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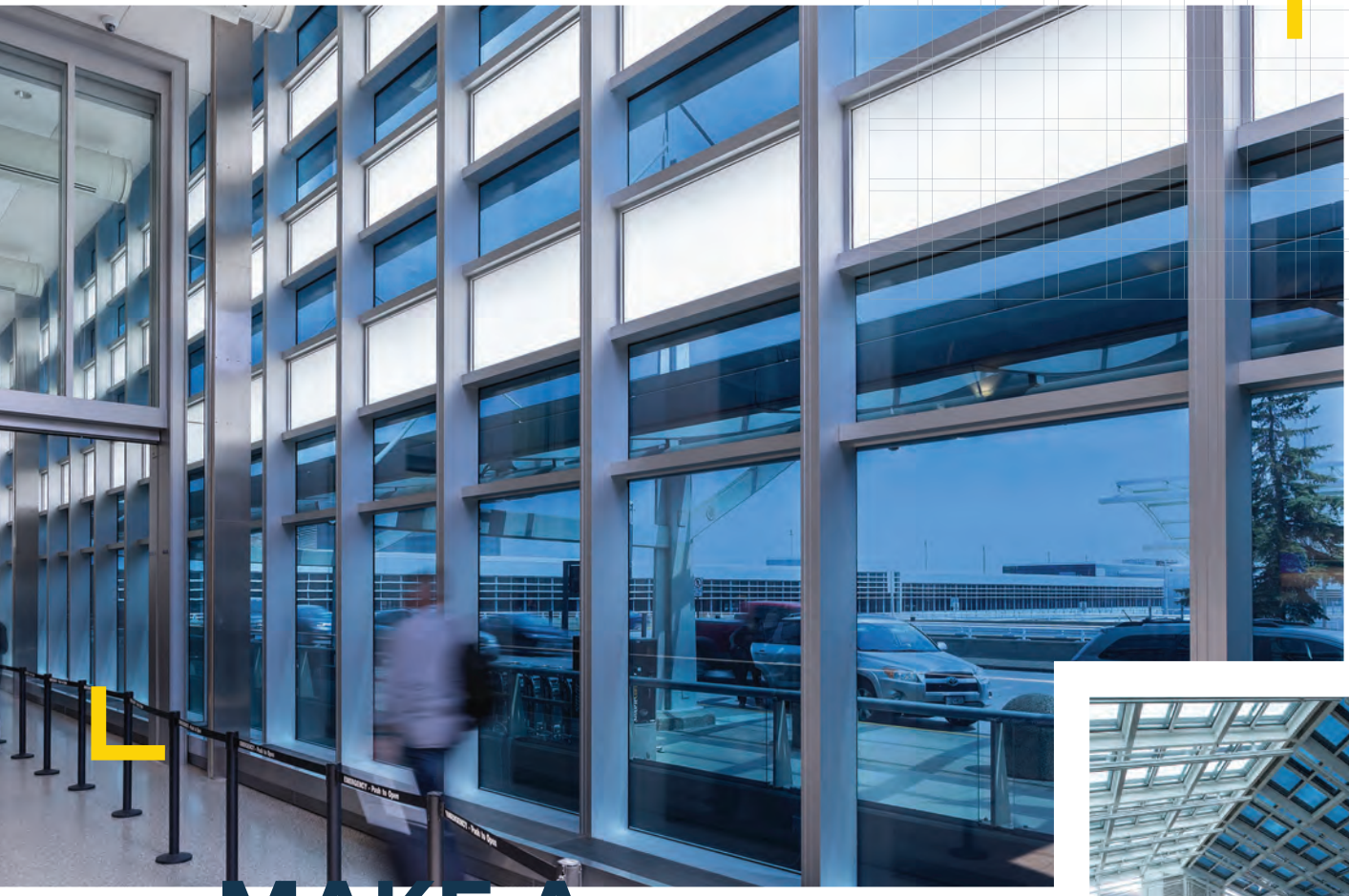

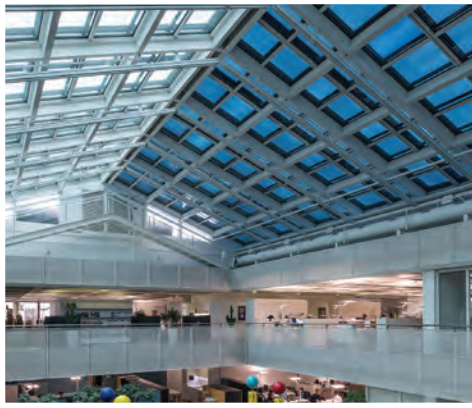

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Show Me!

The onset of the COVID-19 pandemic has created a plethora of commercial options to help airport operators and passengers cope with the new realities of air travel. Frankly, some will prove useful, and others will never fly (pun intended).

At *Airport Improvement*, we've always made it a point to steer clear of unproven theories, products, services and applications that *might* work at your airport. We prefer to cover solutions that are already working, told in the words of your fellow airport directors and their teams, consultants and suppliers. We won't waste your time with theoretical ideas that may, or may not, make the cut.

Open any issue of this magazine, however, and you'll definitely find something innovative. And this issue is particularly loaded with innovation.

Check out our cover story about Brownsville South Padre Island International. Its new terminal includes a huge wall of SageGlass, with special glazing that automatically adapts to control the temperature and glare in the entry hall. Airport officials are also laying the groundwork to add cutting-edge biometrics in the future.

Cincinnati/Northern Kentucky International, featured on Page 22, is a veritable treasure trove of innovations. The team there has even found a new way to sell water—vending machines that dispense flavored and/or caffeinated water in recyclable cardboard bottles! Our coverage also brings you details about the airport's autonomous commercial floor scrubber, its 12-week trial of a personal robot and more.

Other articles in this issue provide an inside look at a virtual ramp control system, new uses for existing sealcoat products and a clever way to recycle airfield runoff.

PAUL BOWERS, PUBLISHER

Common criticisms about our industry being overly risk-averse clearly don't apply to the airports we've profiled. The amount of innovation taking place is stunning, and I'm excited to see what the rest of 2021 will bring!

Cheers,

Paul

New Terminal Significantly Increases Capacity, Flexibility at Brownsville South Padre Island Int'l

BY JENNIFER DAACK WOOLSON

Even though he's not a native Texan, this isn't Bryant Walker's first rodeo.

In fact, his experience building and opening the new B terminal at Sacramento International Airport vaulted Walker to the top of the list when Brownsville South Padre Island International Airport (BRO) needed a new director to lead its $70 million terminal project.

BRYANT WALKER

"The city sought out director candidates with experience managing the myriad of challenges associated with the design and construction of a new terminal, who could capably lead this project," explains Walker, who now serves the dual roles of assistant city manager and aviation administrator for the city of Brownsville, TX.

When he arrived at BRO in 2016, the airport was in the design phase of replacing its outdated terminal, which was constructed in 1971. At just 37,000 square feet, the facility had two gates for two airlines—United and American—plus one restaurant and a hodgepodge of offices for airport administration, security and operations. The security checkpoint no longer met TSA requirements due to its small size, and mounting maintenance costs made it clear that the 50-year-old facility had outlived its useful life.

Bigger & Brighter

The new terminal, set to open in January 2021, is 91,000 square feet, with four gates that can accommodate four narrow-body aircraft simultaneously. The entry hall features an expansive 45-foot glass wall that bathes check-in, baggage claim and a meet-and-greet area in natural sunlight. The TSA checkpoint exceeds minimum design standards to prepare BRO for evolving security requirements. And the entire facility was built in a modular fashion to allow for future expansion predicted by 20-year traffic forecasts.

Walker and his team focused on business and leisure travelers when contemplating the design and customer amenities for the new terminal. Providing convenient access to South Padre Island, less than 30 minutes away by car, also guided their choices.

Another key goal was modifying the terminal to accommodate larger aircraft supporting expanded international and general aviation

service. This required increasing capacity for both people and planes. For instance, the previous gate area only held about 168 passengers—less than one fully loaded 737. Even before COVID-19, holdroom space was limited. With new social distancing requirements, there simply wouldn't be enough room.

ERIK STRAIN

To accommodate larger aircraft, architects and designers positioned the new terminal 200 feet from its predecessor. "The existing airport is sited to only allow regional jets to serve the facility, due to the proximity of the terminal to the FAR 77 transitional surface," explains Erik Strain, project manager and vice president of Corgan. "By constructing the new terminal further from the runway, it allows for contact gates to serve narrow body aircraft. This allows the airlines to use larger aircraft as demand allows. It also increases the potential for additional airlines to serve the airport."

Previously, BRO's Customs and Border Protection facility could only accommodate general aviation operations. Its new Federal Inspection Station, however, can also serve commercial traffic and is designed to process up to 200 passengers per hour.

From Concept to Construction

In terms of design, city leaders wanted a facility that connected Brownsville—which is just 15 miles from the SpaceX South Texas Launch Site—to the 21st century. "Transformation is coming to the city of Brownsville," Walker says. "This new terminal provides the city and management team with the infrastructure to support that change."

FACTS&FIGURES

Project: New Passenger Terminal

Location: Brownsville South Padre Island (TX) Int'l Airport

Cost: $70.4 million

Funding: Federal grants, local bonds, passenger facility charge revenue

Facility Size/Scope: 91,000 sq. ft., 4 gates (2 domestic; 2 int'l swing gates)

Key Elements: Modern, open design; electrochromic glass; new Customs & Border Protection facility; infrastructure for biometric technology

Airport Owner: City of Brownsville, Dept. of Aviation

Project Design: 2016–2018

Construction: 2017- spring 2021

Prime Consultant: Jacobs

Architect: Corgan

Structural & Mechanical/Electrical/ Plumbing Design: Jacobs

Fire/Life Safety Engineering: Jacobs

Lighting Design: Corgan; Jacobs

Engineer of Record for Construction: Garver Engineering

Security: Moye I.T. Consulting, LLC

Biometric Hardware; Security, Self-Service & Display Technology; Seating & Table Charging Stations: Parabit

Baggage Handling System: Vic Thompson Co. (design); G&S (installation)

Seating: Arconas

Civil Landside: Ambiotec Engineering

Civil Airside: Jacobs

Roofing/Waterproofing: Wiss Janney Elstner Associates

General Contractor: SpawGlass Construction

Quality Assurance/Control: Davika Construction

Construction Cameras: OxBlue

Electrochromic Glass: Saint-Gobain (SageGlass); CristaCurva

Elevators/Escalators: OTIS

Passenger Boarding Bridges: Jetways, by JBT

Airside Passenger Buses: Cobus, leased from Port of Seattle Authority

Landscape Architect: SSP Design

A large wall of SageGlass adds natural light; high-tech glazing provides automatic temperature and glare control.

Additional domestic and international markets may be in the airport's future.

Working from a concept design report prepared by Jacobs that identified basic needs for the new terminal, Corgan held a series of design charrettes with the city's design review board and technical advisory committee to develop a vision that represented the city of Brownsville. Architects then developed two different designs, and solicited input from area residents, travelers, local businesses and other airport users.

While design-by-committee is never easy, it seems to have worked in this case.

ROSS PAYTON

"They actually ended up doing a public poll, and the design that was selected is what was implemented," says Ross Payton, a Corgan principal. "I thought that whole process of letting the region help identify and define the path forward was really interesting."

The design was complete in November 2018, but the first of three construction phases began in 2017 with new and relocated parking lots. During the second phase, crews focused on building the terminal itself. The final phase, slated for completion this spring, includes demolition of the former terminal to make room for a new airside ramp and boarding bridges.

Each phase qualified for a different percentage of FAA funding, and the airside phase was not funded until September 2020 with matching funds from the CARES Act. The rest of the project was paid for with a combination of Airport Improvement Program (AIP) grants, FAA discretionary and entitlement monies, funds from local economic development corporations and $8 million from the transportation infrastructure bill passed in 2018.

One provision of the AIP funding was to use steel and manufactured goods produced in the United States, per FAA's Buy American Preference program.

Given the tight budget, Payton and his team kept a close eye on spending. "Going in knowing what the airport was looking for, while also being aware of a constrained budget early on, really shaped the design decisions presented from the onset, making sure that we could get them aesthetically beautiful, but cost-effective alternatives," he says.

Using the required competitive bid process, the city selected Jacobs as the prime consultant, and Corgan was brought on board for architectural design. Garver Engineering was retained to manage construction from an engineering perspective.

"We essentially have a third party that wasn't involved in the design phase that can review the plans and specs as construction is happening," Walker explains. "Another benefit is load balancing to ensure we don't overload the people assigned to this project."

Although this arrangement is not typical for terminal construction, Walker reports that it is working well for BRO.

JASON FRANK

"It was a fast-tracked project, so we were able to serve as another set of eyes and to help with changes that came up during construction," explains Jason Frank, P.E., Garver's senior project manager and southeast Texas Aviation lead. "We were

able to mesh well and had a good line of communication with the design team, owner and contractor."

Together, the team produced a two-level terminal that features a modernized check-in area with self-serve kiosks. Other new passenger amenities include expanded Wi-Fi coverage, interactive kiosks and Parabit Systems biometrics. Designers planned the ticket counter system so it can be modified easily as BRO moves toward a self-service bag check system. Behind the scenes, the new building has updated mechanical, power and technology systems that are more energy efficient and reliable for the airport.


ERIC C. KENNEDY

General contractor SpawGlass used the Lean process, just-in-time deliveries and constraint logs during the construction process. Eric C. Kennedy, president of the firm's South Texas Division, notes that constraint logs were particularly effective helping the team identify and proactively solve problems. For example, instead of moving chillers from the existing terminal as originally planned, the airport purchased new units to prevent downtime and improve subsequent operational efficiency.

Security, Sustainability & Customer Satisfaction

Payton explains that the whole design—from building flow to finish materials to the curbside canopy—is intentional and focused on the user experience. Moreover, the design team's definition of "users" extended beyond passengers to include airport employees, airline personnel, Customs and Border Protection workers, TSA officers and concessions staff.

For international arrivals, the new terminal uses a leading-edge method called "bag first" that flips the traditional order actions occur. Passengers now collect their bags *before* presenting for passport and identification checks. Infrastructure and technology are in place for touchless processing, which is something Corgan designers predict travelers will come to expect, even when COVID-19 is less of an issue. All devices, including biometric infrastructure and scanners, are integrated into a modern, compact podium with antimicrobial surfaces rather than bulky legacy booths.


ANTHONY J. WANAT

Anthony J. Wanat, architect and project manager with Jacobs, notes that the new terminal accommodates customers arriving by car, city bus, bicycle and even walking paths. "He [Bryant Walker] spent quite a bit of time

A new baggage handling system was an important element to accommodating more passenger volume.

looking beyond the airport, going down the road, even several miles away, where the major signs are that direct people to the airport," explains Wanat. "I thought that was very conscientious on his part to consider different modes of travel to and from the airport."

Interior upgrades include LED lighting, lighting controls compatible with the Internet of things (IoT), daylight harvesting, individual room controls for heating/cooling and wireless access points throughout the facility.

One of the primary design goals was to "future-proof" the building as much as possible—not only in terms of capacity and growth, but also security. That included installation of power and data to support the potential future migration to biometrics. "As the terminal was under construction and suddenly we were saddled with the impact of COVID-19, it became increasingly apparent that our commitment to future-proofing was a wise investment," Walker says.

Security enhancements include the improved Federal Inspection Station for screening international arrivals and a more secure card access system integrated with a video surveillance system to improve real-time assessment and response for security issues. In addition, every podium, ticket counter, gate and portal between security areas has cameras able to feed into a biometrics system, which can be activated once approved. BRO can use biometric access control immediately, but full curb-to-gate coverage won't be implemented without airline participation. Similarly, Customs and Border Protection biometrics won't be activated until the agency has approval. But the infrastructure is in place to support both upgrades, and in the interim they could potentially explore the use case for edge analytics.

Other terminal deployments will also support safety initiatives and the industry focus of building customer confidence. Silver ion countertops and antimicrobial films protect common touchpoints, and charging stations visibly distribute power throughout gate holds to support social distancing. BRO invested in automated robotic cleaning as well as cutting-edge needlepoint bipolar ionization technology to combat airborne pathogens.

Even before COVID-19 was an omnipresent issue, the project team focused on creating a clean, healthy facility. Beyond using domestically made products to meet FAA Buy American Preference requirements, designers specified recycled or natural products sourced locally whenever possible. One of the more innovative products is a huge wall of SageGlass in the entry hall. It has electrochromic glazing that provides automatic temperature and glare control to increase customer comfort and decrease energy usage for heating and cooling.

Other sustainability measures include relocating more than 60 palm trees to other areas of the city; crushing and reusing demolished asphalt, limestone and concrete; and salvaging existing terminal materials to keep them out of landfills.

Inter-Industry Cooperation

Although the new terminal is slated to open in January 2021, demolition of the former terminal and construction of a new airside ramp are not scheduled to be complete until spring. In the meantime, BRO is shuttling passengers between the new terminal and remote hardstand locations.

A 60-foot swath of new concrete created a lane for the temporary traffic, but procuring appropriate vehicles to carry airside passengers proved to be more challenging.

Cobus was unable to provide equipment on short notice, but company personnel connected Walker with the Port of Seattle, which had 10 buses in its collective fleet that were mostly sitting idle. The Port, which operates Seattle-Tacoma International Airport, will lease BRO two of its spare vehicles for the four-month interim between the opening of the new terminal and subsequent installation of its boarding bridges.

Construction in the Time of Coronavirus

Local pandemic shutdowns occurred after crews had enclosed most of the new terminal, but they still influenced the rest of the project. Although much of the early design collaboration occurred in-person before the shutdowns, team members in Houston, Dallas and the Rio Grande Valley relied on videoconferencing and a building information modeling platform for sharing files throughout the project. During construction, team members used virtual reality goggles for clash detection and to visualize problems remotely. Drones and OxBlue construction cameras allowed them to monitor construction progress without being on site.

All podiums, ticket counters, gates and portals between security areas have cameras able to feed into a biometrics system, which can be activated once approved.

In retrospect, Wanat says that touring other facilities (before the pandemic hit) helped Walker and Assistant Airport Director Shawn Schroeder make decisions about materials for the new terminal. Seeing electrochromic glass installed, and talking to other building operators about its pros and cons was especially valuable. “I think that went a very long way to give them the confidence to go ahead and spend the premium dollars to have that at their facility,” he says.

During construction, the general contractor created a 25-page COVID-19 mitigation plan (in English and Spanish) to address new safety policies for the project. To gain access to the jobsite, crews had to enter through a trailer with an infrared camera that checked for elevated body temperatures as they passed through.

All 250 on-site workers were required to wear face coverings and maintain social distancing even when it was logistically difficult. Installing sheetrock on scissor lifts 40 feet in the air was one of the biggest challenges. "We had to come up with innovative ways to keep workers 6 feet apart using jacks and Plexiglas partitions, but we didn't cut corners," emphasizes Kennedy. "We got creative to keep everyone safe."

Fortunately, contractors experienced only minor delays in material deliveries. In response, they reworked the construction schedule, used the wait time to complete other tasks and met the original deadlines.

Teamwork to the Finish Line

With the added challenges of working during a historic pandemic, it took a strong team effort to complete the terminal on time, in good form.

Kennedy credits Walker and Schroeder for their decisiveness. "Sometimes we work with clients who are hesitant," he says. "But Bryant and Shawn were both very instrumental in making decisions and keeping the project moving forward. We were able to make it through the pandemic *and* finish the job successfully because of their leadership."

Walker was also known for maintaining high quality standards. "Bryant has big visions for the airport," says Frank. "This is going to be a crown jewel in the Rio Grande Valley. It's a beautiful facility that's ready for cutting edge of technology."

When approaching the project's finish line in November, Walker was remaining careful not to rush. "We want to make sure that we maintain a sharp focus and complete the project really strong to provide the highest quality terminal possible for the citizens and community," he explains.

After the ribbon cutting on Dec. 11 and a few subsequent open houses, crews will sterilize the entire building, and specialists will complete security checks and operational readiness testing to prepare for the public opening in early January.

The project team is scheduled to complete the final phase of construction—demolishing the old terminal and installing the new apron and boarding bridges—during the second quarter of 2021.

A New Terminal Designed for the

21st Century Passenger

View the new terminal in 3D.

Thoughtfully planned to accommodate the present and future needs of travel, the new terminal at Brownsville South Padre Island International Airport features technology and modular architecture built for the 21st century.

***BRO:** Designed for the future.*

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Fort Lauderdale-Hollywood Int'l Updates Signs for Motorists

BY VICTORIA SOUKUP

FORT LAUDERDALE-HOLLYWOOD INTERNATIONAL AIRPORT
BROWARD COUNTY, FLORIDA

FACTS&FIGURES

Project: New Exterior Landside Signage

Location: Fort Lauderdale-Hollywood (FL) Int'l Airport

Operated by: Broward County Aviation Dept.

Est. Cost: $15.3 million

Funding: Bonds; passenger facility charges

Scope: 5,390 signs (4,800 in parking garages; 550 curbside; 39 on entry road)

Installation: Sept. 2019 through Sept. 2021

Wayfinding/Architecture/Engineering: Gresham Smith

Digital Displays: Daktronics

Technology Consultant: Arora Engineers Inc.

General Contractor: Horsepower Electric Inc.

Subcontractor: AUM Construction Inc.

Electrical Consultant: DeRose Design Consultant

Static Signage: L&H Sign Co.

Roadway Static Panels: Interstate SignWays

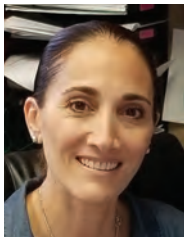
Roadway Sensors: TrafficCast, a division of Iteris

New signage is making it easier for drivers to navigate Broward County's Fort Lauderdale-Hollywood International (FLL). A comprehensive project substantially completed in December replaced aging signs with brighter, easier-to-read LED displays. The new digital units allow the Florida airport to update messages and instructions for drivers in a matter of minutes. Estimated cost for the project is $15.3 million.


MARK GALE

"The addition of these modern and vibrant navigational signs is another example of how FLL is working to elevate the airport guest experience from arrival to departure," says Mark Gale, chief executive officer/director of Aviation for the Broward County Aviation Department.

In total, the airport installed nearly 5,400 new signs. Details such as colors, fonts and formatting were prescribed by a Signage and Wayfinding Master Plan that was completed in 2014. "We spent a lot of time developing these standards," explains Staci Montefusco, expansion project administrator at the Broward County Aviation Department. "It was important that a passenger finding his or her way to FLL had an easy time navigating, that they didn't have information overload, and that we had a clear and concise messaging hierarchy."


STACI MONTEFUSCO

Most installations occurred from September 2019 to December 2020, however final completion of the overall wayfinding signage project is expected in September with the addition of more than 300 interior and exterior signs in the Rental Car Center.

While the latest phase of the project focused exclusively on roadways, curbsides

and parking garages, signage inside the terminals is also being updated in stages. That work is part of a larger modernization initiative that began in 2016 with Terminals 1 and 4; Terminals 2 and 3 are slated for completion by fourth-quarter 2021.

A Logo is Worth a Thousand Words

Improved over-roadway signage is one of the most visible elements of the recent project. As drivers approach the airport, a series of five dynamic 10-by-32-foot LED signs provide airline information for each of FLL's four terminals.

The former static signs, which listed carriers on colored backgrounds coded to the four terminals (yellow for T1, red for T2, purple for T3 and green for T4) had become dull and weathered, making them difficult to read. The electronic signs include full-color airline logos. "Motorists can recognize an airline logo easier than reading the airline name when trying to determine which terminal they should go to," explains Montefusco.

DAVID PARK

David Park, senior experiential and wayfinding designer at Gresham Smith, notes that logos help motorists process the rapid succession of information they are presented with when entering the airport. "A driver doesn't have a lot of time between signs to

process all the information," Park says. "Since the No. 1 question for anybody coming into the airport is 'Where's my airline?' using logos makes those decisions easier as motorists quickly scan the signage."


LEANN HOLLER

Digital signs provide more than just enhanced graphics, adds LeAnn Holler, sales manager for the Southeast U.S. Region of Daktronics' Transportation Group, which provided 81 LED displays for the project. "The airport wanted to use more logos and directional graphics and have more color in the background," says Holler. "You can't always achieve that with a static sign. But they also wanted the signage to be changeable and digital and, more importantly, dynamic. That really was the goal."


EDWARD HART

Edward Hart, vice president and special systems discipline lead at Arora Engineers, notes that pixel pitch (the space between individual pixels) was an important factor. Taking into account average viewing distance, sign content and motorists' average speed, a team from Arora and Daktronics determined that a 15.85 mm pixel pitch would provide the clearest viewing for over-roadway terminal signs. Smaller digital signs located closer to the terminal have a 10 mm pixel pitch. Curbside signs have an even tighter pixel pitch of 8 mm because curbside LED displays are viewed from closer distances.


CLINT BARBER

Color was important, too. The airline logos on FLL's new digital signs have colored backgrounds that match the airlines' logos corporate colors, per Daktronics' recommendation. Clint Barber, project manager for the company's Southeast U.S. Region, explains that white backgrounds, common for printed graphics, increase the intensity level of digital signs and cost more to operate because they draw more power.

"We wanted to reinforce the same messaging that's on the roadway, so when motorists approach the curbside, the dynamic sign also has the airline logo," says Montefusco.

In total, the airport has 39 new road signs. Three are electronic, and five (the large overhead signs) are dynamic.

LED Boards for Breaking News

In addition to new signs, the airport installed two LED messaging boards above the main entry road. Airport personnel program the 15-by-11-foot boards to provide drivers with up-to-date information about issues of widespread importance such as traffic delays, weather alerts and, since the advent of COVID-19, face-covering requirements.

The airport recently used the messaging boards to inform and re-direct motorists when one of its terminals was temporarily closed overnight for emergency power infrastructure upgrades. "We avoided having to set up temporary curbside or roadway signage," says FLL's Montefusco.

More typically, staff use the digital message boards to warn drivers about traffic congestion before they are stuck in the middle of it. Bluetooth sensors installed on the roadway by Horsepower Electric provide operations personnel with traffic data. When congestion is detected, personnel program the message boards to alert drivers about impending backups and suggest an alternate route. This allows drivers who are picking up passengers to arrange a new meeting spot. "The boards can tell motorists that if they use the suggested route, they will get through the airport traffic faster because, for instance, one level may have a 30-minute delay while the other level has no traffic issues," Hart explains.

Montefusco notes that the new message boards allow FLL to address evolving conditions much more quickly. When a change was needed with the old system, personnel had to create a work order, and crewmembers would physically alter the signs from a bucket truck.

"Now, all of that work can be done in a minute or two, and does not require anyone actually going out on the roadway and disrupting traffic to change a sign," she says. "It gives us enormous flexibility."

Supporting Elements


BENJAMIN GOEBEL

Engineers had to route electrical power to many of the dynamic signs and some of the new static signs. Benjamin Goebel, of Gresham Smith, explains that this process was time-consuming, but relatively uncomplicated, because most of the sources came directly from the terminals or power points along the roadway. Routing data communication lines to each of the new LED signs, however, was more challenging. The project team opted against transmitting information to signs wirelessly because of the potential for hacking and because of the propensity for severe weather in the area. Storms in southern Florida can wreak havoc with wireless communications, Hart and Goebel note. "It all had to be hardwired," says Goebel. "And in some cases, we had to route all the way back to some of the main terminal buildings and then out thousands of feet to the new digital and dynamic signage."

Although the improved over-roadway signs are about the same size as their predecessors, the new digital units are heavier than the old static signs. As such, engineers had to make significant structural modifications to the existing supports to prevent the need for FLL to spend millions of dollars on new structures. "Any time you have a design solution that can save money, that's great," remarks Park.

Better Wayfinding in Garages

One of the most challenging aspects of the project was updating signage in the airport's three parking garages. In total, crews installed more than 4,800 signs (all static)—far more volume than in other areas.

New signage, some illuminated, provides guests with additional guidance to elevators and terminals. A new, more linear numbering system for rows helps them find their vehicles when they return. Renumbering the rows required a careful approach. "Replacing signage took three months, so we had to add temporary signs in all three garages that explained the changes," says Montefusco.

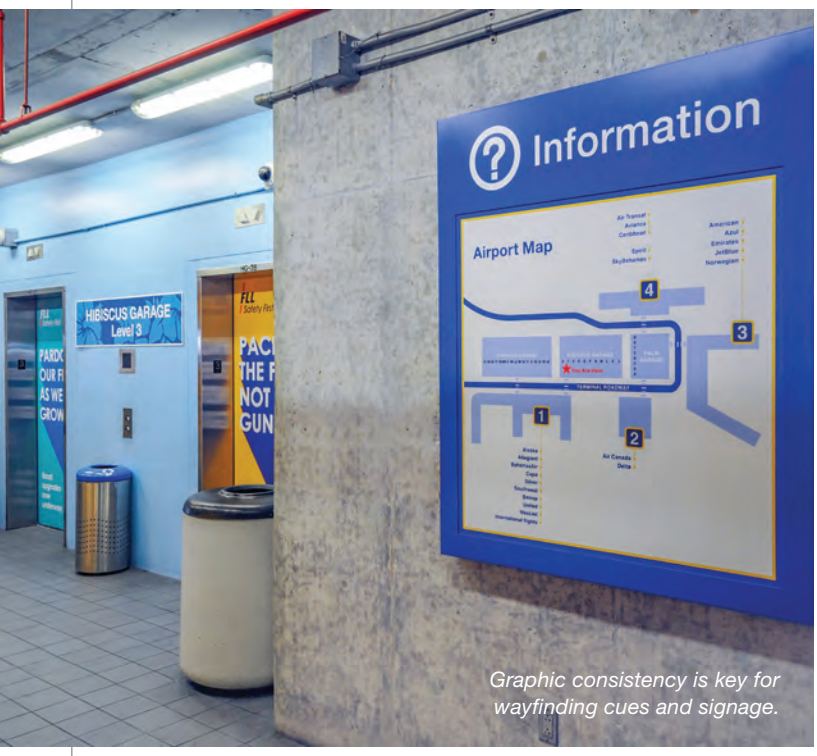
Park notes that the project team took extra care to inform visitors about future changes—for instance, warning passengers that their parking spots might be renumbered when they returned after their trips.

Wayfinding keys that outlined specific changes were displayed throughout the

Curbside signs include airline logos for faster, easier recognition by drivers and passengers.

garages, on exit doors and in baggage claim areas to keep passengers updated. Informational signage was posted two weeks before work began, and it remained up for two weeks after each floor was finished.

The airport also repainted the parking structure interiors. "Each floor is a different color," explains Montefusco. "If a passenger doesn't remember where they parked, they might remember



Graphic consistency is key for wayfinding cues and signage.

the color of the floor they are on along with the quadrant of the parking garage."

Beyond temporary signage, FLL used social media and its website to forewarn and alert the public about changes in its parking garages; but some guests still had trouble finding their vehicles. When that happened, airport and parking personnel often used the garages' license plate recognition system to help them.

Widespread Enhancements

Reflecting on the project, Park from Gresham Smith details several improvements at FLL: It's easier for motorists to get to the airport; it's easier for passengers leaving the terminals to find ground transportation; and it's easier for drivers to navigate parking at the airport.

"We cleaned it up quite a bit," he says. "They had a mishmash of different signage aesthetics. The logic is better now in terms of when information is presented to the customer. In addition, there are fewer signs along the curbside. Airports tend to add many signs over the years, and we were able to clean that up and reduce the visual clutter."

Marc Gambrill, FLL's aviation chief development officer and assistant director of aviation for capital development, emphasizes

the value of developing a master plan—and resisting the inevitable temptation to tinker with it after it is approved. “It is very important so everyone knows what you are working on,” he says. “Once you have a plan, the executives and the organization have to stick with the plan and move forward with it and not modify it as you go.”


MARC GAMBRILL

The project team also consulted ACRP Report 52, *Wayfinding and Signing Guidelines for Airport Terminals and Landside*. “It gave us guidance on best practices,” he adds.

Montefusco says that the project improves FLL in a variety of ways: The new digital roadway signs clearly identify airline and terminal locations; curbside signs reinforce airline locations and direct passengers to the best terminal door for ticketing; and the new color-coding system and more plentiful, brighter signs with larger fonts in the parking garages make it easier for customers to find their vehicles.

Like so many other projects, installing the new signage occurred while the facility was open and serving customers. “We had to keep reminding the team that FLL is an operational facility and that every moment counts for the passenger,” Montefusco recalls. “You can’t just take down a sign and not put another one up. You should at least have a temporary signage plan to guide the passenger through.”

New signs help passengers find various ground transportation options.

Cincinnati/Northern Kentucky Int'l Leverages Innovation

BY THOMAS J. SMITH

Stroll through Cincinnati/Northern Kentucky International Airport (CVG) and you might encounter a machine without an operator scrubbing the floors, a small cargo pod dutifully rolling behind an employee as if by magic, and any number of other tech-forward devices hard at work.

Why the emphasis on futuristic innovations? To build a compelling brand experience that keeps passengers coming back.

"Unlike anywhere else in the U.S., CVG is surrounded by five other competing airports all within a 60- to 90-minute drive," explains Brian Cobb, CVG's chief innovation officer. "Consumers in this drive-centric geography have choices about which airport they will use. You need to create a fandom approach so that decision moves away from utilitarian to trust and a love of the product. If consistent, just as in sports, fans will come back year after year."

BRIAN COBB

In short, innovation is part of CVG's brand. And having a chief innovation officer on its organizational chart demonstrates a commitment to the approach.

Standing still or maintaining the status quo is not acceptable, explains Cobb. Instead, the airport emphasizes improving on what it did yesterday. "If that involves technology, you can call it innovation," he comments. "But it is really about how you propel your brand forward."

He describes innovation as a combination of talent, technology and change management.

"The aviation industry is full of innovative approaches," says Chief Executive Officer Candace McGraw. "At CVG, we are strategically positioning our airport for the future by leaning into new ways of thinking and advancing technologies. By doing this,

CANDACE MCGRAW

we establish partnerships and test technology in a live airport environment, all to enhance the airport experience for travelers, business partners and the community."

To do so, Cobb and his staff leverage their annual budget to research and test a wide range of developing products and services. Together, they assess MVPS (minimum viable product status); and if test results demonstrate enough potential, the team develops revenue strategies to pay for full deployment.

The airport is also a member of Cintrifuse, a technology business incubator supported by the area's Fortune 500 companies, universities, local governments and small businesses.

H_2Oh Cool

Sustainability and enhancing the customer experience are two key elements Cobb's team considers when looking for ways to diversify concessions. The September arrival of two Drop Water vending machines, one in each concourse, checked both boxes. The self-service machines dispense plain, flavored and/or caffeinated water into a customer's own reusable bottle or a cardboard "bottle" from inside the machine. Cobb likens the vending units to Coca-Cola Freestyle® machines found in quick-serve restaurants and convenience stores.

"It is a fun-to-use machine," he says of the mix-and-match options it offers customers. "And it is clearly a sustainable approach."

Regarding sustainability features, the company's patented cardboard containers can be reused before beginning to deteriorate, and then they're recyclable or compostable. Moreover, the vending machines filter the airport's tap water, so the Silicon Valley startup does not transport it in vehicles that burn diesel fuel and produce emissions.

"We really think this is the future of bottled drinks," says Drop Water Chief Executive Officer Scott Edwards.

From a footprint perspective (critical for most airports), each of the company's vending machines holds more than 1,000 of its empty cardboard bottles. A traditional vending machine would require 10 times that space to store a similar number of filled plastic or glass bottles.

CVG is also working with PathWater, a firm that sells purified water in reusable aluminum bottles. The company, also from California, plans to sell its bottled water via existing concessionaires and vending machines; but the coronavirus pandemic is hampering its rollout.

"Right now, the retailers are trying to figure out how to survive rather than bringing on new product concepts," says Cobb. "When they are ready to re-open and are looking to improve their product offerings, this one speaks to the sustainability elements."

He hopes PathWater will be available at CVG by this spring. The airport does not have a master concessionaire to run new products through. Instead, HMS Host and Paradies Lagardère manage and lease retail and food/beverage spaces.

Service, Will Robinson

Robotic ventures are another main category for Cobb and his cohorts. In late fall, they began a 12-week trial of gita, a 2-foot tall "personal robot" designed and manufactured by Piaggio Fast Forward. Airport personnel have been testing gita's ability to carry passengers' items from the security checkpoint to the gate area. Cobb also sees the potential for the droid-like unit to deliver food orders to passengers already at the gates.

"We are using the [pandemic] slowdown as an opportunity to deploy new products," Cobb explains. "Passengers will see all the differences and see that we used the time wisely."

In November, CVG served about 5,000 travelers per day—roughly 40% its usual volume.

Currently, the challenge is determining how to best serve travelers *and* the concession tenants.

"In this COVID era, travelers go through screening and head immediately to their gate and do not leave it," says Cobb, noting that this behavior is taking a toll on retail and food/beverage sales.

He considers the situation a doubled-edged sword. Passengers have fewer options because many concessions remain closed or are open for very limited hours; but there are fewer passengers to support the concessions that are open.

That all-too-common dichotomy is prompting Cobb to search for ways to help concession operators reengage—perhaps by matching their schedules and locations to the airlines' arrival and departure schedules in near real-time. "We need to be more intelligent on what the consumer is doing and spending," he muses.

Housekeeping workers receive messages on smart watches when restrooms need service.

Date-Driven Approach

CVG uses information from a variety of sources to gain insight about customers' spending habits.

In fact, it was the first U.S. airport to deploy Bluetooth and Wi-Fi "sniffer" sensors. CVG originally installed the sensors at its security checkpoint to collect real-time information about wait-times, which was used to guide decisions about reallocating staff resources to reduce wait-times. Later, it added additional sensors throughout the facility to collect information about travelers' traffic patterns.

CVG also participates in the Airport Service Quality program, administered by the Airports Council International, to receive immediate feedback from travelers as they complete iPad surveys at the gate. The airport has also gathered data through online surveys in the past.

And completing the tech loop, CVG's restrooms are equipped with sensors that count the number of guests using each particular facility. Housekeepers wear Samsung Gear Watches, enabled with TaskWatch technology, that alert them when a restroom needs to be serviced.

Innovations Making the Grade

Here is a sampling of the innovations that are currently in the works or already deployed at Cincinnati/Northern Kentucky International Airport (CVG).

Product: Sustainable water vending machines
Company: Drop Water
Hometown: Redwood City, CA
Status at CVG: On site since fall 2019

When Drop Water installed two of its vending machines at CVG last fall, it was a homecoming of sorts. The company originally connected with the airport in 2018 after winning a $25,000 grant at an international event sponsored by a technology business incubator that CVG supports.

Drop Water vending machines filter the airport's tap water and dispense it chilled or at room temperature, with or without flavoring (there are six options) and/or caffeine (three concentration levels). Customers also decide whether to dispense the water into their own refillable bottles or 16-ounce cardboard containers from the machine.

Plain water dispensed into a customer's bottle is free, and adding flavoring costs $1. Plain water dispensed into a Drop Water container costs $2, with prices ranging up to $3.45 for flavoring and three caffeine shots.

Customers using the company's app can order and pay for drinks without touching the vending machine—a feature that has become more popular during the coronavirus pandemic.

CVG is the second U.S. airport to offer customers Drop Water beverages. The firm

tested its machines for six months at San Francisco International Airport (SFO) in late 2019 and in November 2019 installed its first permanent vending machines in San Jose International Airport (SJC). Company officials are currently negotiating to bring its water machines back into SFO.

Product: Neo, an autonomous floor cleaner
Company: Avidbots
Hometown: Kitchener, ON
Status at CVG: Deployed in January 2020

Neo, an autonomous commercial floor scrubber from Avidbots, has been operating full-time at CVG for more than one year. The airport tested the device for two months before putting it into operation. Since its arrival at CVG, Neo has cleaned more than 5 million square feet of flooring.

The machine applies a solution of soap and water, scrubs the floor with cleaning disks and then vacuums up the dirty water to leave the floor dry—all without an operator.

Although Avidbots has its equipment in five of the world's top 10 airports (as ranked by SkyTrax), CVG is currently the only U.S. airport with a Neo.

The machine can clean 40,000 square feet per hour, and a battery pack powers the floor scrubber for six hours. Its 112-liter water tank also lasts six hours in most cleaning situations. At CVG, Neo is deployed around-the-clock.

Before its first mission, the robot was programed with a map of the airport's concourses; but it also "teaches itself" to navigate around anything new in its path. For instance, Neo will stop and adjust if it encounters unexpected objects or people.

The unit also alerts the housekeeping staff when it approaches sensitive objects such as museum pieces on display at the airport. Personnel then switch it to manual mode to clean floors in that area.

Because the machine has optical sensors and cameras to "see," it can

clean around passengers' luggage. In the future, Neo may even be programmed to alert security about unattended baggage.

Cobb, notes that CVG's robot floor scrubber is especially valuable during the coronavirus pandemic because it shows travelers that the airport cleans and sanitizes throughout the day—not just at night.

Neo also cleans floors in a minimally intrusive manner and frees up housekeeping staff to devote more time to other cleaning and sanitizing duties, adds Jeff Schrantz, vice president of global sales for Avidbots.

Currently, CVG has one Neo machine in operation, which it purchased with capital funds rather than operating revenue. The airport is considering leasing a second unit when passenger traffic, and the associated grime, pick up.

Product: gita, a personal cargo-carrying robot
Company: Piaggio Fast Forward
Hometown: Boston
Status at CVG: Ongoing pilot

Late last fall, CVG began a 12-week trial of gita (pronounced JEE'-tah), a personal robot that carries luggage and other items up to 40 pounds. One reviewer described the 2-foot-tall machine as a "cargo-carrying droid."

While CVG is the first airport to test the product, individual owners and planned communities in the U.S. and Europe are already using gita to carry groceries, shopping bags and other parcels. Piaggio Fast Forward sells gita online directly to consumers for $3,250.

Greg Lynn, the company's chief executive officer, explains that gita uses optical scanners to pair with and follow its operator. "It understands who it is to follow and never takes its sensors off the person as it is following them," he relates. "Our core business is to understand the pedestrian environment. It is not like an industrial robot that you have to map everything [for]."

During CVG's proof-of-concept pilot, staff had the personal robot carry materials for meetings around the concourse so travelers could see it in action; and response was enthusiastic. In fact, 90% of airport guests who were surveyed said they would use gita and wished it were already in service.

Before the COVID-19 pandemic, CVG reached out to at least five robot companies seeking a pilot program at the airport. "We see this as a growth strategy," Cobb explains, adding that he was surprised how quickly Piaggio Fast Forward arranged an onsite trial.

"We have had a lot of requests from other airports to have gita run things to the planes or work behind the scenes… but they were not a good fit," Lynn comments. "CVG was the first airport with a vision of helping people to be more efficient rather than replacing people."

Cobb foresees two possible roles for gita at CVG: helping passengers with their carry-on items between the TSA checkpoint and gate area; and picking up food orders from concessionaires and delivering them to passengers already at the gates.

Toward that end, Lynn notes that gita was designed so a large suitcase can stand on end in its cargo area.

Cobb envisions the fee for luggage transport at $10 to $15 for a 30-minute block of time. CVG could also add a surcharge for food deliveries by gita, much as street side restaurants add a fee for Door Dash or Uber Eats delivery.

Likely customers would be aging travelers and parents with small children. "If it works with these demographics, then it can be used by any," says Cobb.

Piaggio Fast Forward designs and builds gita in Boston, but the firm is affiliated with the Italian manufacturer of Vespa scooters.

ThorDrive

Product: Autonomous baggage tug
Company: ThorDrive
Hometown: Cincinnati
Status at CVG: Ongoing pilot

For about a year, ThorDrive has been mapping the airfield and service area around Concourse A to program its autonomous baggage tractor for subsequent use. In December, the company unveiled its proof-of-concept vehicle, a Wollard International tractor augmented with multiple sensors and other tech-forward components.


EDWARD SHELTON

"We have developed the technology to a point with a backup safety operator that we are now ready to operate it in a fully autonomous mode," reports Edward Shelton, ThorDrive's vice president of business development.

For CVG, this means the tractor is ready to pull baggage and cargo into the baggage make-up area of Concourse A. Shelton explains that in addition to reducing the staff needed for ground crews, the autonomous vehicle will enhance safety because "the computer always does as it is programmed and does not cut corners when in a hurry."

Originally a South Korean firm, ThorDrive has been developing its autonomous drive technology more than 15 years. Instead of building vehicles from scratch, it retrofits existing vehicles with its technology.

"CVG has been very excited and supportive of new airport technologies, our development and our path to commercialization," Shelton says.

Late last year, ThorDrive was preparing to seek a new round of investors in hopes of beginning commercial sales by the end of 2021.

If all goes well, Cobb envisions an autonomous ThorDrive vehicle shuttling customers between the parking lots and terminals as well as moving luggage and cargo carts.

Service: At-Airport Personal Assistance
Company: SkySquad
Hometown: Washington, D.C.
Status at CVG: Launching soon

With agreements already signed, CVG plans to begin offering SkySquad's web-booked concierge service early this year.

The company hires independent contractors to provide general airport assistance—everything from greeting passengers at the curb and escorting them through security checkpoints to picking up food orders and keeping an eye on carry-on items while they are in the restroom. As the SkySquad website puts it, onsite assistants "provide the extra set of hands that you have always wished you had at the airport." As such, families with young children, seniors and pet owners are key customers.

Pricing varies according to services requested (surcharges apply for more than five bags, meeting at rental car return, etc.). The family fee is $99 for two hours of service.

At CVG, the company anticipates hiring 20 off-duty, badged airport employees to ensure that its service will always be available. Customers must make reservations at least 24 hours in advance on SkySquad's website.

The airport learned about the concierge service from a former executive at CLEAR who now serves as an advisor for SkySquad.

Interestingly, COVID-19 may end up having a mixed effect on the company. On one hand, the service was just getting started when the pandemic hit and slowed demand to just a few clients per week. But SkySquad founder and Chief Executive Officer Julie Melnick also sees an upside: "With the pandemic, all airports and airlines are looking for ways to give confidence to their travelers. SkySquad does that.

"CVG is known for their innovations, and we were drawn to that," she adds. "We are excited to roll out in an airport that is very supportive of our program."

The company currently operates at Washington Dulles International Airport (IAD) and Washington Reagan National Airport (DCA). SkySquad operations began at IAD in December 2019.

DeWitt Spain Airport Applies Sealcoat to Preserve New Runway Asphalt

BY JENNIFER BRADLEY

FACTS&FIGURES

Project: Runway Rehab

Location: General DeWitt Spain Airport (Memphis, TN)

Runway: 17-35

Length: 3,799 ft.

Primary Elements: Resurfacing, sealcoating & grooving

Cost: $1.48 million

Funding: 86% from the state; 9% FAA Non Primary Entitlement grant; 5% general airport revenue

Timeline: Design in 2017/18; construction July-Oct. 2020

Project Designer: Power Hills Design LLC

Design Subcontractor: Neel-Schaffer

Program Manager: Parsons

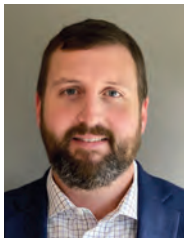
Prime Construction Contractor: VuCon LLC

Grooving Subcontractor: Cardinal/ International Grooving & Grinding

P-608 Sealcoat Supplier: Asphalt Systems Inc.

Sealcoat Application: Vance Brothers

A recent runway resurfacing project at General DeWitt Spain Airport (M01) is proving that sealcoats are not just for maintenance anymore. The general aviation airport, located minutes from downtown Memphis, TN, opted to apply a protective sealcoat over brand new asphalt to help preserve the Airport Authority's investment and increase the life of its new pavement.



BRIAN TENKHOFF

When engineers began planning the $1.48 million rehab, no one expected it to be a leading-edge project. Brian Tenkhoff, manager of Engineering and Construction for the Memphis-Shelby County Airport Authority, explains that typical factors—aging pavement and a maxed-out surface life—prompted the need to rehab the airport's sole runway. But a relatively new trend—applying a P608 sealcoat over the freshly laid asphalt—placed the small airport squarely on trend and is providing a valuable test case for its big sister, Memphis International.

Tenkhoff describes General DeWitt Spain as a very busy airport with a prominent flight school and about 100 based aircraft, including a few jets. Typically, the single-runway facility logs about 57,000 operations per year.

In 2015, the Pavement Condition Index for Runway 17-35 was 68, signaling the need for more service to keep it in shape. There were no major failures, explains Tenkhoff, but the surface was nearing the end of its useful life.

The project team prescribed a relatively standard mill-and-overlay approach, taking 2 inches of asphalt off the top, and then adding 3 inches of new asphalt to create a fresh surface and address minor pavement grade issues. That's where engineers took the process one step further and specified a protective sealcoat, a practice recently approved by the FAA and Department of Defense as a viable option to preserve all airfield pavements.

Crews sealcoated DeWitt Spain's 3,799-foot runway in three days, and the resurfaced runway reopened for traffic in October 2020.

One Thing Leads to Another

The airport added grooves to the runway, per a recommendation from the Tennessee Department of Transportation. Grooves facilitate forced water escape when aircraft roll over the pavement surface by providing increased contact between aircraft tires and the pavement surface for better braking and directional control during rainy and icy conditions. Although a grooved runway is an unusual feature for a general aviation airport, it is especially beneficial for the King Airs and Learjet 35s that regularly use DeWitt Spain. Tenkhoff notes that receiving an attractive price for the grooving procedure helped the Airport Authority decide to include it in the work scope.

Engineers specified a P608 sealcoat to slow oxidation, aging and everyday wear and tear on the grooved pavement. Crews applied a quick-cure product from Asphalt Systems Inc. to the pavement before the final markings were applied—and before a single airplane touched down on the new surface.

"It isn't common," Tenkhoff remarks. "But in our designers' past experience, they were seeing that laying a sealcoat in the early phases of the pavement was providing a significant increase in its life."

GREGORY CLINE

Gregory Cline, P.E., a civil engineer and former pavements expert for the FAA and Department of Defense, completely agrees. After beginning his career studying surface treatments in the early 1980s, Cline spent nearly 40 years focusing on airfield pavement before retiring in 2019 as the FAA subject matter expert on the topic.

"Up until 2011, surface treatments were not allowed on airfield pavements," Cline reflects.

Naturally, DeWitt Spain had full support from all governing bodies before applying a protective sealcoat during its recent project. Thomas Henderson, P.E., engineer manager/vice president with Neel-Schaffer, notes that test patches helped the project team understand how the product would work, look and feel before applying it to the entire runway. He says it was important to monitor timing and other details during the application process to help guide future runway projects.

With the project complete, the designer and airport plan to carefully monitor how the sealcoat performs. "Ultimately, this will determine if our other airports apply this as well," says Tenkhoff.

Gaining Traction

JOE LARUSSO

Joe LaRusso, technical director for Asphalt Systems Inc., estimates that 60% of the total lifespan of asphalt degrades within the first couple years, and the remaining 40% expires over the next 18 years. Cline, who concurs with LaRusso's lifespan estimates, notes that asphalt pavement doesn't necessarily look bad in its first two years, in fact the pavement condition index typically remains close to 100. But oxidation attacks the asphalt binder causing it to break down, and ultraviolet rays from the sun cause further breakdown of the asphalt with virtually no appearance of distress or loss of life for the first couple years. The damage that has been caused, however, cannot be reversed and results in the estimated 60% loss of life. Throughout the lifespan, 70% to 90% of asphalt airfield pavement deterioration and failure are the result of exposure to the environment and degradation of the asphalt (oxidation).

"Roads don't have numbers like this," Cline comments, adding that roadway pavements cannot be compared in any way to their airport counterparts, where designs of asphalt surfaces have to withstand much heavier wheel loads and non-channelized traffic resulting with a pavement surface more susceptible to environmental degradation.

JOHN HUNTER

Cline and LaRusso both agree that preserving pavement life up front during the original installation is a huge gain.

"The FAA and DoD realize this now, too," says John Hunter, aviation lead with Asphalt Systems Inc. "It's a cost savings for the airport to do this sealcoat right at construction and not wait four or five years

when the environmental factors have already taken their toll on the pavement."

Cline identifies three key turning points for sealcoats on runways:

- In 2011, Naval Facilities Engineering Command released an evaluation that provided the support to allow P608 type sealcoating on all airfield pavements
- In 2014, FAA created and published specifications for P608
- In 2018, FAA included a second product called P608-R (which, unlike the original, is not water-based) in Advisory Circular 150/5370-10H

He notes that the product has been allowed for use on *new* pavement since 2014, but the practice was not promoted because there wasn't enough information to ensure that friction loss would not be a problem. The note in the 2018 advisory circular, however, prompted more engineers and airports to consider using it.

Cline further explains that once regulators understood the preventive nature of sealcoats, funding approvals eventually followed. Previously, the product had only been considered and funded for maintenance purposes. "We did review a lot of pavements that already had this—smaller ones and a couple that had been approved locally," he recalls. "The airports avoided the FAA for funding and were paying for the sealcoat themselves. We had a lot of data."

By the mid-2000s, nearly 200 airports had applied sealcoats in several locations (taxiways, runways, airstrips) during self-funded projects, adds Cline. Oregon and Utah were two of five states that amassed data about how various sealcoat products helped preserve pavement.

LaRusso notes that the information states collected has proved useful as the FAA moves toward a 40-year hot mix, in an effort to extend pavement life even longer. "They believe that it's possible, and it is—*if* airports start a pavement preservation program immediately at construction," he specifies.

Cline agrees. "We had a goal to increase pavement life (technically and for funding purposes) to 40 years through maintenance, different materials, etc. And that program continues with ongoing research by both FAA and DoD, agencies' policy and technical changes, and product improvement and development, which is what you see with ASI's [Asphalt System Inc.'s] P608 product."

Memphis Moves Ahead

As a single-runway airport, DeWitt Spain had to close briefly to facilitate its pavement rehab: eight days for mill-and-overlay work, four days for grooving, three days for sealcoating and three days for markings.

"No one ever likes to shut down their airport for nearly two weeks," says Tenkhoff, noting that traffic was directed to Charles W. Baker Airport, a nearby general aviation airport also owned and operated by Memphis-Shelby County Airport Authority.

Because the project included a sealcoat, markings were more of a logistical issue than usual. "You have to put a percentage of paint down so you can open up the runway, then turn around, close it and sealcoat it," he explains. "Then, you can put sealcoat around the markings or cover them up and put full markings on top of the coating."

Crews at DeWitt Spain chose to spray the coating on most of the runway and brush it by hand around markings to avoid having to repaint them. Hunter notes that this involved some back and forth, but ultimately worked out in the end.

Cline explains that a P608 sealcoat don't "soften" asphalt as other seals tend to do, but actually creates a hardened binding surface that provides protection from the environment and keeps the essential asphalt properties in the pavement—which is opposite of untreated asphalt. "People like me are finally backing off the old way of thinking," he reflects. "The early use of sealcoats are okay as long as you know what you're doing."

Hunter credits the state of Tennessee for its forward-thinking attitude toward new pavement strategies. "This project really became about prevention, not maintenance," he observes. "It was well-organized and thought out—the construction seal was an intentional effort to extend the service life and protect their new investment."

And it's *much* cheaper than subsequent maintenance, stresses Cline. Nodding in agreement, Tenkhoff notes that he looks forward to monitoring the sealcoat's performance and possibly applying lessons learned at DeWitt Spain to other pavements owned and operated by the Memphis-Shelby County Airport Authority.

"We were fortunate the project went well," he concludes. "Over time, the top layer of asphalt dries out, and this sealcoat will protect the pavement. We are happy to be a part of this next-generation type of innovation for airports around the nation."

Virtual Ramp Control System in the Works at Orlando Int'l

BY KEN WYSOCKY

FACTS&FIGURES

Project: Virtual Ramp Control System

Location: Orlando (FL) Int'l Airport

2019 Passenger Volume: 50.6 million

Approx. Cost: $7 million

Funding: General airport revenue

Slated for Activation: Early 2022

Engineering Consultants: Burns Engineering; Barich Inc.; GCI Consultants LLC

System Design & Installation: Saab Sensis

Cameras: Bosch

Multilateration Sensors: Saab Sensis

Anticipated Benefits: Eliminating line-of-sight issues; enhancing safety & efficiency of busy ramp; improving aircraft & passenger flow; decreasing fuel burn associated with gate delays; facilitating future ramp expansion; supporting common-use gate policy

When Orlando International Airport (MCO) opens its new South Terminal Complex in early 2022, the facility's gleaming glass façade, airy environs and high-tech features will no doubt impress passengers. But largely invisible technology will also be working on the tarmac to enhance their experience: a virtual ramp control system designed to minimize gate delays.

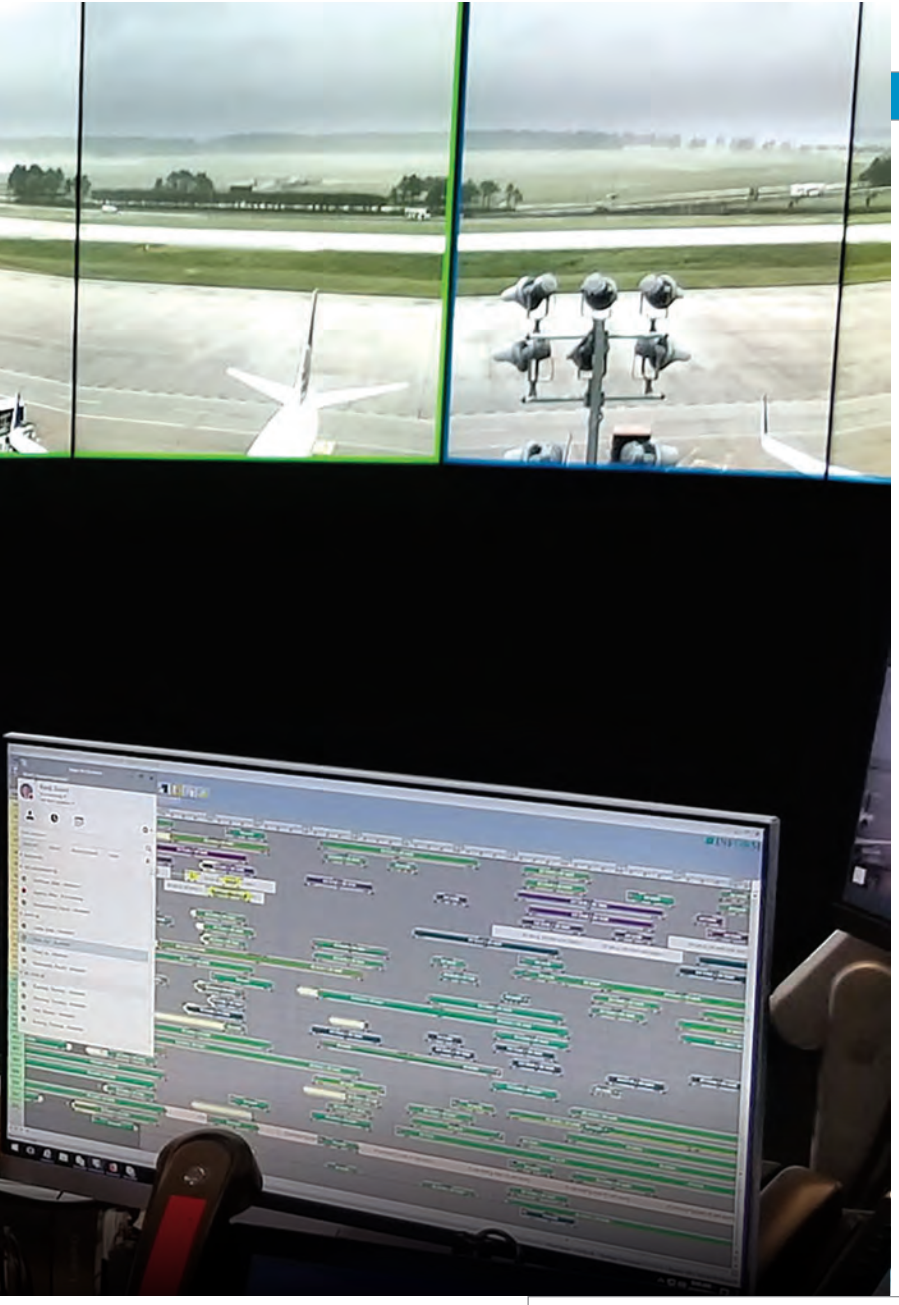
The $7 million system, believed to be the first for a U.S. Category X airport, was engineered to improve ramp safety and efficiency in the near-term and into the future, when the South Terminal Complex eventually has 27 gates. Currently, the Florida airport is in the midst of a $2.7 billion capital improvement program that will allow it to handle an additional 12 million annual passengers decades from now.

"The biggest benefit of virtual ramp control is that we'll control the aircraft coming in and out of the gates, as opposed to the airline carriers scheduling the gates," explains Bob DeBaere, assistant director of airport operations. "The intent is to have the South Terminal 100% common use, where no airlines will lease or operate gates."


BOB DEBAERE

The rest of MCO will maintain both preferential and priority use, creating a hybrid system at one of the country's busiest and fastest-growing airports.

The cutting-edge ramp technology will complement high-tech features inside its new terminal, such as facial recognition software at security checkpoints for international flights, a high-speed baggage system and large-scale interactive media.



spend taxiing, avoiding trips to wrong gates and eliminating the wait-time that occurs when a flight that is assumed to have departed is still at a gate.

"With this system, airplanes will only get sent to a gate the airport knows is open," Meier explains. "Ultimately, people will get out of planes and out of the airport faster. No one likes to sit in a plane, wondering what's going on. So anything that makes the process more efficient is good."

Tower Quandary

Officials at MCO began considering virtual ramp control technology in 2018 because of line-of-sight issues that emerged regarding a proposed ramp tower for the new terminal. Ramp controllers would only be able to see planes up to the point where they entered the ramp area, DeBaere explains.

"There was a blind spot that the FAA said we had to address," he says. "So we put out industry feelers to find out what kind of technology was out there that might eliminate the need for a tower."

Barich Inc. and GCI Consultants helped airport officials select a virtual ramp control system by Saab Sensis.

In a nutshell, the system uses a mix of cameras, radar and sensors to provide an unobstructed view of planes either at the gates or arriving from/departing for runways. (The first phase of the South Terminal project will include 15 gates with 19 aircraft parking spaces.) Live footage from the ramp and gate

MATTHEW MEIER

"Passengers should expect a more efficient process when airplanes land and go to this new terminal, and that's what they'll get," says Matthew Meier, aviation special projects lead at Burns Engineering, one of the design consultants on the virtual ramp control project. "Getting the right plane to the right spot at the right time should be a much easier process."

The system also supports FAA efforts to reduce fuel consumption. The strategy is to help airlines burn less fuel by reducing the time planes

areas is displayed on an expansive video wall with several large, high-resolution monitors arranged in a grid pattern.

"Think of it as a digital virtual window—a bunch of displays stitched together," Meier says. "In this case, it's about six displays wide and two displays high, with an extra one at each end. Together, the displays provide one seamless image."

Cameras & Sensors

The system designed for MCO includes 15 high-resolution infrared cameras from Bosch strategically placed to provide better sightlines and broader views than a fixed tower. Dozens of other cameras, also made by Bosch, will provide additional views of loading docks and other areas.

"Each camera offers limited views, so you have to fan out multiple cameras across the ramp," Meier explains.

Additionally, the system employs 31 multilateration sensors from Saab Sensis to pick up signals from airplane transponders for another layer of location-detection capability. Sensors can also be attached to tugs to help controllers monitor their locations, adds Meier.

Data sent by the multilateration sensors allows controllers to "see" the real-time location of aircraft on the ramp and at gates via individual desktop monitors. The monitors provide an overhead view that mimics the view from a conventional ramp tower.

"Taking data from multiple sources allows controllers to get aircraft to the right gate at the right time," Meier says. "They can track very precisely the location of aircraft on the ground—not only through the 'window' view, but on a plan view (from an overhead perspective) of all the different gates."

Scalability is another advantage of virtual ramp control technology. For example, as MCO expands its terminal and adds ramps in the years ahead, it can simply add more cameras, sensors and video monitors. Investing in a technology platform instead of building more brick-and-mortar towers costs less and conserves valuable airfield land, Meier notes.

Furthermore, because ramp controllers aren't isolated in towers, they can interact more easily with supervisors and other staff. At MCO, the ramp controllers' area is located

right next to the airport operations center, which facilitates communication.

Is It a Fit?

When deployed, MCO's new virtual ramp control system will enable it to operate the South Terminal as a common-use facility. This provides more flexibility to efficiently park planes where space is available, as opposed to directing plans to gates according to airline lease agreements.

Beyond the tactical advantages, common-use systems can also help level the playing field for airlines regarding gate access.

"When carriers have leased areas, the airlines will do 'land grabs'…when gates become available, one airline will try to grab them so no one else can have them," DeBaere explains. "But with common use, that's not possible. Everyone has equal opportunities for expansion."

Meier agrees that virtual ramp control systems dovetail well with common-use policies. "It makes for highly flexible operations because gates aren't tied to whoever leases and operates them," he remarks.

Although the various technologies used for MCO's new system have been around for a while, combining them for virtual ramp control is a relatively new concept, Meier says. Fort Lauderdale-Hollywood International Airport started using a similar system in 2017, and various airports in the United Kingdom, Australia, Norway and Ireland also currently use the technology.

"It's going to become more and more common," Meier predicts. "The cost is lower than a traditional ramp tower, and it's easier to staff and expand."

He notes that virtual ramp control technology is a great fit for MCO because it operates its own ramps. "They're also technically fluent and used to looking at technology to solve problems," he adds.

When it comes to implementing such technology, DeBaere advises other airports to find industry experts that can walk them through various system options. "That's definitely No. 1," he says. "And No. 2, of course, is understanding your own facility and its unique requirements."

New Concourse at Nashville Int'l Updates City's Front Door, Facilitates More Expansion & Renovations

BY JODI RICHARDS

BNA Nashville International Airport

FACTS&FIGURES

Project: New Concourse & Wing Expansions

Location: Nashville Int'l Airport

Owner: Metropolitan Nashville Airport Authority

Cost: $292 million

Funding: Bonds

Construction: June 2018-July 2020

Design Architect: Corgan

Design-Build Team: Hensel Phelps & Fentress Architects

Architecture Support: Jenny Mac Creative; TPD Consulting

Cost Estimator: Cape

Civil Engineer/Landscape Designer: S&ME

Geotechnical: Langan; Terracon; KS Ware & Associates Inc.

Structural Engineer: Logan Petri Engineering; Magnusson Klemencie Associates

Mechanical/Electrical/Plumbing Engineer: IC Thomasson Associates Inc.; DFH Services

Fire/Life Safety: Wiss, Janney, Elstner Associates Inc.

Commissioning Agent: Smith Seckman Reid Inc.

Technology/Integration: EJO Ventures

Technology: Burns Engineering; Win Engineering; Johnson Controls

Signage & Graphics: Jones Worley

Common-Use Equipment: Amadeus

Boarding Pass/Bag Tag Printers & Cardstock: VidTroniX

Operational Database & Resource Management System: Amadeus

Dynamic Glass: SageGlass

Seating With Power Ports: Zoeftig

The new Concourse D at Nashville International Airport (BNA®) didn't just add gate capacity and new customer amenities. It is also facilitating future expansion to help the Tennessee airport cope with years of explosive growth in passenger volume. Operations from elsewhere at BNA have moved into the new concourse to allow remodeling and construction of other areas.

The 115,000-square-foot concourse, opened last summer, includes six domestic aircraft gates occupied by Southwest Airlines, several art displays and upgrades requested by customers, such as more power outlets. The $292 million, 25-month construction project also expanded BNA's ticketing lobby and baggage claim by adding 200,000 square feet of space to the north and south ends of the terminal. Moreover, crews remodeled 136,000 square feet of existing terminal space and built an 11,000-square-foot central utility plant.

Concourse D is an important component of BNA Vision, a $1.4 billion capital improvement program slated to wrap up in 2023. Other key elements will include three terminal garages with a total of 6,800 covered parking spaces, additional space for ticketing and baggage claim, renovations in the terminal lobby, an expanded security checkpoint, a new international arrivals facility, additional concessions space, an airport administration building, pedestrian plaza, hotel and a potential transit connection.

Doug Kreulen, president and chief executive officer of the Metropolitan Nashville Airport Authority, explains that multiple years

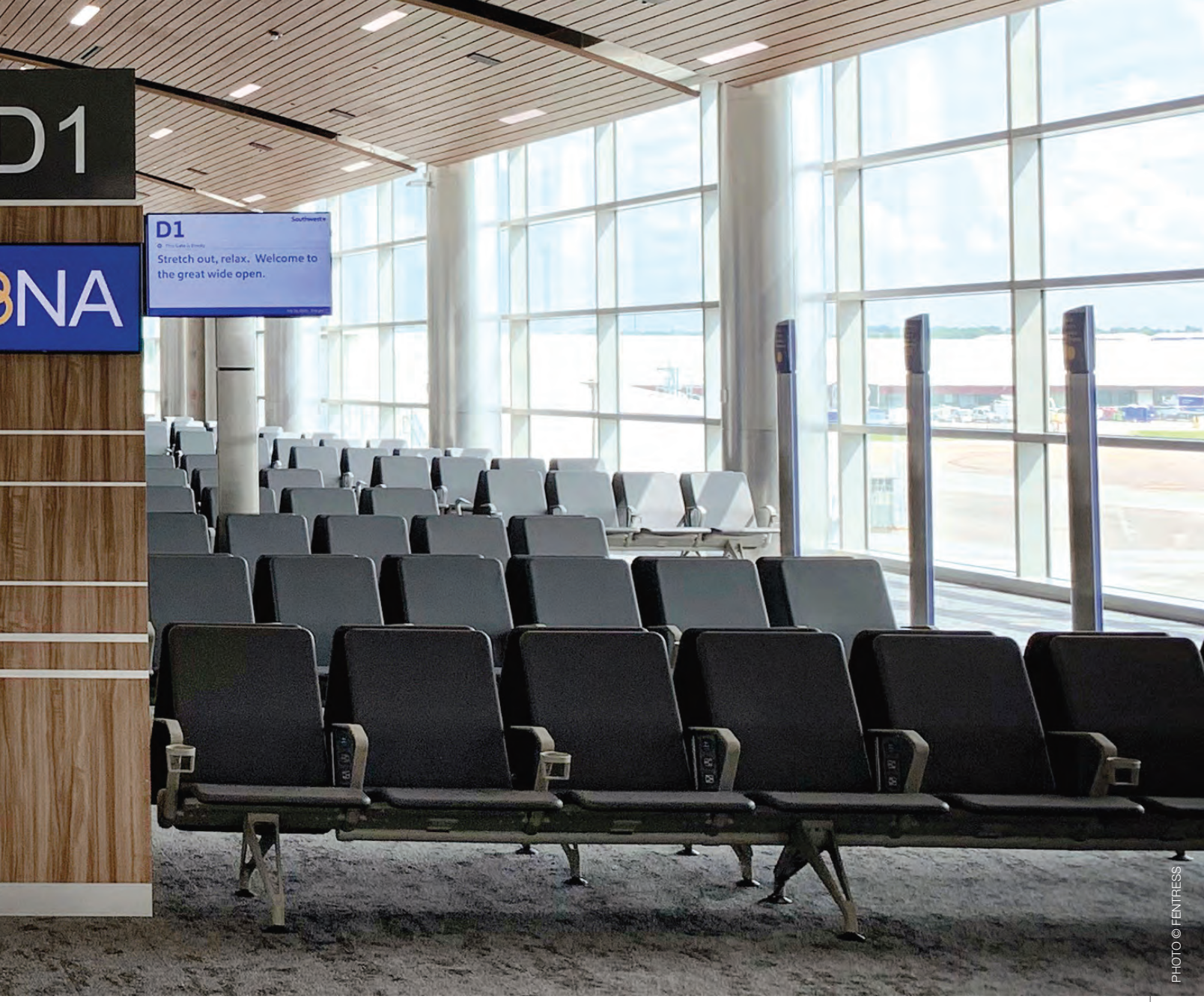


PHOTO © FENTRESS

of double-digit growth caused BNA officials to assess the current and future needs of the airport. In 2015, the airport signed a new airline agreement and "things were accelerating so fast with year-over-year growth that we knew we had to develop a longer plan, a better plan, for how to handle this growth," he recalls.


DOUG KREULEN

While many 20-year airport master plans assume 3% annual growth, BNA was easily tripling that in consecutive single years. "You realize you can't keep up," Kreulen reflects. "That's how the BNA Vision was formulated."

In 2019, the airport served nearly 18.3 million passengers.

Preparing for Growth

The biggest planning challenge was determining what the airport would need to meet the growth, explains Kreulen. The six-year, $1.4 billion plan that was developed includes everything from additional gates, parking and concessions to expanding the road network to help passengers get to and from the airport. Overall, the capital improvement program is designed to increase BNA's annual capacity from 18 million to 36 million passengers.

As with any major undertaking, preparation and careful planning were critical. "It was a big puzzle for us the first three years," Kreulen recalls. "Like Legos or Lincoln Logs, you have to figure out how to move stuff out of the way before you can get to where you really want to work." For BNA, that meant beginning work on the North and South Terminal Wings, including Concourse D, so flight operations can relocate there while crews work on the center of the airport. The middle section of the airport closed in January for approximately three years for additional renovations and construction. Crews will expand the TSA checkpoint from 10 lanes to 24, extend the post-security recollection area and add new retail and concessions. New retail and food/beverage options will be added to the area leading to the international gates for the convenience and benefit of international passengers—a customer segment that may be growing soon. "We want our international customers to land at the front door of the airport so that they're downtown within 30 minutes," adds Kreulen.

When travelers pass beneath the light sculpture "Lyrical Journeys", strands of LEDs brighten and dim, as if passengers are strumming the strings of a guitar or piano.

Supporting the growth of Southwest Airlines at BNA was paramount to the entire project, he advises. "Southwest has a large portion of Concourse C, and in order to encourage them to continue to grow in Nashville, we wanted to provide them with additional gates so that they could continue to keep making their quick turn-times and maximize the use of their facilities and their aircraft."

Thus, Concourse D is large enough to allow for simultaneous pushbacks by 737s from all six gates without adversely impacting Concourse C operations. "It turned out to be a win-win," says Kreulen.

A New Front Door

Once it was clear that BNA's dominant carrier would be satisfied with the new facility, the priority became outfitting the concourse to reflect the feel of middle Tennessee. "We wanted it to be warm and welcoming—so people are excited when they land, but are also wanting to come back when they depart," Kreulen explains.


CURT FENTRESS

That task fell to the Hensel Phelps and Fentress, the design/build team for Concourse D and the terminal wings project.

Curt Fentress, principal in charge of design at Fentress Architects, notes that airport officials wanted a new front door for Nashville that reflects the city's sights, sounds, tastes—everything that makes it a great music city. "I think it's an important aspect of an airport today that it is exciting and memorable and relates to the place," says Fentress.

To that end, designers specified taller wood ceilings to give the new space an open, airy and natural feel. Floor-to-ceiling glass floods the concourse with natural light and allows full views of the airfield. "There's a lot of wood used in the finishes," he remarks. "And the way the building opens up provides a lot of views to the airfield so you can sense the excitement of travel."

A strong art program also contributes to the visual appeal, Kreulen adds. "It's calming and adds a lot of beauty to the airport."

Suspended over the node of Concourse D, *Lyrical Journeys* is a 90-foot-long interactive light sculpture that pays homage to the sights and sounds of Nashville. It includes 14 pairs of steel bridge plates and 20 liner strings of LED lights that brighten and darken in rapid succession as passengers walk beneath the sculpture, creating the impression that they are strumming the light strands as if they were a piano or guitar. "It's really beautiful," says Kreulen.

At the south end of the new concourse, a large vinyl record mosaic called *Every New Day is the Best Day of Our Lives* represents the history of music in Nashville. The photorealistic neon

The new concourse includes six domestic gates, all used by Southwest.

piece includes colors similar to Southwest's familiar corporate palette. "It's a vibrant, exciting piece to be seen," says Fentress.

Art cases between the new concession spaces display work from BNA's $1.5 million collection that rotates throughout the airport.

The design team combined artwork, live music and wood finish materials to evoke the feeling of Tennessee. "We warmed up the aesthetic and made it much more interesting," says Fentress.

New amenities include free Wi-Fi, more power outlets for charging personal electronics, updated terrazzo flooring, an indoor service animal relief area, a nursing room for mothers and bottle refilling stations at every water fountain—upgrades requested by passengers, Kreulen notes.

These elements help make the facility feel more pleasant and friendly, adds Fentress. "It's not so utilitarian as airports have been in the past."

The new concourse has space for nine concession operators, but only one was filled as of mid-December. "We were turning over all that new space to the concessionaires, and then the pandemic hit," Kreulen recalls. "They had 120 days to build out, and the bottom line was that everybody locked down, had to wear masks, nobody could come to work. Basically, they lost all of their construction loans and were worried about their overall financial health; so nobody took any risks."

While Concourse D does have concession kiosks in place, Kreulen laments the lost opportunity associated with not having full build-outs. As passengers traffic returns, BNA expects to amend its concessions agreements and move forward bringing in operators. Currently, the space is blocked off with sheetrock covered with graphics and renderings. "It's coming," Kreulen says. "I think the same time next year it will all be full."

Benefits of Sustainability

Concourse D achieved Silver certification through the Leadership in Energy and Environmental Design (LEED) program. Sustainable components include recycling receptacles, energy-efficient lighting, water conservation systems, electrochromic glass

to block out excessive sunlight and heat, geothermal cooling and an emphasis on using regional labor.

Kreulen notes that the LEED elements are cost-effective as well as environmental—and containing costs recently became even more important than usual. “We were doing something that we would be proud of but that would also save us money in the long run,” he explains. “And now the pandemic comes and everybody is trying to figure out ways to cut costs.”

Several major systems make the concourse “energy-efficient beyond belief,” he adds. For instance, as natural sunlight intensifies during the day, dynamic glass from SageGlass dims automatically to reduce glare and minimize the amount of air conditioning needed to keep the temperature comfortable. Cool 51-degree water from a local quarry is piped in under one of the runways for a geothermal cooling system that saves the airport millions of dollars annually.

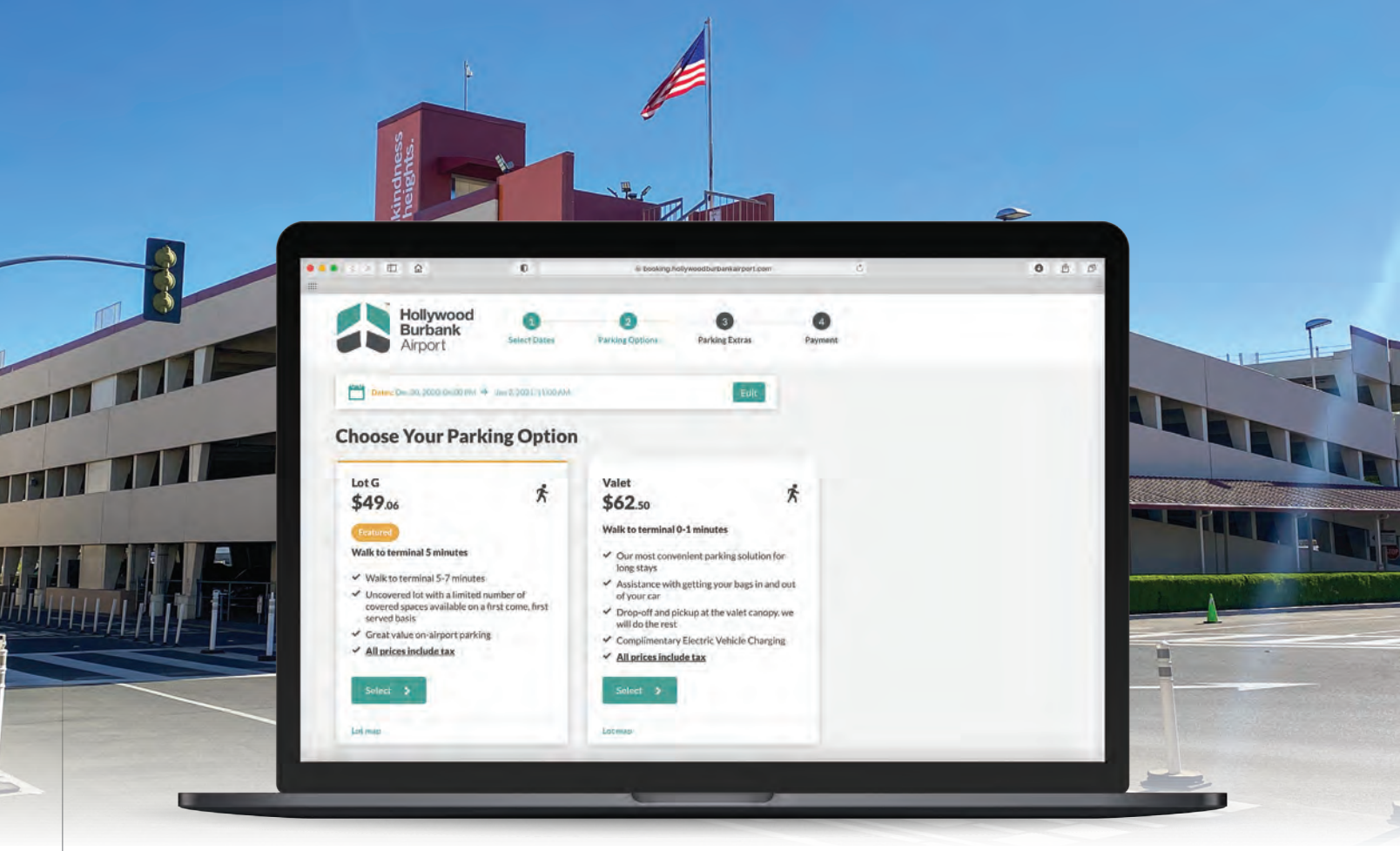
Project Partnership

Airport executives took particular care to assure Southwest that the Concourse D project would not impact BNA’s existing airline agreements. “Once we understood what their needs were and designed this, we always included their executive team in the decisions we were making,” says Kreulen. “But also we proved to them that we would not have to raise our fees. We honored our commitment, stayed on schedule, stayed on budget, and we haven’t passed the burden onto the airlines. And that’s something to be proud of.”

The airport successfully sold $920 million in bonds in December 2019, allowing funding for the project to be firmly in place prior to the pandemic. Although Southwest is the sole airline tenant in Concourse D, all of the airport’s key tenants and business partners are playing vital roles in the technical advisory group for BNA Vision.

The airport’s partnership with its tenants was, and will continue to be, crucial—especially during construction. Common-use passenger processing equipment from Amadeus has allowed BNA to reshuffle airlines to clear the way for work crews. It also partnered with Amadeus to implement an Airport Operational Database and Resource Management System to plan, schedule and allocate airport resources.

Zoeftig seating helped the airport achieve its goal of adding more power outlets for passengers.



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BY KRISTIN V. SHAW

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In March 2020, BUR temporarily suspended its valet services as the global COVID-19 pandemic began to take center stage. A little more than three months later, curbside valet resumed with new safeguards in place: Team members were required to wear face masks and gloves when handling vehicles, and markers on the ground reminded customers to practice social distancing while waiting for their vehicles and paying parking fees. In addition, the airport encouraged passengers to pre-book and pay directly through its website to minimize physical interaction when they arrived and departed parking areas.

Tom Janowitz, senior manager of Ground Access, reports that valet service has accounted for fully 50% of BUR's parking revenue during this unusual time. Long-term Lot A, located less than a block north of the terminal, was closed when traffic declined sharply; and so was Lot C, a much-smaller lot one block east of the airport. They cost $10 and $12 per day, without pre-booking. The short-term parking structure directly in front of the terminal remained open, with space for about 400 vehicles. In order to preserve those spaces for drive-up customers, valet service was priced less than the short-term self-park option.


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The airport engaged SP+, which has managed BUR's parking lots and valet service since 2015, to help with the project. SP+, in turn, hired MAG USA as a subcontractor, tapping into the company's 15-year history of creating pre-book parking systems and growing revenue for airports in Europe, Australia, and North America. Together, the parking specialists created a system that allows BUR to leverage dynamic pricing, stop and start various promotions, and generally increase revenue. The system's ability to provide customers with a contactless option for entering and exiting car park facilities has become exponentially more valuable to BUR official of late.

Dynamic Pricing

Janowitz notes that the airport does not intervene with the complicated algorithms that provide the trading strategy, or pricing structure, for parking. It has the final say on the pricing, but MAG USA manages the algorithms and ever-changing data that establish pricing suggestions. Before BUR implemented the system, static prices for drive-up customers in lots A and C were $10 and $13 per day, respectively; valet service cost $24 per day; lots G and E were $23 and $24 per day; and the daily rate for the covered parking structure was $32.

Now, passengers booking online for a five-day stay in Lot G, which is also covered, typically pay around $12 per day, which is comparable to the previous rates for lots A and C. The algorithms consider how far in advance a customer books, and, much like flight pricing, parking reservations booked further out are often less expensive. Even valet service can be as low as $10 per day, which incentivizes passengers to choose it.


MARTIN JONES

"The physical experience at airports needed to come of age, and passengers needed more digital connection," says Martin Jones, chief executive officer of MAG USA.

The current system at BUR sells parking the same way services like Hotwire or Hotel Tonight sell hotel rooms, offering discounts for capacity that might otherwise go unused. In busier times, it helps the airport manage inventory and fill parking spots that might have remained empty. When all customers showing up were unanticipated, it was difficult for BUR to plan or adjust—and virtually impossible to stimulate demand as needed.

"Pre-booking allows the operator to have much greater certainty and allows them to operate more robustly," explains Jones. "If a customer shows up later than they had hoped because they got stuck in traffic or booked the wrong day, or they show up early, our training helps them manage the customer experience on the ground. That's a big part, too."

The system MAG USA developed provides customers with dynamic pricing driven by more than 3 million machine-learning algorithms and 3,000 predictive models. By reserving their parking in advance, customers can gain peace of mind, and sometimes a lower rate. For the airport, pricing can be changed quickly to reflect demand.

Jones notes that the vast majority of U.S. airports work on a price-per-day model, and passengers typically park for an average of two days. After two days, it becomes more advantageous for them to take a train or taxi. Dynamic pricing allows BUR to match a customer's per-day parking price to the length of his or her stay.

Renewed Interest in Parking & Touchless Tech

Jones reports that the pandemic is having an interesting effect on customer volume and behavior. A recent MAG USA survey of 20,000 customers shows that 11% of airline passengers who would typically travel to the airport by taxi, public transportation or app-based ride sharing vehicles currently prefer to drive there in their own vehicles and park.

"Now, people want to be in their own cars versus shared transportation," Jones explains. "We have received a lot of feedback that customers want a contactless experience. They don't want to stop at a pay point that is hard to keep clean and other people have been touching."

He explains that dynamic pricing allows travelers to realize volume discounts by pre-booking; and airports can collect more revenue because more customers will park. Recovering income from parking is crucial to the overall financial health of an airport, stresses Jones.

Janowitz notes that BUR took care not to cannibalize its established drive-up business. "In the past, we had a two-day average for parkers, and we knew we needed to collect the same amount of money for a two-day stay," he explains. "So if customers book online, they don't realize any savings for the first two days. But at three days and up, the savings start to kick in. The goal was to entice the longer-stay passengers. MAG USA looked at our numbers and told us that's where the growth potential was and the behavior they wanted to influence."

The strategy has worked marvelously, Janowitz reports. Now, the average stay for valet service booked online is five days.

The system also helps BUR's ongoing effort to convince passengers to park at the airport instead of arranging other transportation. Passengers will compare parking rates to the price of an Uber ride, and the airport could see an impact right away, Janowitz says.

Other Online Options

Looking ahead, Jones says that offering customers the option to pre-book a place in various airport lines—even at TSA checkpoints—is on the near horizon. Not surprisingly, passengers say they like the efficiency of that option.

"We have taken the concept of pre-book parking and added that to security queues," explains Jones. "It's only in the UK now, but we have the ability to do that in the U.S., too. Really what we're building is the ability to enable that entire customer journey digitally, including hotel, parking, security, pre-ordering duty free items, slots in the lounge, and so on. The vision was to allow customers to put any product for their journey in a basket online. It's kind of like Amazon, but at airports there are car parks, food and beverage options, vendor services; and it could all go in one cart to check out."

Today, reservations for parking, hotel and retail are usually fragmented. MAG USA is building a digital platform to put them all in one basket, and Jones says there is much more in the value chain.

"I think we will end up having much greater collaboration between airports and airlines, which will ensure that the passenger journey is fully joined up and aligned," he says. "I foresee many more partnerships and better experiences for customers as we start making this seamless."

In the meantime, MAG USA's algorithms help protect existing drive-up parking revenue

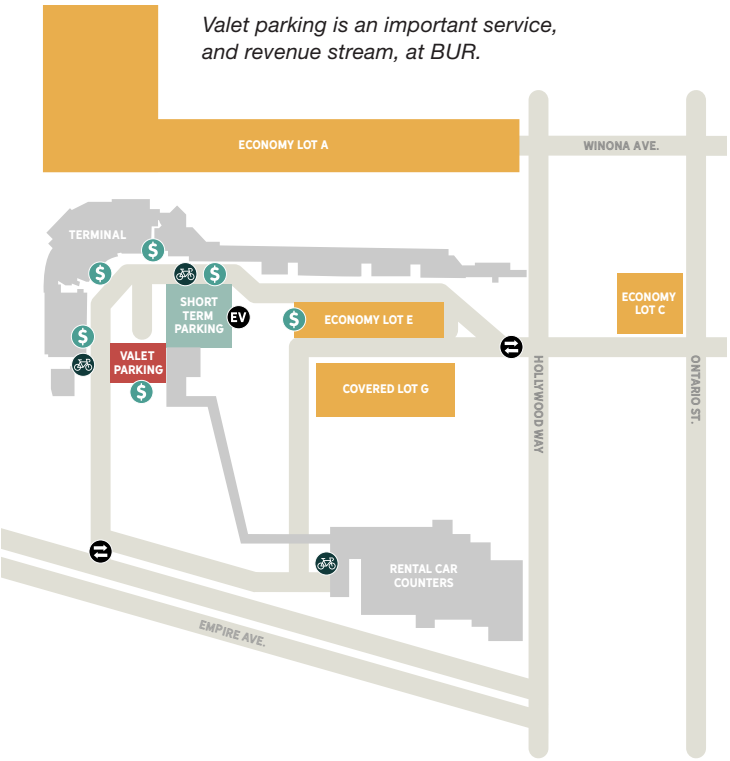
and allow BUR to maintain income from its premium parking options. Airports pay a lot of money to bring in buses and parking systems, and making parking more attractive to customers is much more efficient, Jones comments.

"Airports are traditionally a physical experience, and that's going to change," he predicts. "Customers will want to have greater certainty of when to show up, where to show up and how long they'll be waiting. I think that's an important part of the journey."

The online reservation system at BUR even has a provision that helps the airport secure revenue when customers cancel parking reservations. Passengers have the option to purchase cancellation protection for $1. Without cancellation protection, the system deducts a $7.50 administrative fee from their refund total. Bookings made less than 24 hours before arrival cannot be cancelled and are nonrefundable.

Janowitz hopes that business travel will rebound by next summer, but the airport is delaying any more upgrades to its parking system in the meantime.

"We always want to look in the crystal ball, and it's always a little foggy," he muses. "We're monitoring our activity, and MAG USA provides a huge data set. We are ready when the time comes to introduce the online product to our other lots."



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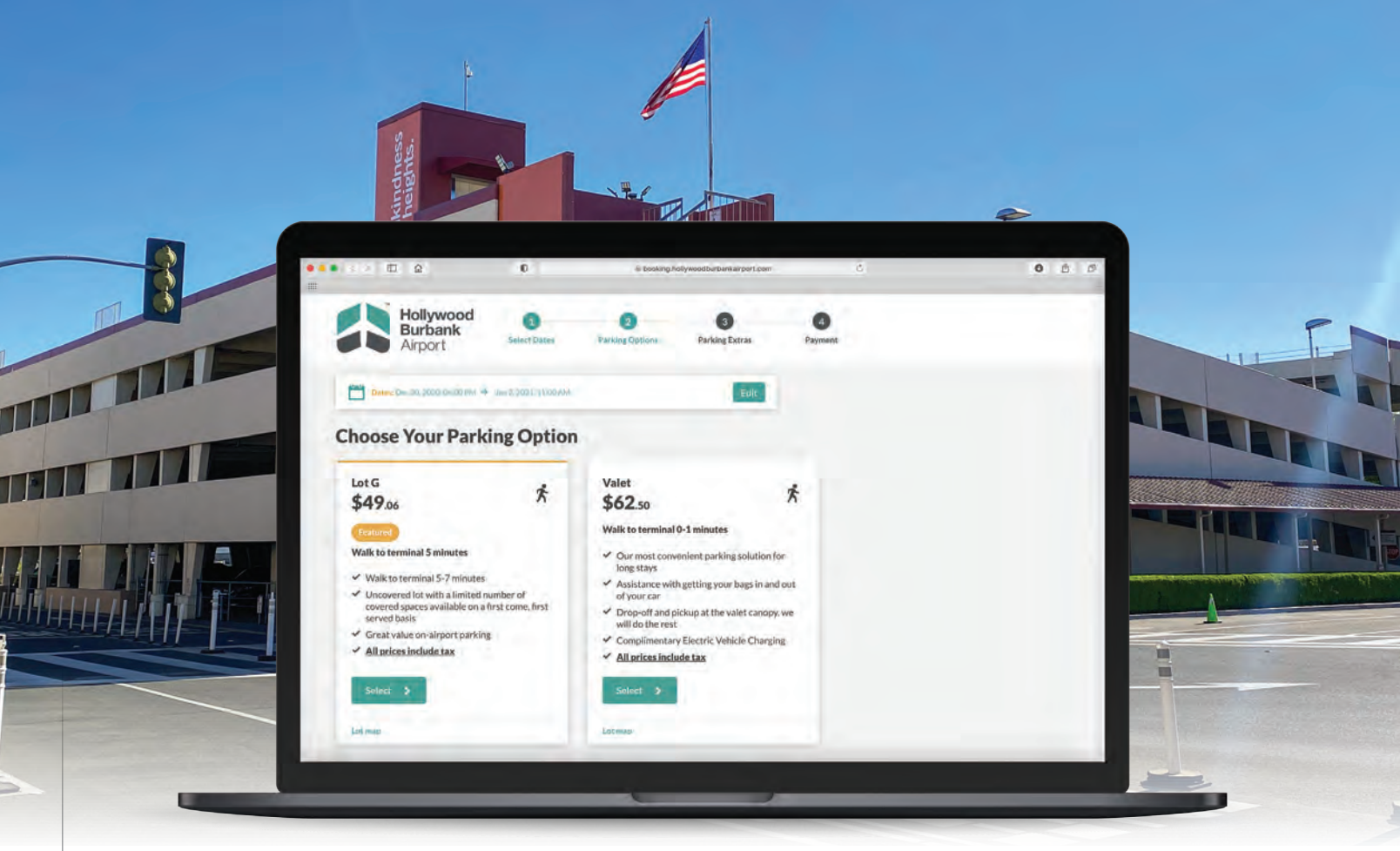

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Dynamic Pricing

Janowitz notes that the airport does not intervene with the complicated algorithms that provide the trading strategy, or pricing structure, for parking. It has the final say on the pricing, but MAG USA manages the algorithms and ever-changing data that establish pricing suggestions. Before BUR implemented the system, static prices for drive-up customers in lots A and C were $10 and $13 per day, respectively; valet service cost $24 per day; lots G and E were $23 and $24 per day; and the daily rate for the covered parking structure was $32.

Now, passengers booking online for a five-day stay in Lot G, which is also covered, typically pay around $12 per day, which is comparable to the previous rates for lots A and C. The algorithms consider how far in advance a customer books, and, much like flight pricing, parking reservations booked further out are often less expensive. Even valet service can be as low as $10 per day, which incentivizes passengers to choose it.


MARTIN JONES

"The physical experience at airports needed to come of age, and passengers needed more digital connection," says Martin Jones, chief executive officer of MAG USA.

The current system at BUR sells parking the same way services like Hotwire or Hotel Tonight sell hotel rooms, offering discounts for capacity that might otherwise go unused. In busier times, it helps the airport manage inventory and fill parking spots that might have remained empty. When all customers showing up were unanticipated, it was difficult for BUR to plan or adjust—and virtually impossible to stimulate demand as needed.

"Pre-booking allows the operator to have much greater certainty and allows them to operate more robustly," explains Jones. "If a customer shows up later than they had hoped because they got stuck in traffic or booked the wrong day, or they show up early, our training helps them manage the customer experience on the ground. That's a big part, too."

The system MAG USA developed provides customers with dynamic pricing driven by more than 3 million machine-learning algorithms and 3,000 predictive models. By reserving their parking in advance, customers can gain peace of mind, and sometimes a lower rate. For the airport, pricing can be changed quickly to reflect demand.

Jones notes that the vast majority of U.S. airports work on a price-per-day model, and passengers typically park for an average of two days. After two days, it becomes more advantageous for them to take a train or taxi. Dynamic pricing allows BUR to match a customer's per-day parking price to the length of his or her stay.

Renewed Interest in Parking & Touchless Tech

Jones reports that the pandemic is having an interesting effect on customer volume and behavior. A recent MAG USA survey of 20,000 customers shows that 11% of airline passengers who would typically travel to the airport by taxi, public transportation or app-based ride sharing vehicles currently prefer to drive there in their own vehicles and park.

"Now, people want to be in their own cars versus shared transportation," Jones explains. "We have received a lot of feedback that customers want a contactless experience. They don't want to stop at a pay point that is hard to keep clean and other people have been touching."

He explains that dynamic pricing allows travelers to realize volume discounts by pre-booking; and airports can collect more revenue because more customers will park. Recovering income from parking is crucial to the overall financial health of an airport, stresses Jones.

Janowitz notes that BUR took care not to cannibalize its established drive-up business. "In the past, we had a two-day average for parkers, and we knew we needed to collect the same amount of money for a two-day stay," he explains. "So if customers book online, they don't realize any savings for the first two days. But at three days and up, the savings start to kick in. The goal was to entice the longer-stay passengers. MAG USA looked at our numbers and told us that's where the growth potential was and the behavior they wanted to influence."

The strategy has worked marvelously, Janowitz reports. Now, the average stay for valet service booked online is five days.

The system also helps BUR's ongoing effort to convince passengers to park at the airport instead of arranging other transportation. Passengers will compare parking rates to the price of an Uber ride, and the airport could see an impact right away, Janowitz says.

Other Online Options

Looking ahead, Jones says that offering customers the option to pre-book a place in various airport lines—even at TSA checkpoints—is on the near horizon. Not surprisingly, passengers say they like the efficiency of that option.

"We have taken the concept of pre-book parking and added that to security queues," explains Jones. "It's only in the UK now, but we have the ability to do that in the U.S., too. Really what we're building is the ability to enable that entire customer journey digitally, including hotel, parking, security, pre-ordering duty free items, slots in the lounge, and so on. The vision was to allow customers to put any product for their journey in a basket online. It's kind of like Amazon, but at airports there are car parks, food and beverage options, vendor services; and it could all go in one cart to check out."

Today, reservations for parking, hotel and retail are usually fragmented. MAG USA is building a digital platform to put them all in one basket, and Jones says there is much more in the value chain.

"I think we will end up having much greater collaboration between airports and airlines, which will ensure that the passenger journey is fully joined up and aligned," he says. "I foresee many more partnerships and better experiences for customers as we start making this seamless."

In the meantime, MAG USA's algorithms help protect existing drive-up parking revenue

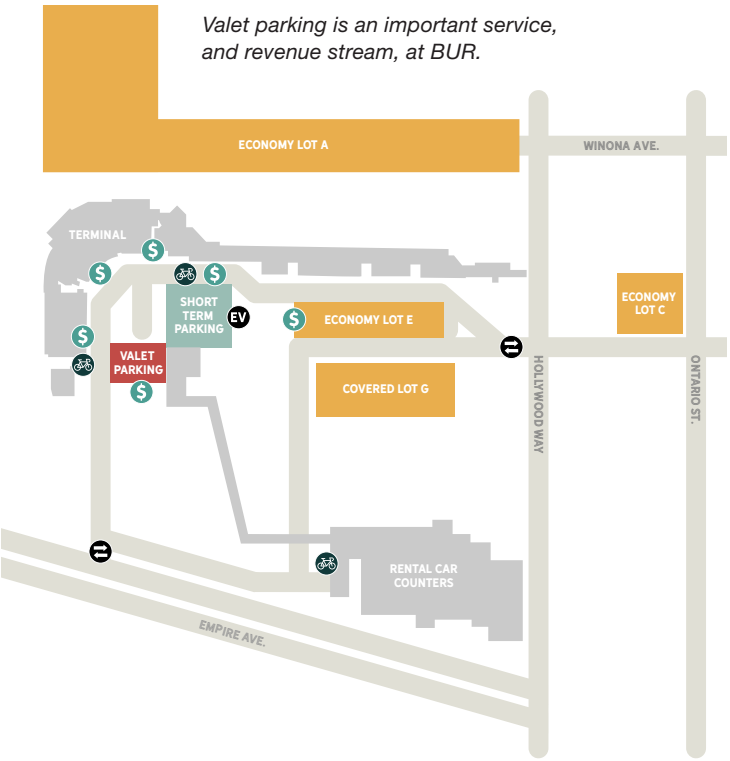
and allow BUR to maintain income from its premium parking options. Airports pay a lot of money to bring in buses and parking systems, and making parking more attractive to customers is much more efficient, Jones comments.

"Airports are traditionally a physical experience, and that's going to change," he predicts. "Customers will want to have greater certainty of when to show up, where to show up and how long they'll be waiting. I think that's an important part of the journey."

The online reservation system at BUR even has a provision that helps the airport secure revenue when customers cancel parking reservations. Passengers have the option to purchase cancellation protection for $1. Without cancellation protection, the system deducts a $7.50 administrative fee from their refund total. Bookings made less than 24 hours before arrival cannot be cancelled and are nonrefundable.

Janowitz hopes that business travel will rebound by next summer, but the airport is delaying any more upgrades to its parking system in the meantime.

"We always want to look in the crystal ball, and it's always a little foggy," he muses. "We're monitoring our activity, and MAG USA provides a huge data set. We are ready when the time comes to introduce the online product to our other lots."



Valet parking is an important service, and revenue stream, at BUR.

PORT OF MOSES LAKE

FACTS&FIGURES

Project: Partial Runway Reconstruction

Location: Grant County (WA) Int'l Airport

Annual Operations: 83,000

Project Cost: About $20 million

Funding: 90% FAA, 10% airport

Key Objective: Remove 5-foot-tall hump in pavement to fix line-of-sight problem

Concurrent Project: New LED edge lights & signage

Construction Duration: 8 months (Nov. 2019 to June 2020)

Associated Runway Closure: 8 months (partial in Nov.-Dec.; full closure from Jan. to June 15)

Lead Design & Engineering Firm: Century West Engineering

Key Subconsultant: Western Pacific Engineering

Lead Contractor: Granite Construction

Electrical Subcontractor: Neppel Electric & Controls

Electrical Supplier: AirSide Solutions

Lighting Manufacturer: ADB SAFEGATE

Unforeseen Challenge: Continuing work despite COVID-19 crisis

Key Benefit: Removing visual impediment enhances airfield safety, allows 24/7 runway operations

Ancillary Advantages: New LED lighting improves visibility, lowers energy consumption, reduces maintenance

Grant County Int'l Flattens Hump in Runway

BY MIKE SCHWANZ

Airports throughout the world face many of the same challenges, but Grant County International (MWH) in Moses Lake, WA, recently tackled an unusual airfield issue.

It leveled a gradual, but pronounced, hump in the middle of its main runway. The sloping pavement, which spanned 4,400 linear feet and was about 5 feet tall at the highest point, made it impossible for some pilots to see traffic at the opposite end of the 13,500-foot runway. For safety, MWH had to shut down Runway 14L-32R at night when the control tower closed, due to FAA requirements.

RICH MUELLER

"This was not a new problem for us," states Airport Director Rich Mueller. "It goes back nearly 80 years."

The unusual pavement profile dated back to World War II, when the U.S. Army Air Corps built the runway for training B-17 crews. Mueller explains that the hump was not an issue for the Army, because it was more critical to have a working runway than a level one. However, the hump *did* become problematic for MWH. While the runway serves a wider variety of military and civilian aircraft, it did not meet current FAA safety standards.

With five runways, uncluttered airspace, consistently good weather and ample aprons, the central Washington airport attracts everything from the Boeing 737 MAX Return to Service program to fledgling pilots and aircraft mechanics from the local Big Bend Community College. It also is the site of international military exercises, air cargo shipments, widebody executive interior makeovers and certification of electric aircraft such as the Aviation Alice. Stretching 13,500 feet, Runway 14L-32R has enough length to handle any aircraft in the world.

The U.S. Air Force and U.S. Navy both regularly use the airfield for military training. The U.S. Forest Service bases VLAT (very large airtankers) there. Notable private sector activity includes a 747-400 reconfigured for testing Rolls-Royce engines. Test flights for

new Boeing aircraft, including the latest 777X, are also performed at MWH. During summer, the airfield is especially busy due to an influx of large cargo planes that fly locally grown cherries to Asia.

With approximately 83,000 annual operations and a mix of traffic, the airport clearly needed to resolve the line-of-sight issue on its main runway. Fortunately, FAA officials gave MWH several years to make that happen.

In 2013, the airport updated its master plan, and removing the hump was a major component. The FAA agreed to cover 90% of the cost if MWH could meet various funding requirements. After the master plan was refreshed, the airport hired Century West in 2016 and underwent two years of preliminary project planning, with final design and engineering completed in early 2019.

Preliminary Phases

As lead consultant for the project, Century West executed planning, environmental statements, engineering, final design and construction. "We were selected for a five-year on-call arrangement to provide all services covering anything at the airport," says Senior Program Manager Kurt Addicott. "However, the runway hump issue was one of our main responsibilities right away."


KURT ADDICOTT

Establishing a budget for the project proved to be a challenge that required multiple discussions between the FAA and the Port of Moses Lake, which owns the airport. Century West suspected that the FAA's original $16 million budget (based on earlier planning level estimates from the Port) was not nearly enough money to cover the scope of the project. Given the airport's goals, Century West performed a preliminary engineering analysis, and estimated costs at closer to $30 million.

In 2016 and 2017, Century West performed predesign work, including site condition assessments, surveys, geotechnical investigations, preliminary engineering analysis, concept level design, operational impacts and mitigation analysis, project phasing analysis, cost estimate and budget planning, initial environment/permitting coordination, and extensive FAA and stakeholder coordination. By the end of 2018, the team finalized environmental statements for the project, clearing the last major hurdle of FAA requirements. A $26 million grant was approved in early 2019, which meant that the airport had to come up with at least $2.6 million—its 10% obligation.

With a firm budget in hand, and the final grant approval issued, work amped up considerably for the project team. "Once everything was approved, we were on a tight timetable," Addicott recalls. "We had to prepare the final design in four months to meet the established bid opening deadline."

Concurrently, Century West held a series of workshops at the airport in late March and early April 2019 to inform potential contractors about the project. Addicott notes that the workshops were helpful to both the engineering consultant and contractors potentially interested in bidding for subsequent work.

The team issued a request for bids in May 2019, and asked for submissions by June 1, 2019. "We had a hard grant deadline on that, and needed to hold that bid date as well for construction to begin in late fall 2019, and finish by June 5, 2020," Addicott says.

Granite Construction won the project with a bid for about $20 million—considerably less than Century West's original $30 million estimate. The bidding climate at the time was extremely competitive and resulted in significant cost savings over other recently bid work items. "This obviously made both the Port of Moses Lake and the FAA happy," comments Addicott.

Before construction began in late 2019, the airport and its consultant developed a plan to provide a viable alternate runway. The longest crosswind runway at MWH is only 10,000 feet. "We initially discussed keeping half of the main runway open, but eventually decided against that," Mueller says. "In the end, we decided to keep the main runway partially open in November and December, 2019, and close it completely for a six-month period from January to June 5, 2020."

The airport provided utility crossings and taxiway connectors for aircraft to use during the closure.

"We discussed the critical operations that had to keep running, and how to get aircraft in and out," Mueller recalls. "We also had to inform our clients about which runway would be closed, and for how long."

Time to Roll

When full construction started in early January 2020, Century West dispatched a full-time on-site construction manager who was assisted by another manager at least half of the time. "In all, we always had from six to eight individuals at the site. This was a very fast-paced project," Addicott says. "We were involved full-time on all aspects of the construction."

Work progressed smoothly until the very last week, in early June, when on-site testing performed by Granite and Century West during the course of their quality control duties indicated problems with constituent ratios in the asphalt mix. Granite agreed to remove and replace the defective materials within the affected section, and the problem was corrected after a brief delay.

The project also experienced three runway incursions—each from a different company—during the last month of substantial completion. (See sidebar on Page 52 for more information.)

Rigid Schedule

The project's tight deadline in early June required Granite Construction to maintain a strict work schedule. Moreover, the region's cold winters and hot summers affected when some work could be performed.

Key airport users also had seasonal demands. For instance, the U.S. Forest Service tanker base is active throughout the summer and fall. Transoceanic shipments of cherries, a main crop in the state of Washington, begin around the third week of June. And the Moses Lake Airshow is normally scheduled during Father's Day weekend, also in June.


CORY BELL

With all these factors in play, Granite agreed to finish the work by June 5, 2020. "To meet this deadline, every step had to be accomplished on schedule," states Cory Bell, construction manager for the project. "During November and December, 2019, we worked on the electrical portion of the project, including the installation of all-new electrical conduits. When we started the main construction work in January 2020, we demolished the existing hump in the runway, which totaled about 4,400 feet, added new aggregate and then began paving."

Granite teams dug down 9 feet to remove old asphalt and concrete, some dating back to the 1940s. Unsuitable material such as black sand was separated and moved to adjacent ground. Crews used an on-site crusher to turn excavated concrete into a gravel base for the new asphalt pavement.

Granite was able to reuse most of what it dug up. "By recycling on-site, we reduced the amount of material that would have been hauled off-site by 14,000 truckloads," Bell reports. "Fewer truckloads not only brought down the cost, but also limited the impact to local highways—benefits airport officials appreciated."

About 10,000 truckloads of asphalt millings and new asphalt did need to be hauled off-site.

In addition, the construction crew had to move about 500,000 cubic yards of rocky soil and sand, which is common in the region. The excavated material was spread on open areas of the airport infield, and compaction and hydroseeding helped prevent winds from blowing material back onto the runway surfaces.

New asphalt (25,000 tons of P401 and 75,000 tons of P403 bituminous pavement base course) was produced near the airport at Granite's own plant. "For trips to and from our facility, our teams avoided the main highways altogether and used back roads to limit impact to the traveling public," says Bell.

During the peak of construction, about 30 individuals were on-site, including subcontractors. Work was moving along according to plan until mid-March 2020, when the COVID-19 pandemic hit and required everyone on-site to adopt new safety guidelines. The runway project was deemed essential by state officials, and Bell notes that Granite closely followed recommended procedures to keep all personnel protected as construction continued. "By following our company's stringent policies and protocols, we were able to protect the health and safety of our team," he adds.

Lighting Improvements

Part of the airport's deal with the FAA was that it would bring the edge lights on 14L-32R closer to the runway. When the Air Force lengthened and improved the main runway for B-52 use in the 1950s, it positioned the lights 50 feet from the runway edge. In recent years, though, the FAA wanted them within 10 feet of the runway. "We decided to align the new fixtures with the runway approach lighting, which placed them only 5 feet from the runway edge," says Mueller.

To accomplish this, construction, electrical and concrete crews had to trench, reroute and rewire airfield electrical circuits up and down both sides of the long runway, using almost 20 miles of cable and more than 220 fixtures.

Mueller and other airport leaders are pleased with the upgraded LED lights that were installed. "These high-intensity lights are much brighter, and will help pilots trying to land in foggy or other kinds of bad weather," he relates.

The new lights have five different brightness levels that allow MWH to optimize visibility for pilots in a variety of conditions, day or night. With the new lights and pavement in place, Runway 14L-32R is now open 24 hours a day, even though the tower still closes from 10 p.m. to 6 a.m. Before controllers leave for the night, they set the lights based on weather reports. If conditions change, personnel from the on-site aircraft rescue and fireighting station, manned 24/7, can raise the brightness levels at any hour.

Project Team Prevails

Despite COVID-19 and multiple runway incursions, Runway 14L-32R reopened on June 15, 2020—just 10 days after the original deadline. As it turned out, the state's cherry crop was a bit slow to ripen last summer, so the schedule delay did not jeopardize fruit shipments. The first cargo planes loaded with cherries departed for Asia promptly on June 18.

Since the runway reopened, Mueller has received positive feedback about the airfield improvements. "Safety issues notwithstanding, the runway project itself was a great success, especially given the tight deadline," he says. "When we first started the construction, some of our clients were unhappy. But now, all seem to appreciate the better runway surface, visibility and brighter lighting. This project was always about preparing for the future."

Contractors were able to reuse most of the excavated materials.

Lessons Learned From Runway Incursions

A recent airfield project at Grant County International Airport (MWH) in Moses Lake, WA, delivered pristine new pavement on the main runway. It also, however, left behind scars on airport leaders, customers and project partners.

In his own words, here's how Airport Director Rich Mueller describes the situation:

"This project was a success; we have a beautiful, smooth, level section of runway and fantastically bright LED runway lights. Our change orders were few and relatively small in relation to the project scope and size. The only real issues occurred within the last month of substantial completion.

While it pains me to say it, we had three runway incursions on the job within three weeks—two involving aircraft, one on takeoff roll. All three involved project vehicles, including a paint truck, a pickup truck and a dump truck.

I am sure airport people will cringe when they read this. Every time I think about it, I still do…and probably always will. While it would be easier to overlook these failings in light of the larger success, I believe it is important to share this information in the hopes that other airport leaders and their project partners can benefit from the knowledge.

Our airport staff and consultant team put together a thoroughly detailed Construction Safety and Phasing Plan (CSPP) that identified safety protocols, operational areas, construction activity areas, crossing and interface protocols, responsibilities of each stakeholder and other pertinent details specific to each phase of work. Despite significant safety planning, there unfortunately is always still some level of risk when undertaking an airfield project. While we implemented site-specific mitigation measures into the project to drive down risk, no strategy reduces risk to zero. Excellent strategy, even well executed, cannot be solely relied upon; there is always room to improve. ***We must be on the prowl for new risks and possible lapses****—not to lay blame, but to address as a team.*

Our take-away? Despite extensive safety planning and well-defined phasing implementation, the human element can (and did) creep in and create serious safety incidents that had the potential for catastrophic endings.

The literal crux of the issue was that work needed to happen on both sides of the active intersecting runway; and as part of our CSPP, a crossing guard and crossing protocols were required and established.

Taking the incursions individually, each operator that inappropriately entered the

runway came from a different company and did so for different reasons. Each faulty action was addressed, in turn, with specific solutions. Looking at the bigger picture, however, we learned a few things that we will use going forward, and offer as recommendations for other airport professionals to consider on future projects:

- *In bid documents, expand the expectations and contract requirements for dedicated safety personnel and crossing guards. Stress the importance of **no** distractions.*
- *Expand the expectations and contract terms in bid documents that require personnel to attend activity-specific operational and safety training.*
- *During longer projects, re-train all personnel at the mid-point of the schedule and advise potential bidders (via annotations) to develop a plan for covering extra work and/or extra hours.*
- *Expand the content of daily and weekly safety coordination meetings, and check off requirements as they are met.*
- *In contracts, tie any runway incursion to a specific and substantial monetary fine, with escalation clauses for repeat offenses. Require expanded details in contractors' Safety Plan Compliance Documents (SPCDs), with step-by-step crossing protocols and plans for crystal-clear communication.*
- *As work commences, find ways to reduce the total number of crossings to those that are truly critical. If contractors identify value engineering ideas, require them to resubmit SPCDs to formalize new baseline protocols.*
- *Encourage multiple shifts of staff from the air traffic control tower to discuss any actions or emerging patterns of concern, internally and with airport staff.*
- *Increase contractual requirements for contactors to have personnel on-site who are solely focused on safety at all times. In addition, urge construction management staff to prevent safety personnel and crossing guards from being distracted by other tasks.*
- *If an incursion happens, **immediately** require a repeat of the mandatory safety training led by airport personnel, and require a full safety stand-down day without adjusting the final completion date.*
- *Lastly, it's vital to specifically and repeatedly remind construction management, air traffic control staff and airport personnel that they are **empowered and required** to step in and speak up about potential safety hazards throughout a project.*

—Rich Mueller

San Diego Int'l Captures Stormwater Runoff for Reuse at Rental Car Center

BY ROBERT NORDSTROM

FACTS&FIGURES

Project: Stormwater Cistern

Location: San Diego Int'l Airport

Strategy: Capture northside airfield runoff for reuse at car wash facility

Cost: $38 million

Funding: Airport revenue bonds

Design & Construction: Dec. 2018-Nov. 2020

Cistern Capacity: 3.2 million gallons

General Contractor: Sundt Construction

Cistern Design & Structural Engineering: Carollo Engineers

Stormwater Drainage Design: C&S Companies

Geotechnical Engineering: Group Delta

Architecture & Design Coordination: HOK

Secant Pile Contractor: Condon Johnson

Dewatering System: Pure Effect

Of Note: System won 2020 Environmental Excellence Award from Industrial Environmental Association

San Diego International Airport (SAN) recently raised its lofty sustainability bar a few notches higher by adding a new, award-winning element to its stormwater management system. The $38 million project, completed in November 2020, features a large concrete cistern that collects runoff from the northside airfield. The water it captures will be treated and reused to wash rental cars—a science-driven approach that garnered a 2020 Environmental Excellence Award from the Industrial Environmental Association.

The 3.2 million-gallon cistern is designed to reuse 16 million gallons of captured stormwater per year at SAN's rental car center, which washes about 4,000 cars daily.

"Right now, all these cars are washed using potable water," explains SAN Vice President and Chief Development Officer Dennis Probst. "The savings will be quite significant."

DENNIS PROBST

The new cistern joins another stormwater capture and reuse system built a few years ago at the Terminal 2 parking facility. It can hold approximately 100,000 gallons and feeds water to the airport's cooling towers, which require 35,000 to 50,000 gallons per day.

Although the new cistern will primarily supply water to the car wash, Probst notes that it could also send water to the cooling towers in the future. At this point, the jury is still out regarding how much.

Both stormwater capture/reuse systems are part of SAN's ongoing water stewardship plan. Other key elements associated with the north side include:

- two infiltration beds with 2.65 acres of surface area,
- underground storage and infiltration chambers capable of holding 640,000 gallons, and
- bioswales for cleaning and channeling stormwater infiltration.

"We're working very hard, piece by piece, to capture and reuse as much stormwater runoff as we can to keep it out of the (San Diego) Bay," Probst explains.

Planning Ahead

The new northside cistern will help SAN comply with National Pollutant Discharge Elimination System permits by collecting 80% of the airport's average annual runoff. Typically, San Diego receives about 10 inches per year, most of which falls in January, February and March.

Maintaining water quality is a significant issue throughout Southern California. At SAN, copper and zinc pollutants from aircraft braking and chain link security fencing are particular issues that will soon be even more challenging. Probst explains that regulations about how much copper and zinc can be discharged into San Diego Bay will tighten in 2026 to approximately 1/1,000 of what is acceptable for human health. Human health requirements are often measured in parts per million; what will be allowed into the Bay after 2026 will be measured in parts per billion, he notes.

"There's no way we would be able to treat the water at those contaminant levels," Probst informs. "If we had waited until 2026 to confront these issues, our Terminal 1 development program would be completed and we would have to go back in and tear things up. We're advancing all of this sustainability work as part of the development program for the new terminal."

Easier Said Than Done

The new cistern will eventually collect runoff from 78 acres of the northside airfield. Constructing the 28-foot deep, 160-foot diameter concrete cistern in a limited space without significantly impacting airport operations was no easy task for the project's general contractor.

"The biggest challenge was determining how to dig a 35-foot hole in an area where the water table is only 7 to 8 feet below the surface," notes Brad Kirsch, project director for Sundt Construction. "The sheer size of the cistern and the amount of dewatering to keep the area dry throughout construction presented a major challenge. You can't construct a tank like this in the middle of a big muddy puddle. We had to find a shoring system that would allow us to create a cutoff."


BRAD KIRSCH

Work on the design-build project began in December 2018 and finished up in November 2020. Sundt hired Carollo Engineers to provide design and engineering services. Carollo Project Manager Miko Aivazian presented multiple cistern design options for Sundt and airport officials to compare and consider. Eventually, the team settled


MIKO AIVAZIAN

From Puddles to Beer

Throughout the years, San Diego International Airport (SAN) has executed several programs to conserve and recycle water, but one *really* flexes the bounds of environmental creativity. It managed to transform moisture dripping from the pre-conditioned air units under boarding bridges into beer—and a popular brew at that.

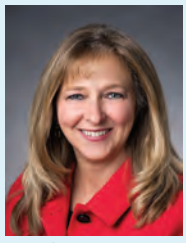
Airport personnel began capturing the dripping condensate back in 2014, and now collect about 100,000 gallons per year from 18 of the busiest jet bridges in terminals 1 and 2. In summer 2018, Water Works Inc., a local water purification company, advised SAN that the condensate's excellent quality would be conducive for brewing beer. In addition to embracing the minor revenue potential, airport officials saw a unique opportunity to educate the public about SAN's water conservation efforts. In mid-September, the Airport Authority agreed to collaborate with Ballast Point, a local brewery, to make a craft beer; and the tasty green project was fully in motion.

Although the condensate is very pure and comparable to distilled water, Water Works further purified approximately 200 gallons of condensate water from SAN using an ozone disinfection process. Then Ballast Point ran the purified water through carbon and 5-micron filters before brewing it into beer.

The final product, aptly named SAN Test Pilot, is characterized as a "light and crisp beer that allows the water to shine through." Because SAN's reclaimed water has a much lower mineral content than water from the municipal supply, it provided an ideal base for the brewers. Beginning with a blank slate allowed them to carefully adjust the water's mineral content, pH and flavor with brewing salts for specific results. Tasters say the Ballast Point recipe has fruity esters similar to a ripe pear, and its Spalt hops produce a sharp citrus zest finish.

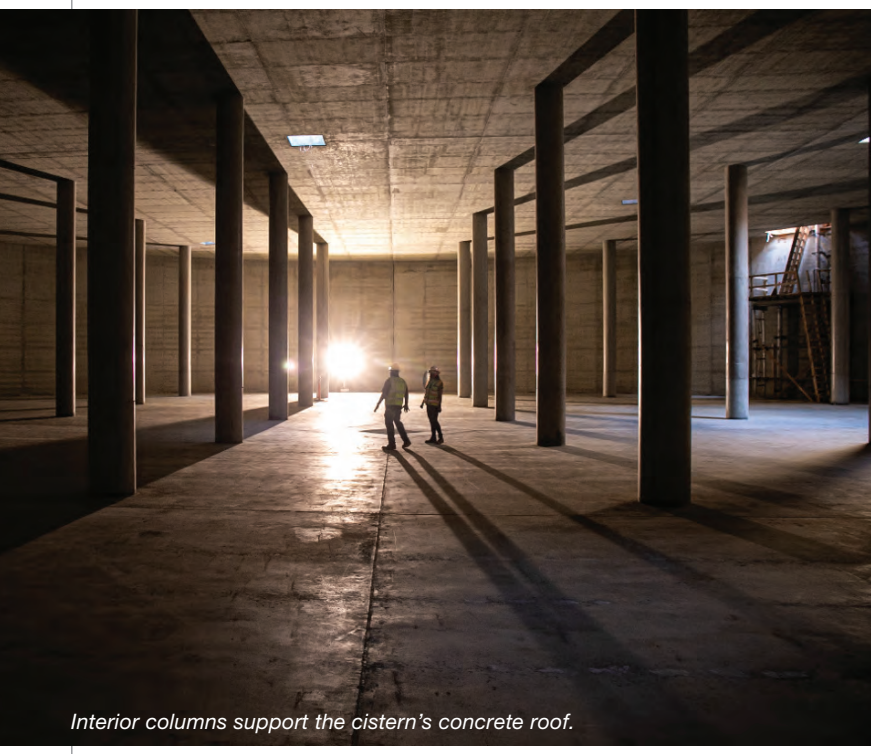
Quite a transformation from condensation puddling on the tarmac.

When the limited edition supply of SAN Test Pilot debuted at three local pubs, the entire 139-gallon batch sold out in less than 10 days.


KIM BECKER

Although the current COVID pandemic put the brakes on further condensate-to-beer production, Airport Authority officials look forward to exploring new ventures in the future. "The airport is always striving to enhance our sustainability efforts and find unique ways to use the reclaimed water we capture," Airport Authority President and Chief Executive Officer Kim Becker said in a press release. "This beer reaffirms our commitment to sustainability in a truly fun and innovative way."

SAN also uses condensate produced by the pre-conditioned air units to power-wash sidewalks in front of the terminals, and to clean airside vehicles, equipment and bins that collect food waste for composting—another one of the airport's noteworthy environmental programs.



Interior columns support the cistern's concrete roof.

on a circular cast-in-place concrete cistern with a secant shoring system.

"The secant shoring system was key," Aivazian states. "Secant piles were selected to meet the smaller footprint requirements and help reduce the amount of water seeping into the excavation pit. A dewatering/pumping system was designed to continuously dewater the excavation pit. The 180 four-foot-diameter secant piles were also used as formwork for the 28-foot cistern walls, but they were kept independent from the walls due to differential settlement between the secant piles and cistern walls."

The cistern's 3-foot concrete mat slab floor is anchored in place by 185 piles, each 16 inches in diameter. These piles hold the weight of the water, but also anchor the cistern in place when it is empty. The concrete roof is supported by 32 interior columns, each 24 inches in diameter.

"The auger-displacement piles were drilled 50 feet below the slab," Kirsch adds. "We had to lower a drill rig into the 35-foot pit with a large crane. I had never lifted a drill rig that large down into an excavation like this before."

The new stormwater drainage system that feeds the cistern, designed and installed by C&S Companies, includes


NICHOLAS ROBERTS

3,500 linear feet of 24- to 54-inch pipe, much of which is deep and within the groundwater table. Managing Engineer Nicholas Roberts explains that the company had to reroute the existing storm drain system because a lot of it was located in older deep storm drain pipes connected to bay outfalls. "We also had to cross and disconnect from large diameter storm drains conveying flows from outside the airport that passed through the airport property," he adds. "We basically had to identify and navigate over and under large diameter pipes, which was a big task from a gravity perspective. To alleviate construction impacts, we scoured old records (circa 1940s) and potholed to the extent possible but had to identify and make adjustments a portion of the system during construction."

Water Reused = Money Saved

Probst categorizes the financial benefits of the cistern project—and the rest of SAN's stormwater capture/reuse system—into two general categories: money saved and costs avoided.

For instance, washing rental cars with captured stormwater will allow the airport to purchase less tap water, which costs about ½ cent per gallon in San Diego. For every 10 million gallons of captured stormwater it uses, SAN can save roughly $50,000.

Avoiding regulatory penalties could have even larger implications—especially those involving National Pollutant Discharge Elimination System (NPDES) requirements, as enforced by the state of California. Probst explains that even though the stormwater draining from the airport meets U.S. Environmental Protection Agency drinking water standards, it also must meet more stringent NPDES standards. Fines for infractions, issued on a per gallon or per day basis, can become prohibitive; and associated enforcement actions can require significant staff time and disrupt future development projects, notes Probst.

"Our stormwater capture and reuse system is intended to future-proof the airport from regulatory changes associated with the stormwater discharge," he adds, noting that the new northside cistern is just one element of SAN's overall water stewardship plan.

Other components yet to be constructed include a large cistern to collect stormwater runoff associated with the airport's new Terminal 1, which is expected to begin construction in 2021. Additional storage tanks and below-grade infiltration systems are also in the works. Following treatment, southside runoff will likely be used to flush toilets in the new terminal and sent to the airport's central utility plant as an additional source of water for the cooling towers—uses that do not require potable water.

"If we're not the best airport in the country as it relates to sustainability and environmental practices, we're certainly in the top tier," Probst proudly relates. "We have a great team doing great work here at the airport, and I'd put them up against anybody in the country."

Murfreesboro Municipal Modernizes With New Terminal

BY JENNIFER BRADLEY

FACTS&FIGURES

Project: New Terminal

Location: Murfreesboro (TN) Regional Airport

Major Tenant: Middle Tennessee State University Aerospace Program

Cost: $4.5 million

Size: 16,000 sq. ft.

Highlights: Open-concept design, business center, tenant space for local aviation school

Architect: Lowen + Associates LLC

Contractor: Smith Design/Build

Grading Subcontractor: Baker Construction

Timeline: Design-build team selected in spring 2018; airport staff moved into temporary trailers in April 2019; university classroom opened Aug. 24, 2020; airport staff moved into new building in Sept. 2020

Furnishings: National Office Interiors

Audio/Visual Systems: AVI

Murfreesboro Municipal Airport (MBT) recently opened a new $4.5 million terminal to welcome visitors to one of the Top 10 fastest-growing communities in the U.S. With immense employment opportunities and a highly touted quality of life, this popular Tennessee city is attracting people of all ages and a variety of aircraft activity.

CHAD GEHRKE

When Airport Manager Chad Gehrke moved to Murfreesboro in 1990, it had approximately 40,000 residents. Today, it's toppling the expansion charts with a population of 140,000.

"All of the surrounding airports have seen a lot of growth due to the population boom," Gehrke reports.

In addition to its new terminal, MBT has 101 T-hangars and serves as home base for a variety of locally owned aircraft, a Vanderbilt University Life Flight helicopter and a handful of corporate jets. The airport is also home to Middle Tennessee State University's Aerospace Program, with a record enrollment of more than 1,000 students in 2019.

Gehrke explains that a new terminal was a must to serve Murfreesboro's thriving community and student population. The original building was built in 1952, expanded in 1984 and looked like an out-of-date ranch home. "We got our money's worth out of that building," he jokes. "But it did not represent the forwardness, excitement and dynamic culture of our community anymore."

Bright, Shiny & New

Today, the new terminal is the star of the airport. It includes modern amenities such as charging stations, new seating, an open-concept layout and great views from the main floor and mezzanine observation deck.

The business center on the north features a meeting room with seating for 70 to 100 people and modern audio/visual systems such as large screen TVs and pull-down screens with projectors. Gehrke is hoping

PHOTO: PRISCILLA HARRIS PHOTOGRAPHY

that the Murfreesboro City Council and other local organizations take advantage of the facilities in the new business center. They could even use the wall-mounted cameras to live stream meetings, he notes.

An executive boardroom and a catering kitchen add extra functionality to the business center. The airport decided against installing a full-size kitchen because that would have involved meeting more stringent building codes. A simple space to heat and refrigerate food will serve the general aviation airport's needs just fine, says Gehrke.

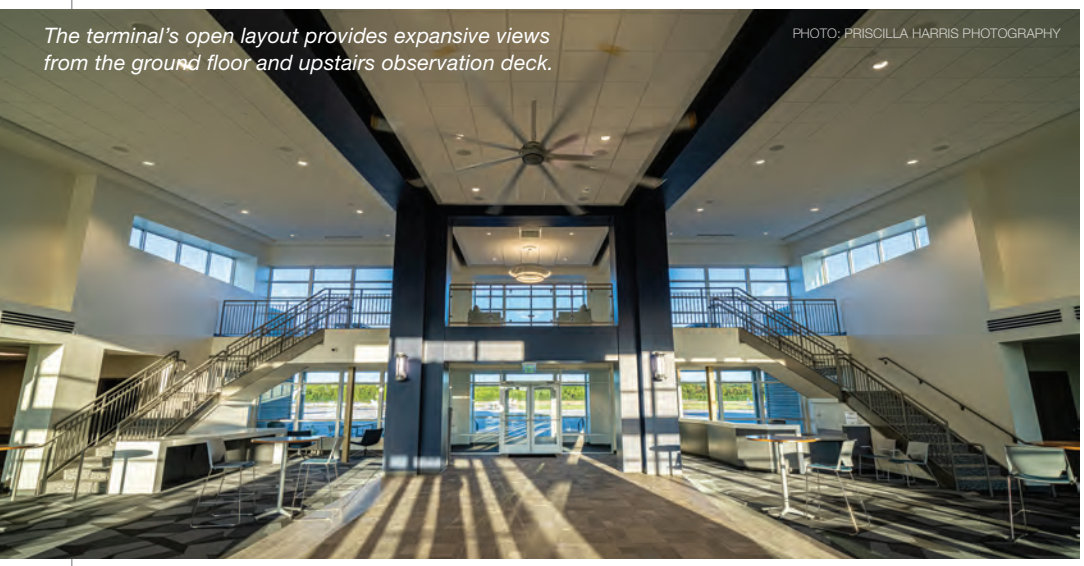
Pilot facilities include individual offices, a private lounge and a separate briefing area.

Staff offices on the south end of the terminal have direct access to the apron and clear views of the airfield. "Like many municipal airports, our staff fuels aircraft, takes care of the hangars and ramp, mows the lawns—all those things," he relates.

Wide and tall glass-paneled areas stretch from the lower level to the mezzanine, providing a nearly 180-degree view of the airfield. The new conference areas, business center and staff offices, as well as main areas, all enjoy the bustling airside view.

Even the roof was designed for visual appeal. Prime contractor Blake Smith of Smith Design/Build, says that unlike most buildings, airports must look good from five sides, including the top. So his firm made MBT's roof uncluttered, with interesting architecture, but also energy efficient, with many different angles to minimize chances of leaking.

Jim Lowen, architect and project designer, shares a memorable moment during construction: "When the metal frame was up, we went to the mezzanine level and took in the view looking down at the airfield, out into the airstrip and at the main gathering space on the other side. That was extremely exciting because this terminal had taken on an entirely different presence than what the airport was used to."



The terminal's open layout provides expansive views from the ground floor and upstairs observation deck.

PHOTO: PRISCILLA HARRIS PHOTOGRAPHY

At that point, Gehrke and city officials were able to see the plans that had been conceptualized on paper brought to life. "It was a powerful moment," Lowen recalls.

Design-Build for the Win

The project began on a traditional design-then-build construction path, but when the initial bids came in from builders, the design had the project on a trajectory to be well over budget by a couple million dollars. That prompted Assistant City Manager Gary Whitaker to suggest using a design-build approach. Whitaker became an integral part of the team going forward, and MBT's terminal became the first facility Murfreesboro built using this method.

The initial field of 10 firms that bid on the project was narrowed to two candidates to present ideas, and the team of Lowen+Associates LLC/ Smith Design Build won the contract. Gehrke notes that the new design for a 16,000-square-foot terminal checked every box the airport had wanted, and more.

To stay within the $4.5 million budget, the design/build team worked with suppliers and engineers to optimize the design for cost effectiveness. "We measure all those parameters and balance it out to get extremely good quality and value," Smith explains.

He says he enjoys using the design-build method because the architectural team and building contractor work as one. "Then the owner comes on as an ally, an asset of the team," Smith adds.

The MBT terminal was not the first time Smith and Lowen have teamed up. The pair has developed an efficient working relationship and deep mutual respect for one another over the course of several previous projects. "He's very creative, and he listens to other people," Smith says of Lowen.

"He's a great contractor to collaborate with," says Lowen of Smith.

After 30 years completing design-build projects, Smith says he doesn't know of a good reason to complete a new facility any other way. But he also warns airport execs that the process can go south quickly if the wrong team is hired.

"We work very cohesively," agrees Lowen. "If architects and contractors work harmoniously together, it very much benefits the client and the budget. This was a great experience, and it came together very, very well."

Tackling Challenges

Even with the right team in place, few airport projects are considered easy or simple. Lowen notes that the main design challenge at MBT was making sure all the necessary elements fit in the building while also creating a structurally interesting look. "The main road is only a quarter of a mile from the airport, so when you drive by, you see the terminal," he explains. "It really has a presence more than it used to. We tried to push ourselves to create something that gave them a great aesthetic that will look like a new building with modern elements for years to come."

On the construction side, the largest obstacles were maneuvering around inadequately documented utilities and keeping the airport operational during construction. It helped that the owner

The airfield serves a mix of traffic, including student pilots, based aircraft and medical helicopter flights.

PHOTO: PRISCILLA HARRIS PHOTOGRAPHY

of Baker Construction was familiar with the site because he is a local pilot who flies out of MBT. "He had a lot of motivation to get this up," Smith jokes.

All of the team principals agree that using pre-engineered structures helped the budget tremendously. Lowen explains that the new terminal is actually 10 individual structures with 10 different roof planes that he and his designers tied together.

"I use Jim's name as a verb: Lowenization," says Smith. "It's been all tricked out and is so cool looking! I really loved when that structure went together; it was complicated."

"This was a financially sound, energy-efficient way to go," adds Lowen. Specifically, he gives the pre-engineered structures high marks for "phenomenal insulation and long-lasting seamed metal roofs with 40-year warranties."

Gehrke considers the pre-engineered structures a good choice that gave MBT the terminal it hoped for—an especially happy ending after the first design didn't pan out.

Ample Space for Air School

With approximately 100,000 operations per year, MBT is busy for a regional airport, and much of its traffic comes from one major tenant: the Aerospace Department of Middle Tennessee State University (MTSU). The school flies 35 aircraft out of MBT, including DA40s, Piper Seminoles, a Super Cub and a King Air 350.

"MTSU is renowned for their pro pilot program and have training in other aviation areas as well, including maintenance, technology, dispatch and air traffic control, unmanned aerial systems and aviation administration", Gehrke says.

The university also partners with the Delta Air Lines Propel program, which helps put students through the training program and into the carrier's ranks, he explains. "Prior to March, there was a pilot shortage, and then COVID hits and now they're furloughing," he laments, hoping there will be more opportunities for graduates in the near future.

The university uses its 2,100 square feet of leased space inside the new terminal to serve hundreds of students and 80 flight instructors. Previously, MTSU had simulation labs, maintenance shops, hangars and other facilities at the airport, but lacked classroom space. Since late August, students have been streaming in and out of the new classroom from 7 a.m. to 9 p.m. "It's really become a popular place," Gehrke reports.

Adding the MTSU classroom to the terminal helps blend various generations of aviation enthusiasts—something Gehrke sees as a valuable advantage. Students can mix with professional pilots from Murfreesboro and elsewhere, many of whom graduated from the very same program.

Overall, Gehrke says he is thrilled with MBT's new terminal, and so are the 172 people who work there and many more residents of the greater Murfreesboro community. "It is a beautiful scene—very representative of our community, inside and out," he remarks. "What was kind of an old, run-down looking terminal area has all of a sudden become modern, inviting and almost unrecognizable—in a great way!"

Airports of All Sizes Are Championing Diversity

BY NICOLE NELSON

BWI Baltimore/Washington International Thurgood Marshall Airport

LEE COUNTY PORT AUTHORITY
Southwest Florida International Airport

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FACTS&FIGURES

Project: Improving Industry Diversity

Program: ACI-NA Inclusion Champion Awards

Strategy: Celebrate proactive, innovative inclusion programs for workforce diversity, business contracting & outreach

2020 Airport Recipients: Baltimore/Washington Int'l Thurgood Marshall; Charleston Int'l; Southwest Florida Int'l

2020 Associate Recipient: HMSHost Corp.

Recently honored as the first recipient of the Leon C. Watkins "Guardian Award" for Excellence in Business Diversity, Ricky Smith knows a thing or two about inclusion.


RICKY SMITH SR.

"I am an airport CEO, but my ministry is minority development," says the executive director at Baltimore/Washington International Thurgood Marshall Airport (BWI). "I always look to make sure women and minorities have access to all of the opportunities that come across my desk."

Airports Council International-North America (ACI-NA) presented its inaugural Watkins Guardian Award to Smith for promoting the growth and evolution of minority- and women-owned businesses and suppliers, while also fostering advancement of civil rights and equal opportunities for all. The award is named for the late Leon Watkins, a ranking official with the FAA Office of Civil Rights who was instrumental in the inception of the Disadvantaged Business Enterprise (DBE) and Airport Concessions Disadvantaged Business Enterprise (ACDBE) programs.

"The number of protégés and mentees Mr. Watkins continues to have in the industry couldn't be counted on a *couple* of hands because he was so impactful in so many lives," Smith says, noting that he feels fortunate to be included in such enlightened company. "The award was already reputable, but to add Mr. Watkins' name to it added a level of prestige because of what Mr. Watkins stood for."

While Smith is humbled to have been singled out for the Guardian Award, he is even prouder that BWI received an ACI-NA Inclusion Champion Award. "It really represents the success in our organization and the work our entire team has engaged in," he says. "It is one thing to have diversity. It is another thing to have diversity *and* active inclusion in your organization."

Large Hub Inclusion Champ

As winner of the diversity award's large hub category, BWI was recognized for removing unnecessary and artificial barriers, particularly in the area of employment.

"I would argue that BWI Marshall has one of the most diverse management teams in the business," Smith says.

Since 2015, the airport has increased women in executive management 129%; and racial/ethnic diversity has grown in executive and senior management 300% and 64%, respectively.

On a broad level, Smith feels that many businesses overcomplicate the issue of inclusion. "The reality is that when you allow a true, level playing field—when you create an environment where people feel invited and like they belong in your organization, where women and minorities can compete to the same standards that are really important—women and minorities win out. They just do."

As a result, new hires at BWI tend to hail from diverse social and ethnic backgrounds.

And many are younger than the industry average. "When I recruit for managers, I am not looking for someone with 30 years of experience," Smith says. "I am focusing on competency, not just someone that has been in the room for a long time."

Smith also makes it his mission to help BWI's leadership team embrace the importance of making sure women and minorities are not subject to unnecessary barriers.

When it comes to selecting business partners, the airport strives to surpass minimum requirements outlined in federal, state and local regulations. For Smith, fostering relationships is the most natural approach to growing minority presence among vendors and suppliers. BWI's signature outreach event, Synergy, provides a daylong conference for existing and aspiring minority business owners to interact with established airport partners. Providing access to BWI's general contractors, professional service providers, airlines and tenants is a key.

"Non-governmental entities are in a better position to negotiate opportunities on the spot," Smith explains. "When we remove that barrier and those restrictions and allow these emerging minority-owned firms to deal directly with the larger prime firms and negotiate opportunities on the spot, we see a better outcome.

"Our experience has been that once minorities get the opportunity to show what they can do, they excel at the same rate that larger firms do. They just need the opportunity."

To further this cause, BWI partners with Fraport USA on a venture called LaunchPad. Since 2017, the program has helped nine local minority- and women-owned businesses open concessions kiosks at the airport.

BWI also sponsors its annual Summer Youth Initiative to stimulate career interests. Since the program's inception in 2015, it has introduced more than 250 underrepresented students to the aviation industry.

Small Hub Inclusion Champ

Charleston International Airport (CHS) in South Carolina won top honors in the small hub category of ACI-NA's diversity awards.


J. ELLIOTT SUMMEY

Airport Director and Chief Executive Officer J. Elliott Summey says that CHS nurtures and promotes women- and minority-owned businesses through initiatives such as its kiosk program, which gives small, "uniquely Charleston" businesses the opportunity to operate concessions at CHS. The airport also surpassed its goal of achieving 15% disadvantaged business enterprise participation during a recent parking deck project. Fully 19% were minority- or female-owned businesses.

"Having a diverse mix of businesses, entrepreneurs and employees leads to success at our airport, and in our community as well," remarks Summey. "Charleston is a very diverse place, and the airport should be reflective of its community."

He was especially delighted when the airport's "wildly successful" kiosk program led to an even bigger opportunity for one participant. Last year, the CHS Board of Directors approved an ACDBE venture between Delaware North and Charleston native Shawnalea Garvin. The resulting Cinnabon location was sweet success for both Garvin and Summey because it is the airport's first inline concession operated by a minority-owned business.

Summey is also proud that CHS harvests some of the region's best and brightest young minds through internship programs with historically black colleges and universities. Partnerships with South Carolina State University and other area schools have introduced minority students and recent graduates to CHS and the wider aviation industry.

Medium Hub Inclusion Champ

Southwest Florida International Airport (RSW), the medium hub Inclusion Champion, was lauded for its commitment to promoting full participation and proactive engagement in the community by hosting or co-sponsoring more than 60 events to assist 12,000+ small, women- and minority-owned businesses in the past five years. Moreover, the events yielded results. The Lee County Port Authority, which operates RSW and one other local airport, exceeded its DBE and ACDBE goals by an average of 10% every year during the same timeframe.

The Port Authority designed an Inclusions Program to improve workforce and hiring practices and developed several employee empowerment and educational programs.

For instance, the "Lunch & Learn" outreach and education program focuses on making employees a priority; and the ASPiRE program provides opportunities for personal development and self-fulfillment within the workplace.

An inclusion program to improve workplace practices is also in the works. Key components in development or being considered for implementation include:

- adopting gender-neutral language in performance management programs and job descriptions,
- initiating equal pay across the organization during the hiring process, and
- including cross-departmental employees in the interviewing process.

In addition, the Port Authority implemented an online certification, outreach and contract compliance system that increased the number of certified businesses enrolled.

"I am proud of the efforts our team makes to ensure we reach out to diverse business partners to make workforce inclusion part of our corporate culture and come up with new ways to engage with our local and aviation community to network and recruit employees and interns," says Ben Siegel, acting executive director of the Lee County Port Authority.


BEN SIEGEL

Outstanding Airport Partner

Travel restaurateur HMSHost Corp. was named the 2020 Associate Inclusion Champion.

Ron Gomes, vice president of Strategic Alliances for the company, notes that HSMHost has120 ACDBE joint venture and sublease partners that generated

$500 million of revenue in 2019. An informal mentoring program developed the same year helped guide promising suppliers and entrepreneurs in a focused effort to invest in ACDBE business capacity and supplier diversity.

"Our mentoring program helped identify and advance promising suppliers and entrepreneurs in a focused effort in invest in ACDBE business capacity and supplier diversity," says Gomes.

ACI-NA recognized HMSHost for the instrumental role it plays to include minority- and woman-owned general contractors. For instance, it helped Chicago's Bowa Construction become one of the first 100% African American-owned general contractors building concessions spaces at O'Hare International Airport.

"HMSHost was honored to receive the ACI-NA Associate Inclusion Champion Award in recognition of our continued efforts to foster diversity and inclusion throughout our business and employment practices," says Laura FitzRandolph, executive vice president and chief human resource officer. "This comes at an important time when we are planning for future growth around diversity initiatives that will drive success for our organization and the industry. As we continue to navigate through the challenging environment of today, we do so with a focus on tomorrow by building inclusive partnerships and a culture of equal opportunity."


LAURA FITZRANDOLPH

In Good Company

Debby McElroy, the longtime secretary of ACI-NA's Business Diversity Committee, says all of the 2020 award recipients deserve accolades for their comprehensive commitments to inclusion.

"We have been doing these awards since 2014 and I am always impressed with the caliber of the many nominations we get in," McElroy reflects. "We are celebrating organizations that have far exceeded aspirational goals and have made a commitment to expanding opportunities to contract with minority and women enterprises in their community."

She also stresses the importance of outreach programs that help develop the next generation of businesses and people to work at airports.

But it takes more than a single project or program to become an ACI-NA Inclusion Champion. "You must demonstrate a body of inclusionary work in all areas," says McElroy. "These awards signify a comprehensive commitment."

Urban Folk Art

Why did the chicken cross the road? To admire its pals on a mural at Gerald R. Ford International Airport (GRR) in Grand Rapids, MI.

Chickens Don't' Fly Too Much, by Reb Roberts, features repeating patterns of bold, stylized chickens and other animals that are on the move—just like the travelers who pass the 80-foot mural on their way in and out of Concourse A.

Art-savvy passengers instantly recognize the piece as a "Reb" due its signature style and, quite literally, the way the painter signs his pieces. Roberts, a self-taught artist, began painting similar murals on boarded up storefronts, in vacant lots and at construction zones throughout Grand Rapids in the 1990s. When his vibrant pieces started gaining commercial success, he and his wife founded The Sanctuary Folk Art Gallery, which sold his creations and also helped local artists experiencing economic hardship or homelessness by displaying their work.

Roberts' mural at GRR was funded by a grant from the Frey Foundation to showcase the talents of West Michigan artists. "For the past decade, it's been a dream of mine to have work displayed at Ford Airport," he comments.

The artist realized that dream by painting six hours a day for eight consecutive days. As he worked, passengers and employees often thanked him for sharing his talents.

Airport President/Chief Executive Officer Tory Richardson and other officials debuted Roberts' cheery, colorful creation last September. The following month, GRR unveiled a bronze statue of its namesake, former U.S. President Gerald R. Ford.

The Right Kind of Quiet

If you're like me, you may feel that your airport is a little too quiet right now. It's an all-too-tangible reminder of the reduced passenger activity brought about by the COVID-19 pandemic. The din of a busy airport is missing right now, and with it, all the things that come from a healthy, robust airport industry… employment, revenues, facility development, growth.

So this might seem an unusual time to be working on an initiative to make our terminals *even quieter*, but that's exactly what's happening at San Francisco International (SFO), through a program called "Quiet Airport." And the goal is to create an experience that is quiet for the *right* reasons, even when the day comes that we're busy again.

In truth, the Quiet Airport program actually started before the pandemic, at a time when SFO was setting new passenger traffic records each year. As terminals swelled with travelers, so, too, did all the familiar sounds of air travel… the distant rumble of aircraft, announcements and conversation in multiple languages, and the din of equipment, people and movement. As our activity levels grew, so, too, did the frequency of these sounds.

The concept of ambiance usually doesn't carry much weight in customer satisfaction surveys. More urgent topics, such as wait times, wayfinding and cleanliness usually drive how travelers feel. But for SFO, we found that ambiance was, in fact, relevant and played an important part in overall satisfaction. While our terminal renovation efforts had invested heavily in design and amenities, we realized that noise in our terminals was competing with, rather than complementing, these other considerations.

With this in mind, the SFO Customer Care team began the Quiet Airport program in 2018 with the creation of new policies for airport tenants to limit their sound footprints and establish guidelines around the use of music in tenant spaces. The following year, the team focused on a larger issue: how the airport, airlines and tenants were using the public address (PA) systems.

To tackle this issue, the team began with the area of greatest need: our International Terminal. Dozens of carriers share this facility, including the PA system, which was used heavily to make boarding calls, solicit passengers for document checks and announce multiple final boarding calls. As one of the fastest-growing airports for international traffic in the U.S., the din of overhead announcements was escalating to a roar, with over 200 PA system calls being made per day, lasting an average of 30 seconds each. During peak summer periods, guest complaints about these announcements outnumbered those about wait times and flight delays.

Airlines weren't the only source of overhead announcements at SFO. The system was also used to communicate paging requests on behalf of federal agencies, airport partners and the general public. While some of this content is necessary for safety and security purposes, broadcasting all such information through the airport was becoming ineffective.

To solve this, we established smaller paging zones, managed by our communications and dispatch center, which target the area appropriate for each message. Final boarding calls in pre-security areas were eliminated, and such calls in post-security areas were confined to a more realistic radius for passengers. We similarly focused gate change announcements on only the zones around the original and revised gates. As a result, the terminal-wide announcements that remained had greater emphasis.

Overall results have been very positive. Terminal-wide exposure to public announcements has been reduced by 77% with no noticeable impact on the quality of service or awareness of information. In the International Terminal alone, we estimate that more than 90 minutes of unnecessary announcements have been eliminated each day.

So when air travel does recover back to the levels we saw before the pandemic, we hope that travelers will find something that was previously harder to come by in our terminals: a little peace and quiet.

Ivar C. Satero *is the airport director at San Francisco International Airport. With more than 25 years of experience at SFO, he has led a wide variety of capital improvement projects, including the construction of new terminals, roadways, a light rail system, rapid transit into SFO and an on-airport hotel.*

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