group of firemen are gathered around a table with a large paper drawing in front of them of the newly-built building three blocks from their station. They are trying to determine how many steps there are to the first hose connection on the third floor. Flat, small print and in 2D, this isn't the easiest task.

Now imagine that same group of firemen engaged in what appears to be a video game, and on the screen is that same building they once struggled with on the paper drawing. They are counting steps to the first hose connection on the same third floor in an immersive reality captured from the actual building. Understanding the exact distance needed to attach the hose, they advance, each image before them changing as if they were physically standing in the building. They need to know the width of the hallway, so they simply drag a curser from one wall to the other and '3.25m' appears in the top right of the window.

Welcome to the world of games-based learning (GBL). The concept of GBL is based on the idea that people learn best by doing. Just speaking to someone in a safety meeting or having them read a risk assessment does not engage them and often fails to provide the understanding needed to truly work safely in a hazardous environment. Just as you would train a pilot in a flight simulator based on a real cockpit, placing engineers, emergency responders and other professionals in the real environment where they will work also allows them to better learn and interact with expected working environments. For GBL to be most effective, the imagery on the screen should mimic the actual situation, through the use of capture techniques, such as laser scanning to capture millions of points. Combined with high-definition imagery, these highly-precise point clouds are then integrated into the game environment using software such as MapFactory for ArcGIS or TruView, enabling professionals to completely immerse themselves in the expected environments and interact with objects they will encounter. In the future, this data could also be input from AutoDesk Recap to AutoDesk Stingray to create the game look and feel.

Point clouds are either put directly into the selected software program or as meshes to create the background of the game. Designers then just fill out the skeleton of a scene, after which programmers can develop the game. Where once 3D design artists needed to create an entire set, including assets and props, from scratch, they can now easily drop in the point cloud data with texture already included and just add the needed detail. This saves an incredible amount of time and effort for designers.

Once the game is created, it can then be implemented into training programmes for applications ranging from building mapping for firemen to chemical spills in a plant for on-site safety officials.

GBL in action

Around the world, GBL is increasingly becoming a standard for effective safety trainings. The three following case studies exemplify how this new technology is working to increase safety for minimising damage and saving lives.

Making electrical plants safer

In any electrical scenario, fire is always a concern. When a regional electricity distribution company in Russia wanted to ensure its operational staff knew how to respond in case of such an emergency, it used GBL for a power substation stretching across 2ha.

Turning to TetraVision, a survey firm designing 3D applications based on reality capture models based in St Petersburg, Russia, the electrical company contracted for a gaming environment to simulate planning, maintenance and repair along with emergency training. Using the Leica ScanStation and Cyclone modeling software, combined with Unity3Dengine to add the game-like overlay, TetraVision was able to provide an immersive visualisation of the power substation.

"Much like a computer game, but even more useful, our deliverable helps electrical engineers 'feel' their work environments before they ever get on site," said Mikhail Anikushkin, TetraVision general director. "With this project, we have demonstrated the immense benefits for GBL, and we hope others will also see the potential for engagement."

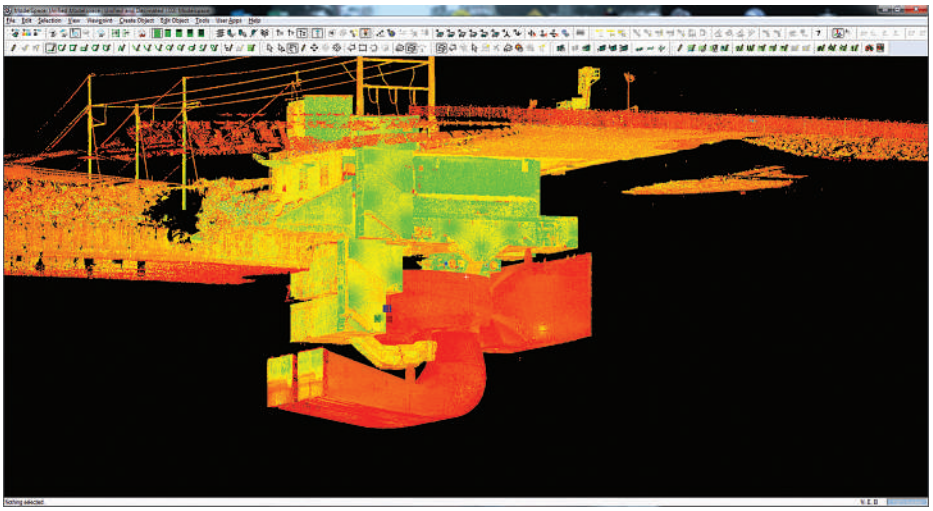
Electrical danger zones according to current standards and regulations were included in the as-built model, as well as automatic calculations of the shortest distance to emergency assets. Using an avatar, players can proceed through steps of correctly and incorrectly conducting emergency operations with instruction on how to perform better.

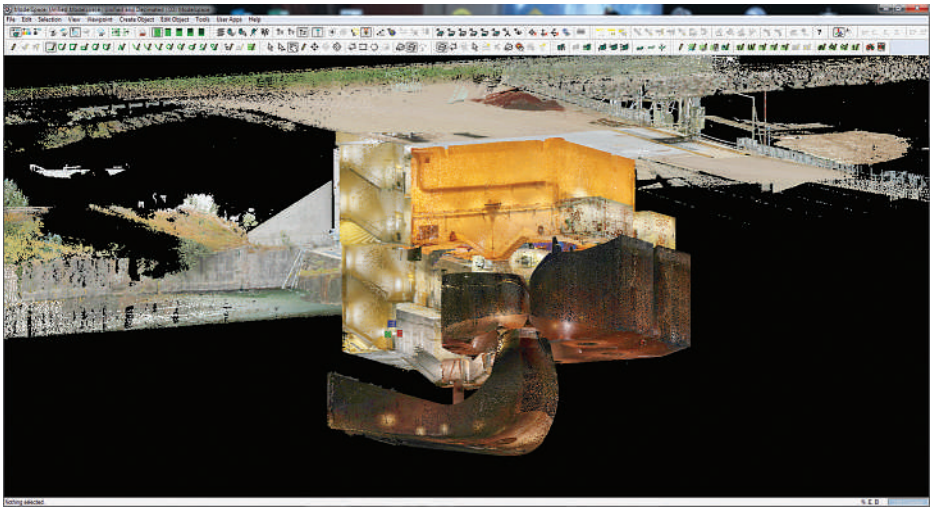
Fortifying engineering designs

Many engineering or architectural designs are now completed in 3D. Unfortunately, this data is often shelved once its primary purpose is complete. However, this 'as built' 3D asset can be re-used as a tool for safety managers and even disaster-recovery planning.

Take a serious fire in a complex environment – how do you communicate exit points, trapped personnel and other vital information to fire teams in the shortest amount of time so they that they really learn it into memory?

Seeable, a design firm located in Shropshire, UK, specialising in 3D and BIM visualisation apps, is answering this call. The firm augments 2D CAD floorplans, topo surveys and even 3D BIM models with 360° panoramic images and single images. Creating immersive environments for engineering, design, transportation and architectural clients, it can add safety hazards such as asbestos dangers, building refurbishment





or live electrical challenges. Seeable's visualisations can then be used to help fire teams and other safety officials know any space before they ever set foot inside.

"Clients are starting to realise the benefits of being able to explore or experience 3D space compared to conventional static 3D animations and images, one key point being 'create once and use many times.' Our visualisations created for fire safety training can then be used for briefing contractors, site inductions and facilities management," says Nick Blenkarn, MD of Seeable.

"Many times can also be in many ways, as once the GBL platform has been created, then visualisations can easily be distributed as AR [Augmented Reality], Immersive VR [Virtual Reality], via a web portal or simply on a desktop. This flexibility of delivery breaks up the old business models of how survey or design data is shared or delivered. We automatically recycle our glass and plastic – this is just digital recycling."

The dataset that Seeable captures with Leica Geosystems laser scanners and mobile mapping platforms deliver to clients can be exported to create an app, which then can be carried on a mobile device. Using GBL principles, Seeable engages users in safety briefings and visualising risks in complex environments. By combining intuitive visualisation in 3D with panoramic images to link the real world with the gaming environment, this visualisation-based training is proving successful.

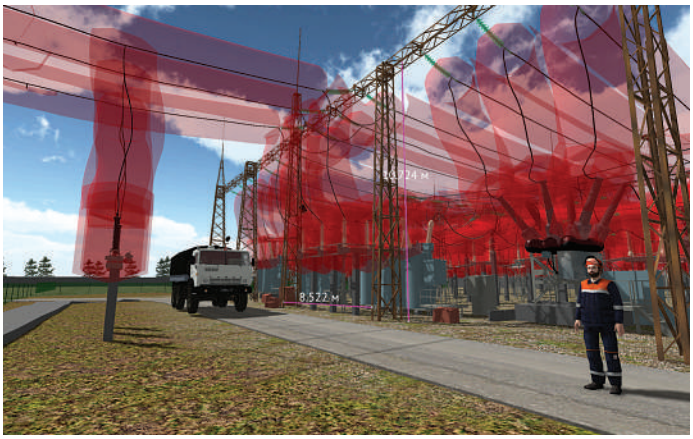
Training the next generation

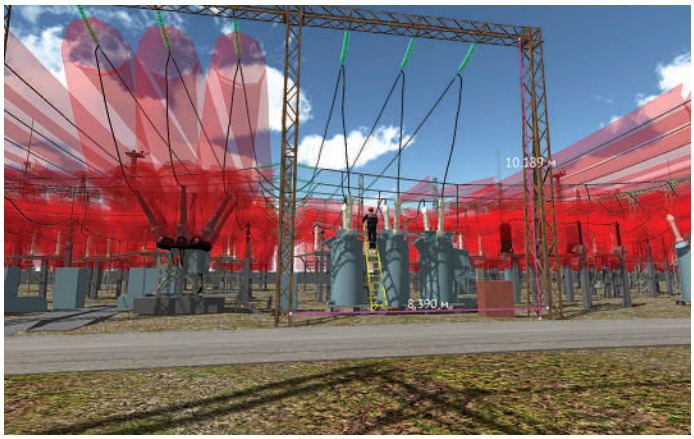
What happens when a critical procedure only comes every eight years and the staff changes in the time in between? Institutional knowledge is lost, but with a precise digital replica, operations can carry on smoothly.

This is what Dioptra, a traditional surveying firm concentrating on mapping and GIS based in Idaho, US, faced with a recent project. The client asked for a scan of the interior of a hydroelectric vertical-shaft turbine plant and turbine area. The short-term goal of the final 3D deliverable was to aid in tours of the plant, using a computer assisted virtual environment (CAVE). The long-term goal of the program, however, was to train the next generation of maintenance staff.

"This project was our first plant project and first scanning project that was not used for civil design purposes. The client wanted to use the scan data for training maintenance staff and for virtual tours of the plant to school field trips and company officials," says Dioptra's owner Stewart Ward.

"The client immediately saw the benefit of this technology and is looking for other projects where this technology can be used in the future."





As the plant only goes through a dewatering, where a hydroelectric facility is drained of water and other liquids to reduce condensation accumulation in preparation for periodic maintenance every five to eight years, the current generation of maintenance crew would all be retired before the next dewatering. Since the watered-filled spaces are inaccessible to maintenance staff at other times, the plant needed a way to train incoming maintenance staff who had not been through the process before.

In order to help this next generation of maintenance crew, Dioptra used the Leica ScanStation to create a GBL environment of the turbine. Placing point clouds into an interactive setting, these new crews experience what they will see and do for the next dewatering.

The future of reality capture in GBL

Terrestrial laser scanners are the primary instruments currently for GBL However, mobile mapping platforms are quickly coming into the picture.

The Pegasus:Backpack, a mobile reality capture platform providing both imagery and point clouds and which is made to go anywhere, is especially beneficial in indoors. Using simultaneous localisation and mapping (SLAM) technology, the Pegasus:Backpack can be used to capture details in building construction, plants and other challenging indoor spaces. In the virtual environment, with imagery in immersive panoramic view, users look up, down, left and right. The 3D points are always available for measurement as the image's pixels are directly calibrated to the individual points in the point cloud.

Capturing regular progressive point clouds and imagery, the end data deliverable shows the evolution of a new building from concrete pilings to the penthouse. Our group of firemen can image each step to the first hose connection on the third floor. Or maintenance can determine the water pipe direction to the hose connection should they need to open a wall to access the pipes to patch a leak.

In the measurement field, GBL is about capturing the as-built information of a building, infrastructure or plant and serving it to a user so that they can interact and find their path to specific answers. This interaction is enabling better learning and understanding.

From firemen to engineers, professionals need to know the world in which they will work next. This is not only about saving time or money but about saving lives.

FROM FIREMEN TO ENGINEERS, PROFESSIONALS NEED TO KNOW THE WORLD IN WHICH THEY WILL WORK NEXT

Stuart Woods is the vice-president of Leica Geosystems Geospatial Solutions Division (www.leica-geosystems.com)

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