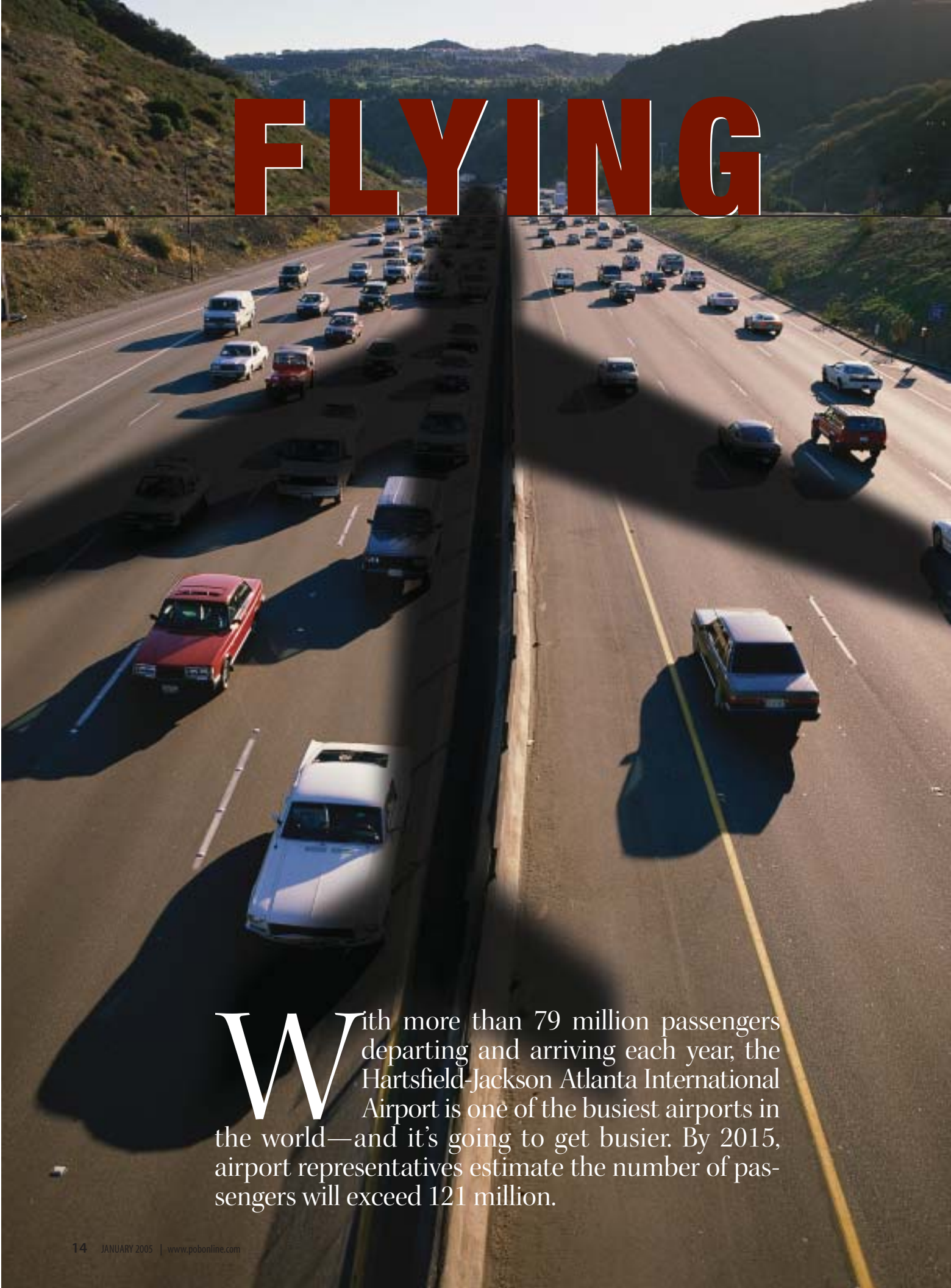

FLYING

With more than 79 million passengers departing and arriving each year, the Hartsfield-Jackson Atlanta International Airport is one of the busiest airports in the world—and it's going to get busier. By 2015, airport representatives estimate the number of passengers will exceed 121 million.

Over the Freeway

by VICKI SPEED

In an effort to meet the increasing demand for air travel and airline expansions, airport officials set in motion the construction of a new 9,000-foot fifth runway, a key part of the 10-year, $5.4 billion Hartsfield-Jackson Development Program (HJDP) capital improvement project. Also included in the HJDP project—which is the largest public works project in the history of the state of Georgia—is construction of an East International Terminal and a consolidated car rental facility, modifications to existing terminals and completion of a new South Terminal building.

Scheduled for completion in early 2006, the new fifth runway is considered one of the most complex structures in the world. Beyond its impressive size, the runway includes the world's longest runway bridge that will span up to 18 lanes of a major interstate and the construction of Georgia's first-ever runway tunnel.

The successful construction of the bridge project is critical to keeping the rest of the HJDP effort on target. To date, construction is approximately 70 percent complete, thanks in large part to the foundation of precision and repeatability established by survey teams from Archer Western Contractors, a general contractor based in Atlanta. For the last two years, Archer Western surveyors have relied on a combination of surveying tools from robotic total stations to grade control lasers to expedite the job with unprecedented accuracy and flexibility.

Early Work Sets the Stage

On Dec. 5, 2002, Archer Western Contractors began work on the $159 million bridge project, with an anticipated completion date of February 2006. The overall project consists of two separate structures that cross over the 400-foot-wide Interstate 285 and two future three-lane collector roads that facilitate the smooth transition of traffic on and off the main roadway. The first structure is a main runway bridge structure that is approximately 1,200 feet in length and hosts a 500-foot-wide runway safety area. The second structure is a 450-foot long, 450-foot wide taxiway bridge. Together these two structures create a tunnel—the first of its kind in Georgia—that I-285 commuters will pass through while airplanes literally land over their heads.

The structures are required to carry loads of more than 1.33 million pounds for the Airbus A380 aircraft as well as future variations of the Boeing 747, which may weigh more than 1.04 million pounds. According to the design team, these specifications will also support a wide variety of aircraft landing gear configurations for a diverse range of aircraft.

Contract specifications require that accuracy on both structures hold to Second- and Third-Order survey precision. The need to hold to this precision at long ranges, and the necessity for a greater than usual repeatability, prompted Archer Western to assess the capabilities of advanced robotic- and laser-driven tools that could assist the surveying team in meeting the set requirements.

"The high degree of precision we were going to need from the survey equipment used on this job made us re-evaluate what we already had," says Tim Williams, Archer Western's heavy civil group chief engineer on the fifth runway project. "During the inventory evaluation, we discovered that most of our current equipment was assigned to existing jobs. Also, equipment that was available lacked the specifications the job needed."

With help from Earl Dudley Associates, a regional full-service surveying equipment dealer, Archer Western expanded its existing toolbox, acquiring two Leica Geosystems' (Atlanta, Ga.) TPS 1100 series robotic total stations to support speedy, high-precision surveys. The first unit provides for quality primary and secondary control, and performs precise structural deformation monitoring as well as the day-to-day construction layout. The second instrument is used for secondary control, construction layout and as-built data collection. Archer Western also upgraded its laser systems to Leica's Javelin dual-grade control lasers. These lasers are compatible with GPS 3D control for earthwork grade control and pipe installations.

A surveyor on the Atlanta bridge project checks data in reflectorless mode.

On the Open Highway

Throughout construction of the fifth runway, Archer Western was required to keep all existing 10 lanes of I-285 open. The interstate is a central artery between downtown Atlanta, surrounding communities and the airport, and carries as many as 160,000 vehicles daily.

"Since much of our work would be across this major highway, it was necessary to divert traffic as the construction progressed. For this reason, we began the project by constructing a temporary detour on the north side of I-285," Williams explains.

Construction of the world's longest runway bridge gets precision attention.

Flying Over the Freeway

Archer Western used the Leica TPS1100 series in full robotic to bluetop the paving surface for I-285.

Surveyors verify control before constructing a new bent wall.

Tight, around-the-clock weekend scheduling helped this industrious contractor get the job done. Over two 56-hour weekends, the Archer Western project teams were able to construct the transitions of all 20 upstream/downstream lanes and the four entrance/exit ramps—thanks to the help of their new total stations.

Since the majority of the work was done at night during low traffic periods, the surveyors relied on the automatic target recognition (ATR) feature of their total stations to automatically track and record targets—and then repeat those measurements at a later time. This feature was particularly beneficial in milling and paving operation stakeout. During the detour work, the typical setup was with an instrument person and two rodmen staking points as fast as they could walk. The milling operation would often require two stakeouts while the paving operations would require up to three. For this operation, speed was the key and the robotic technology combined with ATR made it possible. Without it, the only option would have been to add more labor. "On a job this size, with this time schedule, we need every man and tool working to its full potential," Williams says.

Atlanta's **fifth runway** is considered one of the **most complex structures** in the world. Beyond its impressive size, the runway includes the **world's longest runway bridge** that will span up to 18 lanes of a major interstate and the construction of Georgia's **first-ever runway tunnel**.

Additionally, the Archer Western team used the reflectorless feature to collect measurements to support settlement monitoring of the mechanically stabilized retaining walls. These retaining walls flank both sides of I-285 for 2,000 feet and rise in excess of 30 feet.

"Usually this is a very time-consuming task, but the reflectorless option made it simple and routine for our two-man crews," Williams says. "We continue to use the total stations daily for layout of the superstructure. We also recently acquired a Leica DNA 110 digital level to set the runway deck elevations more accurately and efficiently, as well as to monitor the girder deflections during the deck concrete placements."

The reflectorless total stations were also utilized to verify overhead clearances of existing bridges and the aerial conveyor structure used to provide the embankment materials to both sides of the tunnel structure.

One Laser, Three Operations

Both bridge structures incorporate cast-in-place concrete bents, bridge sub-structure components that support the superstructure. These bents are, in turn, supported by 81" and 83" deep pre-stressed concrete modified bulb tee sections (girders) that span between the bents.

In the last two years, Archer Western has excavated the site and prepared it for construction of these components. The dual-slope feature of the Javelin laser was particularly beneficial during the design phase of this project and for grade control of the foundation excavation and paving operations on both bridge structures as well as pipe layout and utility work.

One particularly valuable application using the laser came early on. Archer Western recommended changing the runway bent footings from a series of level 32' long steps to a constant slope. These runway bents are continuous concrete walls 3'3" thick ranging in height from 50' to 60'. The taxiway bents consist of 7' x 3'3" thick columns with pier caps.

"With this design change, we were able to use the dual-slope capabilities of the Javelin to provide grade control for three sequential operations—footing excavation to sub-grade, pile cutoff grade and top of footing concrete grade—with one man from one setup for the 1,200-foot-long bent walls," Williams explains.

The ease of setup of the instruments was equally beneficial to the operations, particularly the self-leveling and direct slope input features.

"Whether it's the Javelin lasers or the TPS1100 total stations, we have gained enormous advantage during the first phases of the program," Williams adds. "These tools have given us improved speed and accuracy along with low maintenance and less cost as compared to more conventional survey methods. Two crews were able to do the work of three crews during much of this effort."

Looking Ahead to Precise Completion

Now that the excavation and the detour construction is complete, construction on the center bent will begin with a scheduled completion of February 2005. The superstructure that spans I-285 is to follow, with final completion by February 2006.

"We are on-time, on-budget and well-positioned to continue the construction of the remaining substructure and the all-important superstructure thanks to an extraordinary combination of collaborative teamwork combined with the application of high productivity tools," Williams concludes.

A surveyor shoots an elevation onslope with a Leica Javelin S dual-slope laser on a roadway soon to open.

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