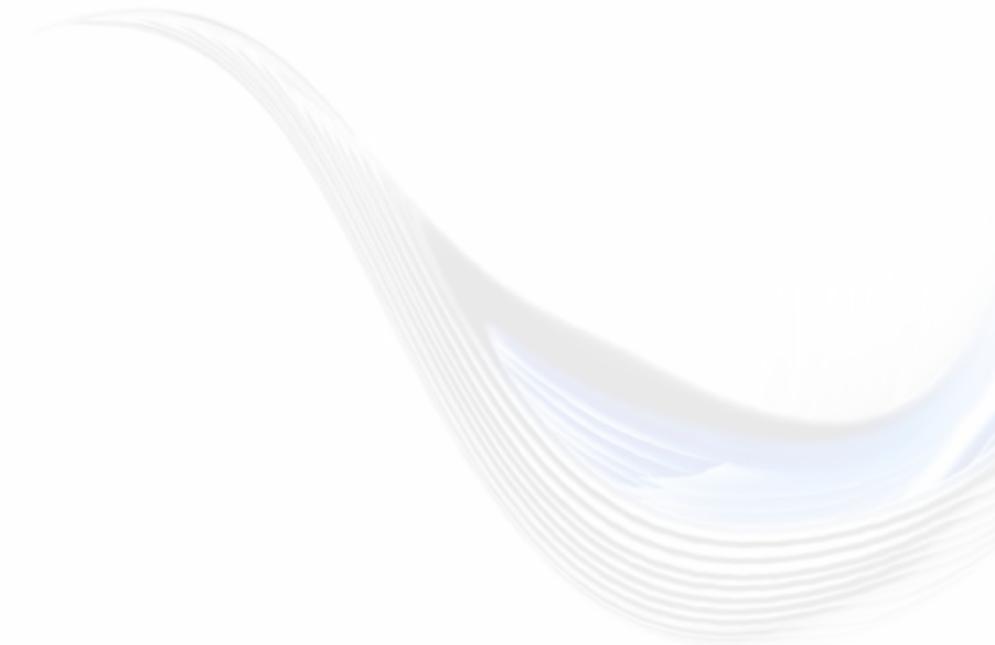**HNTB**

THE TERMINAL OF THE FUTURE
IS HAPPENING TODAY

(3RD EDITION)

By Thomas Rossbach, AIA
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The model of how passengers and airlines use airport terminals today is in a significant shift. Airlines continue to sell unbundled services, charging separately for checked bags, meals and premium seats on aircraft, while continuously finding ways through technology to improve customer service while reducing staff. The use of technology provides a method to be connected to passengers at all times through mobile devices and on-line commerce which increases airline productivity and reduces labor costs.

Passengers are growing more accustomed, or being conditioned, to perform transactions for themselves such as checking in at home, self-checking bags and being continuously updated via their mobile devices, and as a result passengers are finding that involvement in the process provides convenience and saves time and money.

A NEW "FLIGHT CHECK IN" PARADIGM

In the not too distant future airline agents in the airport terminal will be a thing of the past. Passengers will self-check in and tag their bags and retrieve boarding passes on their own through the Internet. For infrequent travelers a few roaming "customer service agents" will teach passengers how to self-check in and board themselves.

Interactive terminal signage and video walls imbedded in the architecture of the terminal building will direct and aid passengers on how to check in and where to find the security checkpoint.

This is evidenced by statistics in the historical shifting of how passengers check in for a flight, going from traditional agent assistance in the ticket lobby, to self-serve e-kiosks for boarding passes, to "remote" online check in, and now to a complete self-serve bag tag and check in process. Today, over 60 percent of passengers check in

on-line remotely from the airport. Half of the remaining passengers use e-kiosks in the ticket lobby and less than 22 percent go to an agent at a ticket counter to complete the transaction of their checked bags.

Self bag tagging and check in has quickly become the new reality where the passenger weighs their own bag, checks in via a kiosk, prints the bag tags, places the bag tag on the bag, prints a boarding pass and simply drops the bag on a conveyor input device, where an airline baggage handler (not an agent) confirms bag fees have been paid, checks the passenger's ID and that the passenger and the bags match. The passenger quickly heads to security and the baggage handler activates the bag tag then pushes a button to send the bag to the screening and outbound baggage make-up system.

These first generation self bag check in pilot tests have shown it reduces passenger queuing and processing time by 60 percent and reduces airline staff by half. HNTB is currently planning and designing a terminal check in system for a global airline which will take this to the next level of simplicity. The future check in processes will enable all check-in processing to be performed remote from the airport. This will include the use of home bag tag printing in which the passenger inserts the home printed tag into a standard plastic sleeve attached to the passenger's luggage. The standard sleeve holder would be purchased from a convenience store, or come attached with the purchase of new luggage. The passenger upon entering the terminal places the bag on a conveyor/scale input drop point where the bag is weighed (if too heavy the extra bag fee is paid with a credit card), next the passenger scans his ID and

after the match of the passenger and bag is confirmed the conveyor starts and inserts the bag into the baggage system. For frequent flyers a programmable electronic bag tag will be used. This "Kindle-type" device will use Blue-tooth or Near Field Communication technology from the passenger's mobile device to display the bag tag barcode from the mobile sourced check-in. With each new trip the tag is reprogrammed for the new destination.

The ticket lobby will take on a much different configuration with pods of self-serve kiosks and baggage input stations, and luggage stations (to allow re-packing avoid overweight bags) for passengers to check in. There will be very few full service 'traditional counters" as passengers are encouraged to attempt self-service first.

Providing customer service to passengers is paramount in today's terminal design. The airport terminal of the future will have dispersed check in locations for both "carry-on only" passengers and full-checked baggage passengers. This will include potential locations such as in parking garages, at the terminal curb, in the pedestrian bridges, in a transit center next to the terminal, and kiosks located on other levels of the terminal. Check in kiosks and bag drops will be strategically placed in the path of passenger flow from the various interface points of the modes of ground transportation to the terminal and on the way to the security checkpoint.

THE FUTURE OF BAGGAGE SYSTEMS IN TERMINALS

Technology improvements will also streamline the screening and processing of checked bags from the passenger drop location all the way to the belly of the aircraft. Technology exists that will enable luggage to be purchased with a permanent "Kindle-type" GPS tracking tag electronically linked to the passenger. Both the airline and the passenger will be able to track the bag in real time with their respective mobile devices. From their aircraft seats, passengers will be able to confirm their bag is actually in the aircraft hold below, before the aircraft pushes back from the gate.

The Transportation Security Administration also is making advances in explosive detection screening technology for bags that increases throughput

of screening bags. This will reduce the number of expensive explosion detection devices required, while simultaneously processing an ever greater number of bags. This also reduces the building space footprint necessary for the screening operation. With "kindle-type" electronic tags GPS tracking, lost bags will be virtually eliminated. Airlines are already using hand-held scanners to confirm which bags are being loaded into each aircraft belly on the ramp.

Tote tilt tray baggage handling systems are replacing standard conveyor belt systems as HNTB is implementing in the new Orlando international Airport South Terminal project. These systems are more reliable delivering 99 percent of bags to the proper baggage destination and require less building area which reduce costs of terminal projects.

Baggage systems are also being designed to be much more energy efficient with highly efficient motors and automated shutdown sensors and systems to reduce electrical power consumption when baggage systems are not being used.

PASSENGER SECURITY SCREENING CHECKPOINT

The departure lobby of the terminal building is changing. Less room is required for ticketing lobbies as more passengers check-in prior to arriving at the airport, and less queuing is needed with the advance of the self bag check process. Passenger security screening, however, continues to consume space both for queuing

and for the screening process. And with the emphasis on expanding the passenger pre-check screening to 50 percent of all passengers the throughput rate for screening will improve significantly. As the TSA employs more soft analytic security techniques to interview passengers, conduct risk assessments and observe passenger behavior prior to the security screening the screening rate also improves.

Airport terminal design architects working in conjunction with the TSA have made great strides in creating passenger screening checkpoints that are efficient, comfortable and easy to manage for passengers. This includes creating flooring which is comfortable for passengers without shoes, providing soothing and comfortable lighting, designing ample room for passengers divesting their personal items prior to the screening devices and TSA processing equipment, creating private search rooms, and creating a pleasant area with comfortable seats for passengers to compose themselves after completing the screening process. HVAC systems are specifically designed for the concentrated queuing areas to adequately "sense" and provide environmental comfort for the large crowds of people while waiting for the screening. Amenities such as water bottle refill stations or concessions which are adjacent to the recomposing area are important since passengers may have been compelled to dispose items in the screening process. In the recomposing area access to flight information and intuitive wayfinding within a pleasing architectural environment will guide passengers to concessions and gates without an overabundance of signage.

The TSA is continuing to develop new processes and technology at the checkpoints to provide better customer service while fully screening all passengers. This includes automatic bin return systems, secondary conveyors and inspection stations for suspect bags, so that non-suspect bags are not delayed for the majority of passengers.

Future sophisticated security checkpoint equipment will not require passengers to divest all their belongings from the bags or their person, which will speed up the screening and post-screening process.

IMPROVING U.S. CUSTOMS AND BORDER PROTECTION PROCESSING THROUGH TECHNOLOGY AND DESIGN INNOVATION

U.S. Customs and Border Protection as an agency of the Department of Homeland Security has experienced reductions in staff due to federal budget cuts. HNTB is assisting three major international airports to improve the throughput of processing arriving international passengers by recommending and implementing new technology through Automated Passport Control kiosks and Mobile Passport Control technology. These technologies eliminate the paper forms that arriving passengers must fill out upon entering the United States. The new systems are much more efficient reducing passenger queuing time and processing time by 33 percent. In the future passengers will be able to fill out forms electronically while on the aircraft in route to the U.S. airport destination through a mobile internet application, further reducing processing time. HNTB performs processing modeling to evaluate the transaction times and to redesign the CBP facility to maximize the throughput of the facility without increasing CBP labor.

Further, HNTB has implemented a unique design for U.S. CBP facilities called "Bag Claim First". This system eliminates the two separate queues for passengers arriving into the U.S. Traditionally, passengers first queue for immigration, then claim their bag, and finally queue for secondary customs inspection/exit control from Customs. The innovative process HNTB has designed, passengers claim bags first and proceed to just one queue for passengers to clear all immigration, customs processing and exit control. This reduces building area, reduces wait time for passengers and reduces U.S. CBP staff levels.

HNTB's innovations have gone one step further in the design of the passenger arrival

experience at Orlando International Airport by flipping the baggage claim to the top level of the new South Terminal which offers beautiful daylit views for arriving passengers rather than arriving in a dim lower level as we see at most existing airports today. These innovations all focus on enhancing the customer experience and designing more innovative and efficient processes for passengers.

FOCUS ON THE PASSENGER EXPERIENCE THROUGH THE USE OF TECHNOLOGY

Terminal buildings and their operations are more business focused, providing services and amenities that passengers want with a high level of customer service. Technology will continue to drive innovation in our travel experience. At the heart of this technological revolution is the more "informed" passenger. The digitally connected passenger of today demands information and services delivered on their preferred personal computing device at all points of their journey and specifically inside the airport terminal. Silos of stand-alone automation are being replaced with integrated systems that allow the exchange of information between the airline, airport ground handlers and customer. For airlines and airports the emerging mobile computing platforms provide a new way to communicate and control passenger flow. This includes more accurate and instantaneous information on flight arrival and departures

sent directly to passengers mobile devices. Airlines can manage the passengers' expectations if they keep them constantly informed on flight status. This includes information on flight delays, gate changes, overbooking and irregular operations management. In addition, passengers would have the capability with their mobile devices to order on-line and pay on-line for food and drinks they want on the flight, which will be waiting for them on the aircraft.

With mobile connectivity via GPS technology, passenger location information also can be used by the terminal building automation system to control cooling and heating based on where passengers actually are in the terminal. This in turn saves energy, operations and maintenance costs for the airport terminal building, which improves the bottom line for the airport.

Mobile technology can go further to providing customer service, where an airport retailer can target specific mobile promotions based on the customer's precise location in the terminal. As retailers offer specific targeted mobile promotions to airport terminal visitors, passengers will come to expect this same type of one-to-one marketing at the airport. In the future, authorized airport advertisers could also be customized to send on mobile offers with a portion of the revenue going to the airport. As passengers walk past certain interactive advertising displays the electronic ads will change for each customer.

A MORE "SYNERGIZED" CONCESSION MARKETPLACE

A synergistic concession marketplace within terminal buildings is the future in maximizing the revenue from passengers by incorporating food and beverage venues, retail stores, customer service providers, entertainment, integrated art and interactive advertizing in a space that interacts with all components. It generates more excitement and choices for passengers and increases revenue opportunities for the airport. Airports such as Austin-Bergstrom, Atlanta and San Diego provide entertainment in conjunction with their combined food and beverage and retail hubs within their terminals to draw passengers to stores. HNTB achieved this in the design of a new "Sunset Cove" synergy market at Terminal Two at San Diego International Airport. With a great view to the airfield and the integrated art, entertainment and shopping are co-located to raise the revenue synergistically for the airport in one centralized space with easy access to

multiple gates. In the future, as flight information and announcements from the agents at the gate are broadcast via each passenger's mobile devices, passengers will be able to stay at the marketplace until the very last moment of their assigned boarding time. Each passenger will be sent a countdown clock to the exact time it is their turn to board. And in an event of a delay, passengers can feel comfortable leaving the gate area to spend more on concessions because they will be notified via their mobile device alert when the new boarding time will occur.

As public eating habits continue to move towards achieving a more healthy body and the reduction of obesity, healthier food choices will be available at airport concessions, with calorie and food preparation information provided. This will require the terminal design to dedicate a larger back of house kitchen space in order to prepare fresh food in lieu of pre-prepared food made off-site.

The terminal food and beverage vendor menus will be easily accessed via locally broadcast to mobile devices so passengers can order without waiting in a line. For example, a passenger waiting in the security screening queue could order and pay on-line from a mobile device, and then stop by the concession counter, on the way to the gate, to pick it up. Advertising for the airport concessions would also be provided in the security queue and other pre-screening locations.

THE DIGITAL PASSENGER EXPERIENCE

Passengers are being entertained more than ever before with innovative digital experiences in airport terminals. These experiences offer a new source of revenue to the airport via corporate sponsorship or direct advertising, but blend that experience with interactive entertainment and public art. HNTB assisted in the design at Tom Bradley International Terminal's digital experience at LAX and is completing an interactive digital design at Orlando and Denver Airports. These interactive digital experiences bring the "sense of place" of each city to its passengers and visitors while raising the bottom line for the airport.

DEPARTURE LOUNGES AND SELF BOARDING

Airlines are researching and experimenting with self-boarding at departure lounges. Passengers in the future will "self-board" through control gates at the gate door at the boarding bridge. A few roaming customer service agents or security personnel will teach passengers how to self-board by swiping their mobile device or boarding pass. Airline agents will primarily be engaged in specialty passenger issues, accommodating upgrades for passengers and conducting airline pre-flight tasks rather than checking in passengers at the loading bridge door. Interactive terminal signage and video walls integrated into the interior architecture of the departure lounges will aid and

direct passengers to the boarding process. Self-boarding and self-ticketing check in will substantially reduce airline personnel in the terminal, thus reducing labor costs.

To respond to the highest complaint identified through airport passenger surveys, airport terminal designers are

providing ample electrical outlets for passengers in the departure lounges for charging of mobile equipment that every passenger carries today. Some new terminal designs provide an outlet within reach of every passenger seat or workstation. Stand-up and sit-down workstations are also an amenity business professionals appreciate while waiting in the departure lounge.

Airport departure lounges will have interactive electronic "destination" advertising monitors for passengers. The advertising will change automatically since it is linked to the flight information display system for every new flight in each departure lounge, based on the destination. This will be another source of revenue for the airport. The airport business manager will seek out tourism businesses at the destination sites to advertize in real time to the passengers destined to that location.

SUSTAINABILITY – HIGH PERFORMING BUILDINGS

Airports will continue to focus on operating and constructing new terminal facilities which represent the airport as a leader in sustainable stewardship. However, the focus is shifting from achieving Leadership Energy and Environmental Design certification to analyzing true return-on-investment for sustainable and energy strategies.

This will include on-site alternative energy generation, energy conservation strategies and more energy efficient baggage handling systems. HNTB provided this analysis at San Diego International Airport by analyzing a myriad of energy saving and generating strategies and calculating the net present value return-on-investment for the airport to select the best strategies with the highest payback. This resulted in San Diego Airport's Terminal 2 West achieving the highest sustainable rating and the first LEED Platinum commercial terminal in the world.

Alternative energy technologies are developing rapidly. In the future "quantum dot" photovoltaic integrated building skin and roof panels will enable all the sun exposed airport terminal building surfaces to generate electricity at double the efficiency of today's commercial solar cells. And they won't even look like solar panels. Thermal energy storage systems and other energy strategies will be commonplace for airports.

Terminal design today incorporates recycling centers in the terminal complex for airline aircraft waste, general terminal building waste and concession vendor waste including the composting of coffee grounds and recycling of glass and aluminum. Daylighting strategies will use more daylight with artificial lighting controls to automatically dim or shut off lighting in the terminal when it is not needed. The use of geothermal wells, thermal storage tank systems and solar panels on terminals are just some of the cutting edge sustainable systems HNTB has implemented at airports around the country.

LANDSIDE ENHANCEMENTS

As check-in lobbies continue to shrink due to mobile technology and remote self-check in, the amount of terminal building interior linear, check-in frontage declines as passengers progressively spend less time in the check-in lobby. However the landside curbfront demand does not decline and will certainly continue increase. There is a limit to how much the terminal building front entry length can be reduced, while still allowing enough curbfront length to accommodate peak hour originating passenger vehicles.

HNTB has innovated a new "Express Curb" at Tampa International Airport where passengers who have checked in remotely, and have "carry-on only" bags, by-pass the ticket lobby altogether and proceed directly to security speeding their journey to the gate.

Terminals in the future need to be seamlessly connected to the ground transportation infrastructure. Landside roadway curbs, transit stations and multi-modal transit centers must be integrated with the airport terminal to make the total travel experience simple and convenient for passengers. This includes providing passenger amenities within these facilities. The terminal of the future will have baggage systems incorporated with the transit station and the multimodal transit center where baggage feeds placed in these locations are linked to the screening and baggage make up system in the terminal.

TNC'S AND AUTONOMOUS VEHICLES

Transportation network companies (e.g., Uber and Lyft) and autonomous vehicles will be a disruptor for the airport landside. As more passengers choose to abandon their personal vehicles, parking demand will drop and curb congestion will grow. Parking decks may have to be repurposed for added curb front and marshalling access for passengers seeking their TNC car or their autonomous vehicle. Airports may begin tolling airport access roads for access to the curb and to compensate for lower parking revenues.

In the near future autonomous bus-train vehicles may replace Airport People Mover systems since they need no guideway, no fixed electrical power or connected maintenance facilities. HNTB is currently innovating these concepts with three large hub airports to solve their APM transit challenges.

To be a terminal of the future means to focus on customer service for the passenger by embracing the trends discussed in this discussion. However, the designer must be able to envision not only what is needed today but anticipate what will be needed in the future.

Traveling through airport terminals can once again be the fun and easy experience it used to be, while accommodating future technologies and processes, and energizing and recreating the allure and adventure of air travel. ▪

Quick Check-in

"Traveling through airport terminals can once again be the fun and easy experience it used to be, while accommodating future technologies and processes, and energizing and recreating the allure and adventure of air travel."

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