

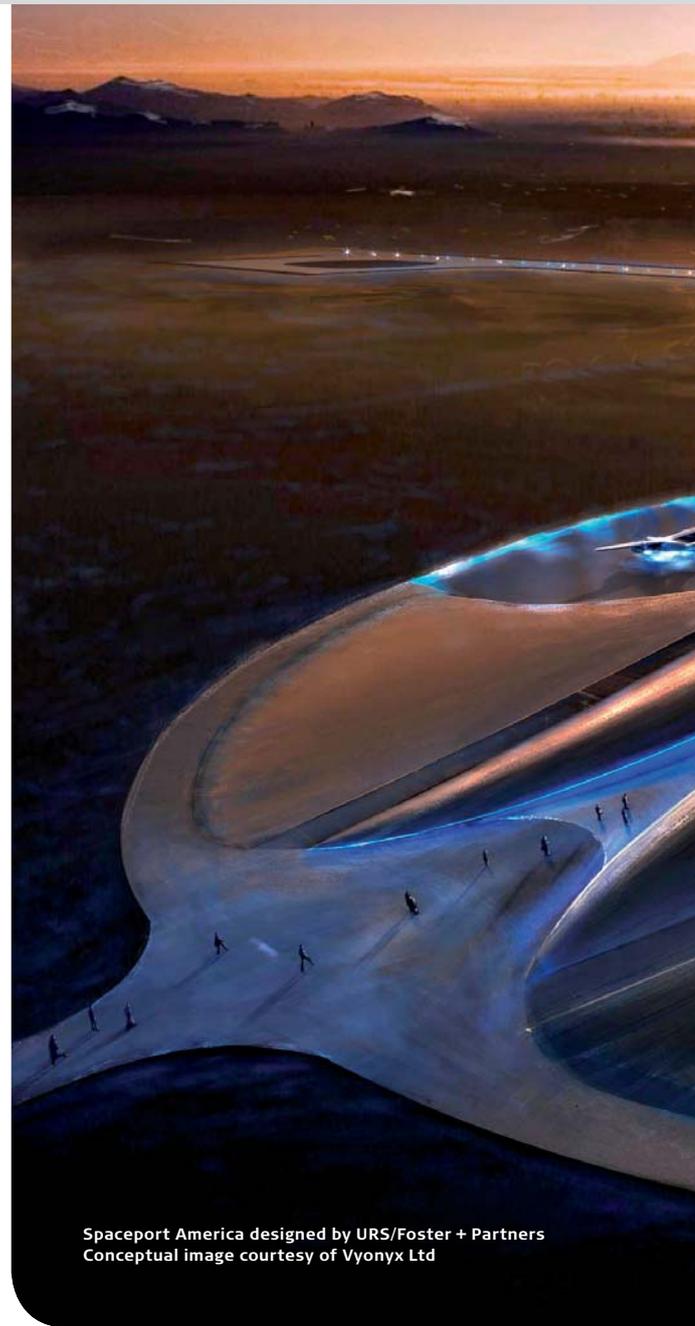
by Daniel C. Brown

Welcome to space tourism, Southwestern style! Contractor David Montoya Construction finished construction of the Spaceport America runway in a remote area 60km (37mi) southwest of Truth or Consequences, New Mexico, in September last year. Billionaire Sir Richard Branson's space enterprise, Virgin Galactic, cut a deal to be a tenant at Spaceport, and Branson hopes to send tourists into near orbit as early as this year. More than 300 people have reportedly signed up for tickets, which start at \$200,000 each. The state of New Mexico and two local counties have financed the \$198-million project. And thanks to stringless concrete paving system Leica PaveSmart 3D and some space-age machine control equipment, construction on Spaceport's \$27-million runway was able to wrap up nearly two months early.

Montoya's superintendent David Guerra said the runway, which is 3 km (10,000ft) long by 60m (200ft) wide, was completed seven weeks ahead of the scheduled date. Montoya paved the runway with a Guntert & Zimmerman S850 slipform concrete paver automatically controlled by a Leica PaveSmart 3D system guided by two robotic total stations. The paver had to make six passes, each 10m (33.3ft) wide, to cover the complete width of the runway. Depth of the concrete is 35 cm (14in). Leica PaveSmart 3D regulated steering, grade, draft, and crossfall of the slipform paver in real-time, and integrated seamlessly with the paver with no need to install complex retrofit hydraulics.

No stringline was used on either the concrete paver or the placer-spreader that preceded it. The automatic paver control system based its guidance on a digital terrain model – a digitized 3D model of the runway – entered into a Leica Geosystems computer onboard the paver. The paver also had two prisms, mounted above the machine, for tracking by the two robotic total stations set up on tripods ahead of the paver. The prisms on the paver were set in relation to four points on the slipform concrete paver's pan, which extruded concrete for the runway.

If he had used stringlines, Guerra would have used one stringline for the placer-spreader and another for the paver. "The two stringlines are time-con-



Spaceport America designed by URS/Foster + Partners
Conceptual image courtesy of Vyonyx Ltd

suming to set up," said Guerra. He bought the Leica Geosystems machine control equipment, including six Leica TCP1201+ robotic total stations, because he wanted a system that was independent of the paver and simple to use. "The total stations, their tripods, and the required radios and batteries are easy to move on and off of the project," he said.

Automatic Accurate Steering

When setting up the two total stations, a technician back-sighted each of them to three known control points, fixing the location of the total stations relative to the runway's digital model. The total stations could then "see" the two prisms on the paver and communicate the paver's precise location – by free-



Precision for Space Tourists

wave radio – to the paver itself. The on-board computer processed the differences between the actual paver location and the digital terrain model. Knowing those differences, the computer could control the paver pan location automatically.

“I’d say that machine control saved us at least 50 percent of the time it takes to use stringline.”

David Guerra, Superintendent at Montoya Construction

Montoya actually used four robotic total stations to control the paver, but only two were active at one time. Two stations were set 150m (500ft) ahead of the paver, one on each side of the paving lane. Those two controlled the paver while the next two waited 300m (1,000ft) ahead for the paver to catch up. When the paver passed the first two stations, the second two took over, and the first two stations were then leapfrogged out ahead. That way the paver never stopped, says Anthony Cerisano, Leica Geosystems’ on-site service representative.

Guerra said he got accuracies of $\pm 1.5\text{mm}$ (0.05in) on the concrete slab. It took two workers to control the paver. Montoya used the paver operator to read



the paver's computer to check elevation and steering; the main quality control worker handled placement of the robotic total stations and supervised the operation.

“Leica Geosystems equipment is really, really good equipment. It's really accurate and we have received excellent technical support from the company.”

*David Guerra, Superintendent
at Montoya Construction*

Unlimited Benefits

Automated machine control saves time and money because it eliminates all of the detailed survey labor normally needed for a runway: staking of hubs, set-

ting blue-tops, and the labor to set up stringlines. Typically a concrete paver is controlled by two stringlines set at precise locations on each side of the lane being paved.

Further benefits of machine control include improved jobsite logistics, easier and faster truck turnaround, greater jobsite safety (no stringlines to trip over), and faster machine setup and clean-down at the end of a shift. The result is a lower cost, higher productivity construction process with none of the human error associated with traditional staking activities.

Most space tourists probably won't know the airfield was paved with a Leica Geosystems' stringless machine control system. But they'll certainly appreciate the smoothness of the runway. As the saying goes: Build it and they will come, and they're expected to come to Spaceport America – organizers are planning on 1 million visitors each year. Bon voyage, we say! ■

About the author:

Daniel C. Brown is the owner of TechniComm, a communications business based in Des Plaines, Illinois/USA.



■ Montoya is paving the runway with a Guntert & Zimmerman S850 slipform concrete paver automatically controlled by a Leica PaveSmart 3D system.