VR/AR IN AIRPORT OPERATIONS

The rate at which technologies have developed over the past decade has been exponential, and for many of us we could not have imagined their existence. Virtual and augmented reality are examples of this, illustrating just what the future could hold. More often than not, these digital tools are being used in businesses to optimise operations, aid training and avoid mistakes within construction, and airports are not exempt from this. This guide demonstrates just some of the applications of VR and AR that are available.

Visualising **airports** in a **virtual** environment

On the subject of virtual reality (VR) and augmented reality (AR), video games and gadgets come to mind. Yet this technology can be used in many more ways and places, including airports, said *Laurens van Oostendorp*, Service Manager and Transformation Manager within the IT department of Royal Schiphol Group.

ROYAL SCHIPHOL Group sees potential in smart VR and AR applications that increase airport efficiency. Just like many others, Amsterdam Airport Schiphol is an organisation where various disciplines are continually cooperating to become Europe's preferred airport for passengers, airlines, logistics service providers and other businesses alike. VR and AR can provide significant added value in facilitating this cooperation, particularly when practising situations or actions which are too complex, or which would be impossible to imitate in operational airport processes or real life because they would cause disruption.

Applications

While VR and AR technology has existed for some years now, it is still first generation with regard to its development stage. However, the technology does already yield several opportunities for aviation. They include the provision of training, applications which are carbon-neutral,

This image illustrates one of the ways VR/AR can be used in airports

and the visualisation as well as the partitioning of land and buildings. These innovative and more efficient improvements can mean a lot to aviation. We have already implemented the first VR and AR applications in our processes at Schiphol. The fire service is using a virtual environment where emergency services can practise various scenarios, particularly ones which are too complex or even impossible to practise in real life. The firefighters can simply and easily use this application to maintain and improve their skills, without affecting operational processes.

Schiphol is more than just an airport. It can be considered a modern city, with a vibrant centre surrounded by runways. The airport is an international hub for various types of transport, aimed at both people and goods, with countless facilities. Within this city, Schiphol Real Estate is concerned with the development, leasing and management of real estate at Schiphol. Here, VR and AR provide added value as well. These fresh solutions are implemented in developing and leasing office space and logistics buildings at Schiphol. VR and AR can be used, for example, to provide potential lease holders with a good impression of a building still under development. They can offer insight into the layout of office floors, showing what the reception area will look like or how building materials will be applied. A virtual environment is the perfect means to do so. In addition to its excellent visual impact, the application can also be used to provide a visual check of construction drawings. It allows us to visualise plans, offer insight into the actual future situation and furnish potential lease holders with a custom information package.

Starting off

The technology has a great deal of potential. Although developments and implementations are currently ongoing affairs, we can engage in development and thus contribute to the technology's emergence. This strategy will allow us to create what we currently need and what we are working towards. It takes courage to embrace the unknown, while the expected added value of the technology needs to be weighed carefully. VR and AR started out small, with a single idea that had a major impact. Launching any new ideas on VR and AR as well as the technology implementation require simple and easy access. A crucial aspect in this context is involving colleagues and stoking their enthusiasm. As soon as they become acquainted with the subject matter and way of working, it will open their eyes to the opportunities offered by the new technology.

At Schiphol, building information modelling (BIM) data is available, which is required to visualise the airport in a manner true to life. This data formed the basis for Schiphol's successful trials in VR and AR applications. Based on the BIM data, a virtual Schiphol environment can be created. The central platform that we are developing based on the BIM data will provide many opportunities to be widely used for various applications.

Make IT easy

The facility of use is important in IT applications, so our guiding principle is 'Make IT easy'. Our intention is to provide solutions which will benefit our passengers, airlines, lease holders, concessionaires and employees. We want to ease the experience of our stakeholders at Schiphol, optimising it with IT that is user-friendly, provided by the best IT personnel. Ease of use means that the IT solutions provided are flawless, offering good performance. This means that the technology involved is also in keeping with the principle to 'Make IT easy'. Easy technology must always work and make many things possible, providing reliable and agile infrastructure. Above all, technology is about people, so 'easy' must also be a goal in your organisation. Implementing and using new technology such as VR and AR requires good support as well as simple and easy access.

Opportunities

The first VR and AR applications have been launched by Schiphol, which sees many relevant opportunities for aviation that involve VR and AR applications. It stands to reason that many airports will have access to BIM data to visualise their organisation in a virtual environment. It is important for airports to have a central platform as a starting point. Once your organisation has this, it is relatively easy to operate multiple VR and AR applications, meaning that their development is concentrated. This situation makes it possible to engage with VR and AR applications in a cost-efficient, scalable and future-proof manner.

The operational processes of all airports involve a lot of collaboration with various chain partners. In addition to the cooperation within the organisation which a central platform provides, it can also encourage working together with chain partners.

Apart from fire service and real-estate applications, airports can consider such VR and AR applications as providing training related to winter operations and the snow fleet, crises, practising airside driving, surveillance and marshalling. There are other opportunities as well: VR and AR can provide support in e-learning or visualise routes through the terminals for passengers on their own devices. All in all, the opportunities are endless. ■

Laurens van Oostendorp is Service Manager and Transformation Manager within the IT department of Royal Schiphol Group. Alongside his responsibility for keeping operational business processes up and running, Oostendorp is also involved in IT innovation and improvement. Oostendorp plays a leading role in implementing VR and AR applications within Royal Schiphol Group.

Schiphol Airport' CIO, Sjoerd Blüm, expects a steep lift-off of VR and AR use cases in airports in the coming five years. CIOs are creating a place for VR/AR platforms in their platform strategies. With the accessibility of BIM data and the affordability and increased user-friendliness of VR/AR devices, he expects a strong acceleration.

Using **virtual training**
for emergency realities

Christchurch Airport turned to virtual reality technology to aid the training of airport fire fighters: An example of innovative evolution within airport operations.

AIRPORT fire fighters do some of the most challenging work on the campus and are considered by many to be heroes.

At Christchurch Airport, New Zealand's second largest airport, the fire fighters are first on the scene at more than 500 on-campus emergencies every year. This includes fires, rescues, alarm activations, fuel and hazardous material spills, special services, medical emergencies and aircraft incidents.

The men and women of the fire service are highly and specially trained. They hone their skills every day they are on duty, but there is one aspect of their work which has been very difficult to train for. Until now.

The airport's fire fighters have added another aspect to the way they train for

"VR is the solution for a difficult part of the fire team's job"

aircraft fires, using virtual reality (VR) equipment. This means that training that takes part in an aircraft that is on fire is no longer necessary; the inconvenience of clearing an area to carry out a training session is negated whilst safety concerns are mitigated.

Tim Morris, Manager Airfield Operations, said the money being invested in the fire service gives the team the experience of

managing an aircraft fire without actually being in such a fire.

"Using VR takes us from observation to immersion and is the next generation of training and recruitment. We can simulate real situations that are otherwise almost impossible to train for in real life," he said.

"The fire fighters will be able to fight fires without fighting fires, so when the time comes to fight an actual aircraft fire, they will be working in an environment they are familiar and confident with."

The VR experience means the fire fighters are the first in New Zealand to don headgear to visualise and interact with a very tough situation, and Manager Airport Fire Service, Peter Moore, said it's truly significant.

"This training replicates possible fire scenarios on a scale not possible in our training area, so it is a very valuable addition to the suite of training options we already have," he explained. "It's also about giving unconstrained access to the interior and exterior of various aircraft so they are well familiarised, prepared and have confidence to work in and around the aircraft, enter safely, navigate their way through it in very low visibility, locate specific items, perform emergency shutdown of aircraft engines, work with the specialised equipment they carry and of course save lives."

Offering such specialised training in this way also reduces production and operational costs, as well as having the ability to continue to develop over time.

The initiative was developed in collaboration with Christchurch-based company Corvecto, to produce an innovative and powerful virtual reality training programme which will be able to evolve as needs require.

Manager Digital Solutions and Data Technology, Art Martinson, commented: "VR offers a training platform in a situation where safety is the top priority. It means our people can train for a complex and hazardous scenario. It gives our fire fighters an environment to improve their skills safely, through training modules where they can learn and demonstrate their competency."

The team has just completed scanning a second aircraft to add to the training schedule, to expand the VR training opportunities, without needing access to aircraft between flights.

Tim Morris said VR is the solution for a difficult part of the fire team's job.

"It combines necessary training with sustainable training that does not put people or property at risk"

"One of the tougher parts of our business is getting a new focus which offers new skills," he said. "We have introduced ground-breaking digital technology in an innovative way to train our rescue airport fire fighters."

The fire team has had a lot of invitations to demonstrate the VR training, including demonstrations to other airport fire teams and members of New Zealand's parliament. Just as the fire fighters experience it, guests brave enough to put the headgear on and try the technology speak of how real the

sensation is of being inside the aircraft, focused on the tasks they are assigned.

"The VR training has caught people's imagination and they understand how it combines necessary training with sustainable training that does not put people or property at risk," concluded Moore. "We describe it as adding 'muscle memory', so instinct and memory will kick in in the event of a real fire. It truly is a win-win and we look forward to adding more aircraft types to our training library." ◼

To see the VR training in action, visit **youtube.com/watch?v=qcBMBWJf1II&t=133s**

Embracing digital
engineering

Developments sit in the digital future, but how do we get there?
Planned infrastructure usually lies in the rendering of images; training usually
depends upon asset availability. But what if all of this could take place in a realm
away from reality? *Krishan Tangri*, GM, Assets at Brisbane Airport Corporation
discusses this further.

BRISBANE AIRPORT (BNE) is Queensland's most important transport hub and Australia's third-busiest airport. Operating 24 hours a day, seven days a week, BNE has two major terminals accommodating 33 airlines flying to 83 domestic and international destinations.

With passenger numbers forecast to more than double by 2034, Brisbane Airport Corporation Pty Limited (BAC) has invested $1.7 billion into building critical infrastructure since 2012, with a further $1.8 billion worth of infrastructure developments scheduled to be delivered between FY18 – FY22.

Digital engineering

BAC has embraced all facets of digital engineering as "a collaborative way of working to enable more productive methods of planning, designing, constructing, operating and maintaining assets".

As the airport acts in the role of asset owner, operator and maintainer, it has a strong interest in the 'whole of asset life' approach and is focused on adding value at every stage of the asset lifecycle.

In an effort to transition smoothly to a full digital engineering environment, BNE has examined the challenges it faces in the context of a fully operational international airport, a semi-mature local supply chain, strong legacy systems still in

"Augmented reality really starts to make the viewer question what is real and what is not"

place since privatisation in 1997, variable skillsets of current staff, quality standards and protocols to be adopted, with the over-riding desire to be able to demonstrate 'value added' and a balance between new technology and the achievement of tangible benefits over a non-digital engineering approach.

Faced with multiple opportunities across the full spectrum of infrastructure development, the airport has utilised and harnessed the benefits of various digital technologies.

Laser scanning

This technology has been employed successfully in the survey of existing assets, particularly complex plant room areas and previously unchartered building services. The resultant point cloud file is then transferred into a working, rendered parametric file suitable for use by designers and contractors as an accurate base for any proposed upgrade.

Either the point cloud model or the accompanying rendered parametric file can be navigated in viewing programmes to gain an understanding of the 'as-built' conditions.

Significant time savings have been achieved by using point cloud laser surveys when compared to older methods of measurement. The production of 3D parametric files suitable to accept material or product meta-data is another major benefit.

Programme (4D) and cost (5D)

To extract maximum benefit from the production of 3D BIM files, BAC has developed the ability to link the meta-data from the design files to both programming (4D) and cost (5D) applications. Although further work is required around the issue of unique identifiers, encouraging results have been achieved.

Use of real-time information allows all participants (asset owner, designers, consultants including quantity surveyors and programmers and contractors) to visualise the progress of construction activities and related costs over the progress of the projects. BAC is working toward an industry-wide protocol that can be utilised across the portfolio of projects, regardless of the originating native file type.

Virtual reality

With its recently commissioned Demonstrator Room, BAC is now capable of reaping the benefits of its virtual reality arrangement, particularly in the area of project fly throughs, visualisations and 3D renderings for the benefit of all stakeholders.

Our finding is that project sponsors and stakeholders, whether an internal client department, an external tenant, executive leadership team or the general public, all have one thing in common and that is the desire for clearer, more interactive, more realistic visualisations of the final product. With an emphasis on customer experience throughout the airport's terminals, the VR arrangement has become a valuable tool to bring all stakeholders closer to the design in the early stages of design, where constructive suggestions can be incorporated without compromising the delivery of construction documentation.

VR case study 1 – wayfinding and signage

Using a digital 3D model, BAC was able to create a virtual wayfinding experience where the key stakeholders – operations, public transport operators, rental car operators and parking/ transport operators – were given VR headsets to view new wayfinding paths through the upgraded passenger sky-bridge leading to and from the domestic terminal. This VR tool allowed the stakeholders to be immersed in the new environment, allowing them to explore the different options to be experienced by passengers on both inbound and outbound journeys and modify and prototype in real time, thus ensuring their input into the final design. This increased collaboration and communication benefited BAC and the commercial stakeholders, ensuring that expectations of the result were clearly understood and accepted.

VR case study 2 – airside driver training

With BNE's new runway set to be commissioned in mid-2020, a strong need has emerged for the training and re-training for multiple airside drivers to understand the new layouts of roads, taxiways, aprons and aircraft parking positions.

This is being achieved by the development of an interactive airside 'driving simulator' tool specifically tailored around the new arrangements and features the incorporation of the new road network, airside signage, proposed aircraft movements, prevailing weather conditions, airside lighting, day evening and night time visibility and FOD.

The power of this simulator sits with the completeness of the digital environment in which the user finds themselves immersed. The environment was created from 3D BIM models, aerial imagery, GIS data and gaming engines to add in aircraft, weather, FOD and the driver's dashboard imagery, all whilst sitting in a realistic vehicle driver's console.

The benefits are numerous. The training is happening now, long before the physical asset is commissioned. All drivers will be trained, ready and licensed on day one, rather than having to wait.

BAC envisage this VR tool to be of ongoing benefit when new contractors/ drivers require initial training before being licensed to drive airside.

Augmented reality

Combining real-world imagery with scaled, computer-generated 3D images to enhance the viewers' experience is a very powerful visualisation tool which has found multiple applications at Brisbane Airport.

The idea of overlaying 3D digital imagery over photographs of the existing view to generate a unified and enhanced view of the end product, in its simplest form, provides earlier and more detailed visualisation which generally leads to more informed and accurate decision making.

When further enhanced with the introduction of sound and touch, augmented reality really starts to make the viewer question what is real and what is not.

AR case study – international terminal expansion

In 2017, BNE embarked on an international terminal expansion project to accommodate increasing aircraft gate demand.

The architects were challenged to produce a series of three AR images which were to describe the current building, the proposed development and then the ultimate solution for the future.

The provision of these images, which clearly blurred the lines of what is real and what is not, helped all stakeholders understand the logic of the mid-term development and the prospect of future seamless ultimate expansion when required. It was very simple but effective.

Benefits

Digital engineering, including the aspects of VR and AR, has brought benefits to BNE when analysed on the 'whole lifecycle'. Capital cost efficiencies have been realised through a reduction in unbudgeted variations, reduced contract sums because of less unknown risks at tender, coordination

Brisbane Airport is using VR for the training and re-training of airside drivers

"The VR arrangement has become a valuable tool to bring all stakeholders closer to the design in the early stages"

Krishan Tangri is an Executive Leader with more than 25 years' experience in infrastructure, facilities and construction management with well recognised private and public organisations. Since 2010, Tangri has provided strategic foresight to Brisbane Airport Corporation as Executive General Manager of Infrastructure Development and Delivery, overseeing multi-billion-dollar asset, infrastructure and construction portfolios. Having led and embedded a cultural shift, he now leads a commercially oriented, highly qualified and efficient business unit which is on track to deliver the $1.3 billion new parallel runway project on time and under budget.

issues being resolved during design phase rather than onsite and improved accuracy of cost estimates earlier in the process.

Time benefits have been realised through reduced design review and approval periods, shorter design periods, increased offsite manufacture and improved stakeholder engagement through clearer visualisations.

Quality improvements have been achieved from off-site manufacture, greater and more effective coordination and fewer non-conformances due to improved discipline coordination.

Safety improvements have been significant from the use of VR equipment in safety briefings, toolbox talks and site inductions. Better visual representation of construction elements and site conditions have provided improved interface control and clearer stakeholder understanding.

Optimisation of designs to increase energy efficiency, reduce water wastage and minimise waste have contributed significantly to BNE's environmental and ESD targets.

Using the 3D BIM model and VR to mitigate project risks around staging, disruption and business continuity, passenger experience has proven to be highly beneficial.

Next steps

Now that the 'value added' has been assessed, BAC is looking to the next steps on the digital engineering journey. Of all things, we see the need to establish the 'central

point of truth' as the most powerful and necessary element to be instigated.

To achieve this goal, a dedicated digital engineering server is contemplated, equipped with appropriate permissions and access protocols. All information will reside within and be available for multiple departments including finance (for the asset register and depreciation schedules), operations (for up-to-date working information and data relating to the asset base), facilities (to extract all meta-data for use in the CMMS maintenance platform, including warranty information), CAD and spatial data (to generate the airport digital twin and retain all of the as-built information for future reference).

Further progress is planned in the VR area, particularly in relation to scenario testing (optioneering), operational training in the virtual environment (emergency response) and safety (virtual walkthroughs, evaluations and checking).

Linking of 3D BIM data, BIM geometry, in ground GIS data, photography and asset data to provide AR images both in the office and in the field presents further opportunity to extract benefits from the whole of the digital engineering initiative.

Conclusion

The transition to digital engineering, including both VR and AR is an ongoing process but BNE is determined to harness the

benefits in such a way that it brings benefits to all stakeholders, from the design process, stakeholder management, financial data analysis, facilities management, contractors, the supply chain and ultimately BNE as the asset owner, operator and maintainer.

Results to date have been encouraging. The two pilot projects undertaken have returned an average 'value added' of 12.5 per cent over the design and construction phases. Further assessment is yet to be undertaken for the handover, commissioning, maintenance phase but the signs are positive.

It is clear that digital engineering is becoming business as usual at Brisbane Airport and the corporation takes pride in having developed a skill base to further develop the benefits of this advancing digital technology. ■