

Pilot's-Eye View – Seeing Is Believing

Location, location, location... it may be essential, but you need content, contrast, and brightness when you arrive at the approach path. New simulator databases, displays, and tools are enhancing the look of locations around the world. **Rick Adams** reports.



Tropos 6000 series airport scene.
Image credit: CAE.

Call it the Ürümqi factor. (It is pronounced ur-a-moo-chi). Ürümqi is the most inland city in the world, capital of China's Xinjiang Uygur Autonomous Region, not far from Mongolia on the ancient Silk Road.

In the context of civil aviation, Ürümqi is certainly off the beaten path. And that is exactly the point. Not many training operators are going to be terribly interested in an expensive, detailed, high-resolution database of the Ürümqi Diwopu International airport (URC). But with two million people in the city, airlines fly there from Beijing, Shanghai, Guangzhou, and dozens of other domestic connections.

The good news for pilots who must fly to URC is that a couple of new database approaches can, literally, put Ürümqi on the map. Both offer civil training operators a worldwide database and thousands of airports with at least sufficient resolution and detail to practice approaches to those airfields, for which every detail has not yet been modeled down to the hairline cracks in the concrete.

True Airport

The new forefront visual differentiator, now that image generators have become nearly commoditized and the industry has embraced LCOS projectors, is database content. But customized airport databases historically are not cheap and take considerable time and effort to keep up to date.

CAE is seeking to take on the burden of updating the most frequently used airport databases, while at the same time adding a capability for rudimentary training at pretty much every macadam landing strip on the planet. It is offering a new subscription-based service called True Airport, compatible with CAE's Tropos 6000 and Tropos II image generators. Customers who subscribe to True Airport on an annual basis will receive automatic notifications when a new version of an airport is available – new runways, air traffic control towers, other prominent buildings that serve as approach cues, and so forth. The update can then be downloaded via a web portal and installed on their simulator similar to a Windows software patch. CAE says there are “no limits, no quotas, no restrictions” on the amount of updates a customer can receive, and promises all subscription libraries to be Level D qualifiable.

In addition to the high-detail airport databases on which an airline customer routinely trains its pilots, True Airport will add a worldwide inventory of some 23,000 fields built “on the fly” from Jeppesen, Aeronautical Information Publication, and other digital data. “These will be generic versions of specific airports,” explains Phil

1958

First Frasca Simulator

1960

Frasca Table-Top Simulator

1975

Developed Simulated Sound Generation

1976

Transition to Electronic Flight Modeling

1983

Transition to Digital Simulation (PC)

1984

Developed Electric Control Loading

1985

Developed Textured Free-Flight Visual System

1987

Applied Motion to General Aviation Devices

1989

HS-125 with Motion and Hydraulic Control Loading

1991

Developed Graphical Instructor Station (GIST)

1992

Bell 412 with 6-Axis Motion System

2000

737 with First Electric Motion System

2003

Delivered 16 Level 6 FTDs

2005

FPS with TruVision™ Approved to Level C

2007

First Level 6 Helicopter FTD

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Perey, director of visualization products and advanced database technologies for CAE. (Perey, by the way, has actually flown into Ürümqi, so he knows what the airport and environs are supposed to look like.)

For the numerous non-custom airports, “all runways, taxiways, aprons, air traffic control, and terminal gates” will be faithful to the position and height of the real world. To provide terrain cues, “geo-representative” roads, buildings, trees, and other cultural features will be added in their appropriate places. An approach reference bridge may be a generic model instead of custom version of the real-world bridge, but it will be in the correct location.

“It’s a very good replica. If a pilot has not flown into the area, they wouldn’t know it’s not real.” CAE is using a technique called “motif compositing” to create the limited detail airports. “It’s a very good facsimile of the real world. It won’t be perfect,” says Perey, “but it will be darn close. We’ll use the best knowledge of the area we have, and it will only get better over time.”

Perey regards the geo-representative content as “ten times richer than most Level D airport databases in training today.”

The purpose of the True Airport database is to enable pilots to train on and become at least somewhat familiar with airports they may have to land at someday, for example if diverted or in an emergency. It also can be helpful to business jet pilots who must use small airfields wherever the executive needs to go (but the company does not want to invest in custom DBs for every possible destination). Another potential user group is very light jet (VLJ) owners, who may be individuals, prone to file a flight plan for almost anywhere they can afford the petrol to go.

Shared Vision

Frasca International and Diamond Visionics are touting the marriage of their database technologies as TruVision Global – an integration of Frasca’s TruVision high-resolution

Finnish Aviation Academy will be the first to take delivery of Frasca’s new TruVision Global.

Image credit: Frasca International.

airport imagery and Diamond’s GenesisRT worldwide “source to scene” creation.

Dave Gdovin, president and founding partner of Diamond Visionics, says it is as simple as “dragging and dropping” higher-resolution source data into the GenesisRT database, which already includes more than 10,000 generic, geo-typical airport areas. The simulated airports are “in the right location and on the same footprint” as their real-world counterparts; Frasca customers can then populate them with whatever level of enhanced resolution for which data is available. And a lot of the data is free or nearly so from government sources.

For example, Gdovin notes that minugia-type GIS data is available for Washington, DC, that reflects “every single lamp post, every garbage can, every park bench, every fire hydrant” in the city. “For us that’s a drag and drop.”

The Diamond software automatically positioned 200,000 generic buildings in downtown DC, plus 25 specific structures such as the White House (model cost: \$1.25), “and we can fly it at 60Hz, not a problem.”

John Frasca, vice president for the Urbana, Illinois, training device maker that bears his family name, says TruVision Global’s base map level includes runways, coastlines, representative terrain, rivers, roads, variable time of day, sun / moon / star models, sea state, improved urban lighting, even moving automobile lights. “Satellite or aerial imagery can be added and will automatically integrate with the base map features.” The high-res content “fades in” with the surrounding low-res imagery.

Frasca’s first delivery of the new TruVision Global will be a worldwide base map with a high-detail inset of southern Finland. The customer is the Finnish Aviation Academy in Pori. The high-content area is vast – 350 by 250 miles – and

includes over 27,000 miles of roads and 275,000 buildings. There are also 13 “mission specific” areas such as airports, hospitals, and accident scenes.

The Bristow Group has also ordered TruVision Global for two Frasca full flight helicopter simulators, an S92 and an EC225, for its training center in Aberdeen, Scotland. The database will feature several high-detail airports, coastlines, and North Sea oil fields.

Diamond Visionics’s Gdovin relates that Frasca “stopped by our booth at IIT-SEC” (the annual US military training conference in Orlando) last December. “We sent them a GenesisRT demo software license, and they started integrating it into their IG.” The Vestal, New York, group’s software tools are claimed to eliminate the traditional labor-intensive database construction process.

“Databases used to take weeks or months to produce. Depending on the size, GenesisRT shrinks that to hours or days.” Gdovin calls Diamond’s method “a different paradigm. No one else is doing it. It’s a very efficient, high-performance way to create complex scenes that outperform standard image generators.”

Crystal Perception

Even before it has received its first regulator certification, liquid crystal on display (LCOS) projector technology has almost become the de facto standard for new civil flight simulators. CAE’s Perey says traditional CRT technology “is essentially gone from our production plant.” In fact, demand is so high it has had to cannibalize its Montreal demonstration facility to use those inventory LCOS projectors on customer projects.

Barco’s new training-tailored SIM 7Q is CAE’s new projector of choice. “What civil customers are requiring for visuals in new or upgraded simulators,” says Barco marketing communications director Jay Luis, “is more resolution, more contrast, and smear-free operation – all in all, more realism.”

The SIM 7Q offers QXGA (Quad eXtended Graphics Array) high-definition resolution of 2048 x 1536, high brightness in the 2,000-3,000 lumens range, and contrast ratios of 8,000:1 with plans to expand to 50,000:1.

Perey believes it has solved the black level problem inherent to LCOS projectors by reducing background illumination for night scenes. The other fixed matrix display conundrum, smearing as the scene moves, can be resolved via a shuttering technique, which reduces the anomaly “to CRT levels”, and which it hopes regulatory authorities will deem acceptable.

The increased brightness – double or triple that of CRT technology – and greater

resolution promises a "more immersive, more realistic" day scene, Perey adds. "Everything in the scene is driving depth perception."

One example: pilots in training should not need to slow down to read runway signs as they taxi because, in some current visual systems, if they do not they will overshoot the available tarmac. "That's a real case."

Perhaps the most valuable merit of LCOS, though, may be reduced total life cycle cost for simulators, which tend to be used constantly for 20 or more years. "No longer will projectors be misconverged or misaligned. You set it up once and it's all performed digitally."

Inevitably lamps age over time, moderating from a "white blue" light to "white yellow". The LCOS projectors will adjust over the life of the bulbs so the quality is consistent across multiple projectors.

FlightSafety International Visual Simulation Systems director of marketing, Dan Myers, describes the issue thus: "New projector technologies can have serious impact on maintenance and repeatable performance due to potentially excessive color drift, resulting in mismatch across multiple windows or viewports."

He says FSI's new auto alignment system is addressing drift "to ensure the same

high quality image that is presented to the first crew is also provided to the last crew. For absolute night environments the LCOS is currently the best," Myers says. "For more moderate budgets and just enough performance for Level D, the new HD projectors are a good alternative."

VDC Display Systems Group is in a co-development with Sony to adapt the latter's high-def SXRD Cinema projector for training simulation applications.

"This 4K projection system is a true COTS [commercial off-the-shelf] solution for a broad range of simulation applications," says David Heiden, president of parent Video Display Corporation. "The 4K resolution redefines all previous benchmarks of realism."


At the same time VDC is not abandoning legacy CRT users. "Today, CRT-based projection systems are often referenced in the past tense," Heiden remarks. "However, much of the civil aviation industry is still relying on CRT technology for training simulation."

VDC has acquired the rights to make both Sony and Panasonic CRTs to support the installed base. "VDC can replace virtually any projection CRT in the simulation market. We are also developing channels to help these markets transition to the newer technologies when they're ready."

One-Minute Alignment

Asker, Norway-based 3D Perception is enjoying market success with its novel CompactClick auto-alignment system for distortion correction using LED sensors embedded in the screen. "A full recalibration can be performed within one minute without any need for additional color meters, light instruments, or cameras," says Olav Sandnes, sales director.

CompactClick measures the actual projected image geometry on screen and feeds this information to the geometry correction system. "Each sensor position is well-known, and will never drift," Sandnes explains. "The integrated LED sensors also form a reference grid that can be switched on for verification. And measurements are fast."

3D Perception "looked at various camera-based calibration systems" before focusing on screen-mounted sensors. It dismissed camera-based systems for multiple reasons, among them: they require an additional reference system, they rely on positioning a camera at the eye point (ie, rigging every time an alignment is to be performed, since the camera needs to be out of the way of the observer), and they are generally slow and difficult to synchronize a camera to a fast sequence of test images. 



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