Planning *Future-Proof Airports*





AVIATION ARTICLE COLLECTIONS

Planning Future-Proof Airports

Implementing Clean Technologies

Embracing Advanced Air Mobility

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Moving Forward, Full Throttle, Wheels Up



Successful airports of the future will be agile airports. A range of factors—from the global pandemic to rapid technological advancements—requires airports to adapt and respond effectively. Another key factor is climate change, which is driving the need to implement net-zero practices for all elements of airports, from terminals and landside vehicles to aircraft and ground support equipment. Airports are under pressure, not only to develop infrastructure that supports projected travel demand but also to reduce carbon footprints.

Utilization of fossil-free energy sources—electric and hydrogen technologies and sustainable aviation fuel—is essential to connect more communities and advance equitable solutions while supporting sustainable growth. The challenge is to move forward as these clean technologies mature, enabling the development of new transportation services such as advanced air mobility.

We are pleased to offer WSP aviation insights on how to turn envisioned higher-level futures into 21st-century realities.

Here's to an exciting future for aviation.



Eric Peissel
Global Director, Transport & Infrastructure

1

Agility Underpins Future-Proof Airports

Providing spaces and services to support future travel demand and changing passenger preferences



October 13, 2021

Tim Morrison
Aviation Director
United Kingdom

Airports are at a crossroads, challenged to make decisions that will shape a strong future in the aftermath of the COVID-19 pandemic. Moving forward from a severely disrupted airport ecosystem requires a new way of thinking that incorporates agility at the core of all efforts.

What does agility involve? How can agility prepare airports for rebounds in air travel and effective response to heightened passenger expectations? In the following Q&A, Tim Morrison, Aviation Director, WSP in the UK, discusses how this capability can facilitate sustained positive change and support performance for years to come.

What is agility in the context of an airport, and why is it essential?

Tim Morrison: Agility is the power to adapt and adjust in a timely way; it is also the ability to anticipate and be responsive to customer needs. Agility requires an airport planning strategy that builds in flexibility.

An agile airport combines several key actions: embracing digitalization to improve operations and continuously advance the passenger experience; adapting to different economic models; and deploying Modern Methods of Construction [MMC] during redevelopment—all within an overarching decarbonization wrapper.

To be fully agile towards achieving optimal continuous service, each of these facets must reach their full potential. Taking a Future Ready[1] perspective will enable the best possible impact. Future Ready considers key trends—related to society, climate, resources, and technology—when making decisions to support today's and tomorrow's needs.

Airports are dynamic ecosystems, able to respond to change while also being catalysts for change. This dynamism has already been demonstrated in various ways, such as their finance structure, be it public or private or a combination of them; the application of technology enabling seamless home-airport-destination travel experiences as well as contactless security and CT [computerized tomography] scanning; and the generation of opportunities to advance the airport experience rather than encouraging passengers to rush through, to and from the gate. Airports have long embraced DfMA [Design for Manufacture and Assembly]; this MMC philosophy is the best way to expand and redevelop airports whilst maintaining operations. Utilizing pre-assembled modules—a kit of parts—is key. Looking into the future, facilities should embrace re-using a given kit of parts over and over again in different configurations to suit varying spatial requirements. This re-use practice, a natural extension of the MMC approach, enables projects to drive down the use of raw materials and reinforces the circular economy mindset too.

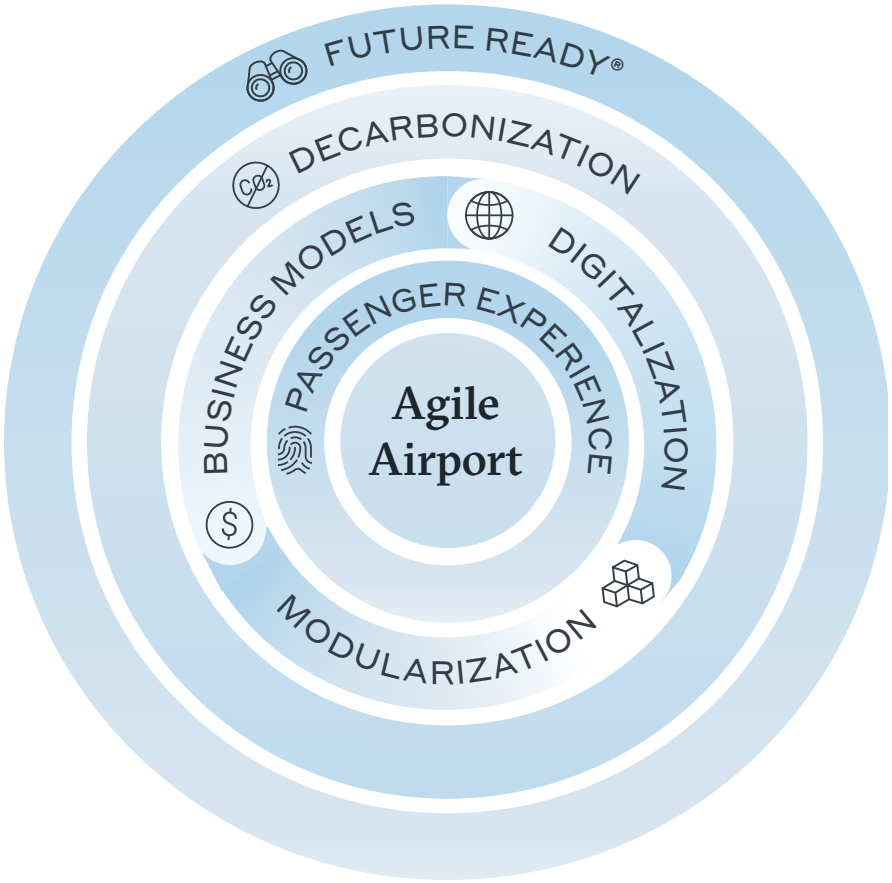


Figure 1 – Key aspects to develop agile airport ecosystems

1 Future Ready is WSP's global innovation program. Future Ready® is a registered trademark of WSP Global Inc. in Canada and New Zealand. WSP Future Ready (logo)® is a registered trademark of WSP Global Inc. in Europe, Australia and in the United Kingdom.

The impact of COVID-19 continues to test response and recovery capabilities across sectors and societies. How can airports leverage this experience as they move forward?

Tim Morrison: The last year has clearly demonstrated the importance of being agile or nimble, words not typically associated with airport infrastructure.

This agility is a function of mindset and behaviour and of the physical infrastructure. Experience over the past year has promoted a rethink regarding our surroundings and how to carry out business in an environment that will require business and industry to rapidly respond to more unexpected events; future occurrences will likely necessitate expediting or modifying plans to accommodate new needs.

Certainly, 2020 presented new considerations, such as how to integrate testing centres, quarantine hotels, alternative queuing; and how to use robots to maintain hygiene standards safeguarding staff and the public; it has also underlined the need for airports around the world to operate as highly diverse businesses in order to cope with the drop-off of traditional aeronautical revenues. Alternative non-aeronautical revenue opportunities include conference facilities, hotels, public arenas, sports facilities, pick-up points for internet retailers, leisure facilities, food and beverage destinations, quick-change stands or pop ups, and even pet kennels.

The agile mindset will help airports to embrace diversification of the traditional airport landscape. Contemporary airport designs have been exploring potential uses of airport spaces within and around these sizable built assets to make airports a destination and help them integrate further into their adjacent communities. This process started some years before the pandemic and will likely accelerate now—the pandemic has highlighted the vulnerability of non-aeronautical revenue generation, which has typically been associated with the flying passenger.

You mentioned that agility is not typically associated with airport infrastructure. Can you explore agility in relation to new assets and existing assets?

Tim Morrison: Airports represent a massive investment in fixed assets. These assets—terminals, runways, taxiways, carparks, rail stations, offices—are all built with a purpose and a lifespan. To be competitive, airports will increasingly need to repurpose these assets—to reinvent the uses of the assets and/or ensure they can expand or contract over time to support travel demand[2] and changing passenger preferences. The art of agility is to ensure the output solution to the original brief is not so rigid that the use is singular and therefore prevents any other use in the future, thus requiring a demolition to start again. This adaptability does not need to be accompanied by an increase in capital costs. In fact, the valuation of the built assets when they have this inherent adaptability will be greater as they will not have the traditional shelf life.

This 'loose fit' response to the brief does require a way of thinking that supports flexibility from the planning stage of infrastructure projects through the lifecycle of the asset. Using a digital toolkit, we are now more than ever able to create scenarios for well-considered decision-making. Indeed, the 'what if permutations are aplenty. The application of the digital tools by innovative thinkers also allows assessment of the asset's investment value in terms of the embodied carbon, not just the operational carbon. This whole-life carbon approach to development analysis will come to the fore as aviation endeavours to meet its 'license to grow' challenge. Whole-life carbon assessment is the rapidly emerging environmental measure associated with the built environment. This approach broadens consideration of carbon emissions, moving away from the focus on operational carbon in decision-making to tackle embodied carbon. Unlike operational carbon, which can be improved during the lifetime of a building, embodied carbon is all the emissions associated with the materials used—arising from extraction, manufacturing, transportation, installation, maintenance, and disposal.

The whole-life carbon analytical approach to the use of existing assets based on criteria such as embodied carbon will be driven by use of alternative materials in designs and digital tools that support such innovative applications.

2 "The Impact of COVID-19 on the airport business and the path to recovery," Advisory Bulletins, Airports Council International (ACI), March 25, 2021.

What lasting positive change can an agile mindset bring to the severely disrupted airport ecosystem?

Tim Morrison: While the pandemic experience has been harrowing, it has also presented opportunity to explore how to take stock and ensure we build back in ways that allow us to integrate fast-moving initiatives, especially those related to creating greener flight. This imperative requires collaborative efforts to accelerate the use of sustainable aviation fuel (SAF) and embark on paths to embrace hydrogen infrastructure and electrification of built assets, specifically ground support equipment and aircraft and; there is also a need to determine how to incorporate AAM [advanced air mobility] into the airport matrix. Each of these functions requires foresight, a will to embrace change and an appreciation of the transition periods. None of these will be overnight interventions; they will develop and co-exist for many years alongside existing infrastructure.

These green initiatives are key to meeting sustainability objectives and supporting the 2050 net-zero goal. There is a nice circularity here when considering these future aviation fuels and the local community; airports could also become the local hydrogen vehicle refuelling station and electric vehicle recharging facility, offering business diversification and a service to the local community.

As travel rebounds at different paces around the world, successful airports will be agile airports—those with adaptable physical infrastructure that enables effective response to changing circumstances resulting from a range of factors, be they economic or political events, a seismic mood change in retail, climatic disruptions, a national or international security incident, or a global pandemic.

Contact



Tim Morrison
Aviation Director
United Kingdom
Tim.Morrison@wsp.com

2

Frictionless Travel to, from and within Airports

Key factors to improve experiences for all travellers



February 22, 2023

In the following Q&A, WSP aviation advisors explore ways to create smooth, convenient and pleasurable travel experiences.

Bosco Rodrigues
Global Airport Planning and Advisory Director
United Kingdom

Larry Schneider
Senior Vice President and National Aviation Senior Director
USA

Alexander Jackson
Assistant Vice President, Aviation Project Management
USA

Alberto Ruiz
National Director, Transportation Systems
Canada

What overarching idea should guide efforts to create a high-quality travel experience?

Bosco Rodrigues: The travel experience has been closely associated with airports themselves, but the experience actually begins and ends where passengers, and meeters and greeters, start and complete their journeys. Historically, transportation to and from airports, has been seen as a perfunctory activity, generally devoid of any sense of enjoyment or even thrill. This is where the concept of a "frictionless traveller experience" can change the focus and overall outcome. The considerations for a frictionless experience are wide-ranging, spanning journey planning and the geographical distance covered by each traveller.

Can you explore the main considerations to foster frictionless travel?

Bosco Rodrigues: Technology—more specifically, digital concepts such as smart baggage check-in, wayfinding and biometrics-enabled security—is minimizing steps and removing interruptions that have traditionally complicated journeys and added stress. This process will be continually enhanced by ongoing technology advancements, to provide overall service improvement and help shape a smooth, convenient and pleasurable experience.

Creating frictionless travel also means extending our view beyond the destination airport to the surface access links relative to pedestrians, cyclists, roadways, rail and air. This multimodal perspective is needed to support people's changing travel preferences and mobility options. By viewing airports as part of communities, rather than isolated from them, decision-makers would position airports within the scope of planning efforts to develop integrated multimodal systems. Airports will then factor into transport capacity requirements and social equity considerations to advance accessible transport for all people and communities.

This perspective also embraces the needs presented by decarbonization and urbanization as well as the opportunities enabled by digitalization. Smart apps are enabling the selection of options, comparing different forms of transportation based on cost, journey times, carbon emissions and even health benefits. As rebounds in air travel continue, these considerations will play a larger role.

Another consideration is advanced air mobility [AAM]. As AAM emerges as a viable mode option locally and regionally, it can also become part of a linked network of mobility as a service [MaaS] offers, along with bus, rail and micromobility modes. AAM will then contribute to an increasing array of public and personal transport choices, facilitating the means of access to and from airports and informing how we harmonize airports into urban and rural areas.

Given these varied considerations, how can airports support an integrated multimodal experience?

Larry Schneider: There are many avenues to creating an integrated multimodal experience, and, as Bosco noted, technology is a key factor. As a point of reference in the United States, where more airports are making advancements technologically, Orlando International Airport [MCO] is notable because it continues to embrace technology. Facial recognition is used for arrivals and departures and will soon be implemented across all modes of transportation, allowing passengers an easier transition. In addition to biometrics, other technological applications include RFID [radio frequency identification] tracking, which is embedded in the new independent carrier baggage handling system, and a virtual ramp control system, which guides the planes in and out of the gate through all weather conditions.

The next evolutionary step for airports advancing seamless travel is a one-ticket pass, which can be an application on a phone or a physical ticket. The one-ticket pass would allow people to exit one mode of transportation and enter another without waiting in line for a new ticket.

Bosco Rodrigues: It's important to note that airports around the world are at different points in their journeys, implementing varying levels of technology. Accordingly, the frictionless experience will be achieved at different paces. Heathrow Airport is an example often cited as a 24/7 vibrant transportation hub, offering boundless opportunity to create a frictionless multimodal experience between a myriad of mobility services, including pedestrian, high-speed rail, commuter trains, metro, bus, car, coach, taxis, car rental, shuttles, and eventually air taxis. A common challenge for airports in similar situations is not just connecting different forms of mobility but making the connection effortless for travellers, which is already an aim of cutting-edge projects such as the new Neom International Airport and, at a more personalised level, the Red Sea International Airport, both in Saudi Arabia—where WSP advised relative to integrated multimodal travel to support frictionless travel.

Alexander Jackson: As Bosco stated earlier, in order to foster multimodal options to and from airports, airports need to be integrated into the local community. This integration begins with purposeful collaboration between airport leadership teams and local transit authorities. Most US airports function as individual entities, even if they are part of a city or port authority that may oversee other transportation modes. Creating a platform to discuss common goals in developing multimodal transportation systems is the first step for airport leaders to take in building a more inclusive community environment at a local or regional level.

How else can airports foster frictionless journeys for all travellers to, from and within airports?

Larry Schneider: Advancing inclusive transportation involves a host of considerations, and one of them is how to create spaces designed to help all people navigate more easily.

More than one frictionless ticketing solution is likely needed because people with different disabilities—auditory, physical and visual—must be accommodated, and each disability may require a specific solution. Biometrics plays a key role to eliminate the need to hold a ticket or a phone. Planners and designers can explore how our senses, through sound, light and touch, can guide paths between different modes of transportation. Currently in the ADA, or American with Disabilities Act, there are audio and visual requirements; use of sound and light can be further explored to provide options that support navigation for all people. Recognition memory can be enhanced using music and lights, for example, allowing people to draw from sensory experience to assist them at different airports or multimodal locations around the world if the same patterns are used. We can also borrow ideas from the natural environment, to incorporate calming influences to help those who find travel a stressful experience. Aesthetics plays a large role in forming what MCO calls "The Orlando Experience" by instilling a sense of place through natural light, foliage and water elements.

There are layers to supporting accessibility and inclusivity—the design of spaces and infrastructure, the technology used and how airports collaborate to share effective approaches.

A cross-disciplinary group of professionals, including architects, engineers, planners and environmentalists, can drive progress by looking at the patterns of movement between modes of transportation to help the industry understand the diverse human needs involved to create a truly frictionless approach for all travellers.

Alexander Jackson: Keeping in mind that frictionless travel will rely extensively on technology, it is important for airports to consider that not all travellers have the same technological understanding or capabilities. In order to foster an environment that works for everyone, product selections and guiding philosophies need to consider intuitive solutions that streamline the facility while ensuring that they work with all types of devices or have opportunities for those who may not carry a smartphone.

Bosco Rodrigues: An airport's business and pricing strategy also has a part to play in developing inclusive transportation. For example, Heathrow Airport offers free or heavily subsidized travel at and to and from the airport aimed at staff and passengers travelling to and between its passenger terminal buildings. Such initiatives have tapped into an employee base who may otherwise have struggled to afford travel to work at the airport. Airports outside of the UK have followed a similar path to embed themselves in the local community.

Turning our attention to promising aviation technologies, what can airports do now to take into consideration the advent of advanced air mobility?

Larry Schneider: For some time now, airports in the USA have been master planning for emerging electric, alternative fuel and advanced air mobility. As part of the planning exercise, airports are working with their local power utility companies to increase electric power. This may seem like a simple task, but the power grid was not designed to accommodate emerging electric aircraft, such as eVTOLs and electric vehicles. Capacity and resilience of existing electric distribution grids will increasingly become a priority for airports modernizing their infrastructure systems.

Alberto Ruiz: This need must be considered within the wider context of business diversification to support a multimodal approach that enables expanded access so that all passengers can make choices for their mobility needs. Airport operators are tasked with applying, and expanding, funding sources to advance plans relative to passenger movement within the terminal as well as from public transportation areas, offsite parking lots and car rental areas—not to mention having to fit everything within existing land constraints.

One of the first steps in support of shaping their capital programs is for airport operators to define their business approach, which will entail reimagining their business models. In support of sustainable responsibility, it will be necessary for airport operators to explore and take into consideration the repurposing of existing infrastructure on airport property to be used in a multimodal approach. Internal business-line

stakeholders in collaboration with their engineering teams would first assess existing infrastructure and conduct feasibility studies to help determine how to repurpose assets while, in parallel, understanding the challenges that will arise during that process.

Prior to the implementation of emerging eVTOLs and electrification of the industry, a key step, as Alexander noted earlier, will be purposeful collaboration, where local and commercial airports work closely with government and city councils. With the industry on the verge of considerable change, the question is, Will airports adapt quickly enough to stay on pace? Airport authorities and operators should continually revisit their business models to strengthen aeronautical revenue streams, with heightened attention to increasing non-aeronautical revenues. In order to provide a seamless passenger experience, airports require simplified access to city cores; it is crucial for airport master plans to include integration of new technologies such as eVTOLs and rapid transit connections as part of their multimodal approach.

Bosco Rodrigues: I agree with Alberto, reassessing an airport's business model is important. Transition is key for existing airports, whilst new, or greenfield, airports such as Neom International Airport will need to decide whether to construct a fully developed Future Ready®[1] airport design or include legacy fuels and means of propulsion for both advanced air mobility and surface access with a plan to swiftly transition as the market, regulation, governments and business dictate.

1 Future Ready® is WSPs global innovation program that seeks to better understand the key trends in climate change, society, technology, and resources and how they are impacting our world, locally and globally. Future Ready® is a registered trademark of WSP Global Inc. in Canada and New Zealand. WSP Future Ready (logo)® is a registered trademark of WSP Global Inc. in Europe, Australia and in the United Kingdom.

Advanced Air Mobility and eVTOLs are more evolution than revolution in aviation planning, operations and infrastructure, sharing common attributes with existing aircraft such as helicopters and general or business aviation aircraft. So, what makes them different? I would argue it's purely the means of propulsion—electric and SAFs [sustainable aviation fuels].

Solutions that accommodate the future needs of airports will require integrating them into the urban fabric. This will involve connecting an airport's existing surface access network—rail, including metro and local trains, coach and transit bus—with city transportation systems, helping to create a truly integrated, frictionless multimodal experience centred around, but which may ultimately outgrow, the airport.

Alexander Jackson: As part of this process, it is also essential to look beyond the physical infrastructure. As digital systems become more prevalent and relied upon, the associated risks continue to build. Network infrastructure and cybersecurity capabilities need to be assessed and upgraded as airports expand into the realm of digital systems that manage electric grid supply and new fuel supply sources.

Contacts



Bosco Rodrigues
Global Airport Planning and Advisory Director
United Kingdom
Bosco.Rodrigues@wsp.com



Larry Schneider
Senior Vice President, National Aviation Sr. Director
USA
Larry.Schneider@wsp.com



Alexander Jackson
Assistant Vice President – Aviation Project Management
USA
Alexander.Jackson@wsp.com



Alberto Ruiz
National Director, Transportation Systems
Canada
Alberto.Ruiz@wsp.com

3

Airport Planning Embraces Future Travel

Turning challenges into opportunities within the aviation matrix



November 11, 2021

In the following Q&A, WSP planning and advisory experts propose ways to advance the airport planning process as aviation grapples with rapid change and heightened uncertainty amid travel rebounds.[1]

John van Woensel
Vice President
National Aviation Planning Manager
United States

Greg Ballentine
Senior Project Manager, Aviation Planning & Advisory Services
Canada

Bosco Rodrigues
Technical Director
Airport Planning and Advisory Services Leader
United Kingdom

Arnold (Arnie) Rosenberg
now retired – led many planning projects at WSP

1 "The Impact of COVID-19 on the airport business and the path to recovery," Advisory Bulletins, Airports Council International (ACI), March 25, 2021.

What are the essential elements of airport planning today?

Bosco Rodrigues: The foundation of effective contemporary airport planning lies in our ability to work in unison with an increasing array of stakeholders to reach an optimal solution for the short-, medium- and longer-term advancement of an airport. This cross-pollination of ideas as well as the exponential growth in data analytics are both liberating and intellectually challenging in equal measure. The pandemic, for example, has required airport planners to rethink what is an appropriate amount of space per passenger for health and safety reasons whilst also improving service quality as a potential benefit. Over time, technology will likely facilitate implementation of a more cost-efficient solution.

Empathy and understanding move us away from the siloed mentality that often characterized past practice to a holistic one; this perspective enables adoption of new approaches and technologies to address the pressing concerns of today and tomorrow. Only through a more cooperative and highly collaborative planning process can airports identify, prioritize and address issues in a sustainable manner.

John van Woensel: I think the cross-pollination point is true for internal airport stakeholders as well as external ones. In the US, what we sometimes see is a lack of true acceptance, let alone support, for a plan that was developed in an organizational stovepipe. The plan may be signed off by the director, but if various departments and stakeholders conclude that the process did not consider their concerns, they will not support it; this lack of buy-in will likely result in a shelved plan, rather than one that could have led to a broadly beneficial outcome.

Bosco Rodrigues: Effective planning also enables airports to respond in a timely way to changing circumstances. Planning has traditionally called for simultaneous consideration of socioeconomic issues and the connection of strategic and tactical requirements; however, the acceleration of technological advancement and growing attention to societal and environmental issues, notably the urgent need to reduce carbon emissions, require professionals to think and manage processes in an agile way.

Greg Ballentine: The multidimensional nature of the planning process makes transparency and stakeholder engagement necessary actions from the outset; it is important to engage airport stakeholders, including tenants, operators, government agencies and the general public, throughout the planning process, and all should all have ample opportunity to provide input.

As an example, transparency was key to the success of an airport master plan that WSP recently prepared for Billy Bishop Toronto City Airport, where activity grew rapidly over a span of 10 years from less than 100,000 annual passengers to nearly three million in 2019. The airport is located on the lakeshore adjacent to the downtown, in proximity to high-density residential development, community facilities and the city's waterfront park system. As a result, there has been a lot of local opposition to the airport.

At the start of planning process, the planning team initiated a robust stakeholder engagement process that included over 70 meetings held with the general public, community associations, special interest groups, airport operators, government agencies, politicians, and Indigenous communities. This engagement continued throughout the duration of the project.

Valuing the input from all participants, the airport master plan adopted an innovative approach to future airport development that includes a managed growth strategy [MGS], which balances the operational and business objectives of the airport and its operators with community objectives and environmental and sustainability initiatives. The MGS includes placing caps on annual and peak-hour passenger activity and aircraft movements as well as focusing on environmental initiatives, such as reducing the generation of aircraft ground noise, placing greater emphasis on the use of public transit as the preferred mode of landside access, and converting an existing diesel vehicle ferry to electric.

As a result of these initiatives, PortsToronto, the operator of the airport, was awarded the 2020 ACI North America Environmental Achievement Award.

Planning for infrastructure is a long-term process. How can airports plan effectively given the need to accommodate change more quickly than ever more?

Greg Ballentine: Traditionally, the airport master plan has been considered a roadmap to achieve a vision for the airport while ensuring that short-term infrastructure and business decisions do not compromise long-term objectives. Airport master plans are considered living documents in that they are meant to be updated on a periodic basis to adjust to changes in activity and operational objectives. Flexibility is the key to protecting the long-term vision and accommodating change.

Environmental sustainability, greenhouse-gas reduction, pandemic resilience and climate risk are areas that must now be considered in the master planning and terminal planning processes. We [WSP] are presently undertaking a climate risk study for an airport in Eastern Canada that is examining potential risks associated with climate change. This includes everything from reduced landing approach minimums to the threat of flooding and impacts on building performance. The key is to recognize potential weaknesses and identify possible mitigation measures. As another example, we are working with a terminal operator to determine how a prolonged pandemic could impact passenger processing and spatial requirements and in turn require adjustments to the terminal expansion's functional program, including provision for increased queuing space, expanded departure holdroom areas and touchless restroom facilities.

Bosco Rodrigues: These points underline the importance of asset and operational adaptability, which should be built into airport master plans. This involves technical and infrastructure flexibility and, just as importantly, airport operator and owner flexibility as well as stakeholder agility. The Red Sea Airport [RSA], currently being built in Saudi Arabia is a recent example of this theory being put into practice. As planners, we direct and guide airports such as the RSA along a pathway from where they are now to where they want to get to.[2] This journey of transition must address the complex practical realities of airports as businesses and providers of public services and local economic stimulus while minimizing their environmental footprint. Their existing infrastructure, facilities and services are akin to a town or city, with a correspondingly complex array of competing stakeholder needs and requirements. In this way, airports are microcosms of society, with similar challenges and opportunities.

It is important to understand that significant challenges ahead also present opportunities to continue to do what aviation has always done well—stimulate economic growth, facilitate trade and enable tourism—while moving towards carbon neutrality, to achieve net zero. This is where electric and hydrogen technologies and sustainable aviation fuel play a vital role.

Accommodating change and making the most of possibilities requires a reassessment of the current capital-intensive airport business model involving lengthy planning-design construction timescales, towards one that is more dynamic. This shift will enable the delivery of flexible facilities more quickly and more cost effectively; it will also result in a less disposable aviation culture that strives towards a progressive strategy, one that re-purposes and recycles infrastructure, reducing embodied carbon in the process while also accommodating change to support new opportunities for non-aeronautical revenue generation.

I believe aviation can draw inspiration from other industries where there have been efforts to decrease embodied carbon. The automotive industry, for example, has gone from one of the worst environmental offenders to one of the leading recycling innovators. Some furniture and lifestyle manufacturers and service providers have also embraced the circular economy, revolutionizing their whole procurement process and supply chain and how they respond to rapid change relative to societal norms.

Arnie Rosenberg: Out-of-the-box thinking will certainly be tomorrow's business trend setter. Considering environmental and energy strategies is a must-do in today's aviation long-term planning process. Electric-powered and hydrogen-fuelled aircraft will be the next reality check that airports and the aviation industry will have to address. Where and how will airports get the electric capacity to fuel their aircraft power needs? How will hydrogen generation and the movement of its components be accommodated? Strategic thinking for long-term planning must also include the new generation of eVTOL [electric vertical take-off and landing] aircraft and hypersonic, high-altitude aircraft that we have glimpses of today.

John van Woensel: The planning process will likely benefit from including the power supply utility in defining future power needs to accommodate electric aircraft and vehicles. To build resilience into the planning process, airports can consider redundant power supply, perhaps dual power, to terminals from substations that are spread far apart so they are not all affected by a flood or other unexpected event; they would be fed from different power supplies in case one of them goes off-line. Another possibility is connecting different forms of power in a microgrid.

2 The Red Sea Development Company, The Project.

Considering the challenges discussed here, what new capabilities will shape successful airport planning teams?

Bosco Rodrigues: Airport planning professionals themselves will draw from many disciplines and skills to address the complex challenges airports are facing now and will face. In the near future, I expect airport planning teams to consist of professionals with multidisciplinary backgrounds—reflecting the need for dynamic and imaginative solutions—and empathy and emotional intelligence, which cannot easily be replaced by artificial intelligence.

Arnie Rosenberg: As Bosco noted earlier, effective communication, coordination and collaboration will drive problem-solving. Bringing together an array of people, data and technology will position organizations for optimal performance and growth in a sustainable manner. This collaboration advances integrated planning and enables organizations to be agile in response to changing circumstances as they make strategic and tactical decisions.

It takes a cohesive team of professionals—planners, architects, engineers, program and construction managers, and cost and risk specialists, among others—to develop master plans that help airports maintain the positive contributions of aviation while supporting decarbonization and the environment.

John van Woensel: It is also important to point out that we are not saying to include everybody in the plan and that the plan must consider everything. This would be too costly, make the process unwieldy, and take too long to support timely decision-making and movement toward implementation. The real value of experienced planners becomes clear when they work with airport authorities to define the elements that are most important for their particular situation, timeline, and infrastructure decision needs, and then include those things in the process. It is difficult and against the nature of planners to exclude scope, but it is always necessary to make sure the planning assignment remains practical and manageable.

Contacts



Bosco Rodrigues
Technical Director
Airport Planning and
Advisory Services Leader
United Kingdom
Bosco.Rodrigues@wsp.com



John van Woensel
Vice President
National Aviation
Planning Manager
United States
John.VanWoensel@wsp.com

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LAX Terminal 1.5: Improving the Airport Passenger Experience

Exploring the newly opened Terminal 1.5 within the Los Angeles International Airport modernization program



Figure 1 – The interior of LAX Terminal 1.5 with a view of the automated people mover system under construction

July 8, 2021

A Case Study in Airport Planning

In 2011, WSP led the team that prepared the project definition documents for advanced planning and preliminary design of the recently opened[1] Terminal 1.5 at Los Angeles International Airport (LAX).

Los Angeles World Airports (LAWA) is in the midst of a $14 billion capital improvement program at LAX that began in 2009 and is expected to last through 2028.[2] Following the North Terminal Complex Integration Program study by WSP, the Terminal 1.5 project was identified as the top priority. The project encompasses concept development and preliminary design plans, including terminal expansion and integration, and modification of Terminal 1 passenger processing functions: security checkpoint, ticketing and baggage claim.

Mark Kuttrus

Assistant Vice President
Senior Aviation Planner
United States

Arnold (Arnie) Rosenberg

now retired – led many planning projects at WSP

1 Terminal 1.5 was opened June 4, 2021.

2 LAX development projects, which were originally scheduled to run through 2023, will now run through 2028 to support the Summer Olympics in Los Angeles. For details about the projects in the capital improvement program: Los Angeles World Airports, Project Fact sheet.

The team (12 subconsultants) developed programmatic criteria for the functional integration of Terminal 1 and Terminal 2, creating preliminary architectural space concepts and adjacencies, preliminary design, and detailed cost estimates; the project definition documents included multiple elements: an executive summary outlining the project scope, a preliminary schedule, project budget requirements, constructability, risk assessment, the enabling projects, phasing elements and design specifications.

In the following Q&A, leaders of the WSP team on the Terminal 1.5 (T1.5) project explore the planning process that led to the final project and its grand opening; they discuss the challenges addressed to generate operational improvements and an enhanced passenger experience at LAX.



Figure 2 - Four-level Terminal 1.5 at LAX

What is the significance of the LAX Terminal 1.5 project?

Arnie Rosenberg: The T1.5 project is part of the larger modernization program underway to redevelop Los Angeles International Airport into a 21st-century world-class airport, serving as an international connecting hub and a major domestic destination. T1.5 is intended to improve the operational flow and curbside efficiency of the airport and improve the overall passenger experience by allowing people to move with ease from concourse to concourse without having to leave security.

The PDD [project definition document] team developed a rigorous program that provided both the airport and experts who prepared the subsequent environmental documents with a detailed roadmap, specifying how to get this project through the environmental, design and construction processes and integrate it into the continuously operating and expanding airport.

Through its overall effort to improve operational efficiency and the passenger experience, LAX has become a model for how to plan and implement such a large expansion program.

Can you address the key considerations in the Terminal 1.5 planning effort?

Arnie Rosenberg: The planning effort involved the development of a series of project objectives, to improve day-to-day operations and the passenger experience.

The operational side focused on performance characteristics, particularly passenger and vehicle congestion and energy efficiencies; there were also safety and security goals relative to peak-hour utilization and the latest Transportation Security Administration [TSA] requirements for baggage and passenger screening.

State-of the art design concepts were involved to enhance the terminal and passenger experience, using LAX's temperate weather and natural airflow for cooling the structure and modern materials to block heat from the sun in the summer months. In addition, improvements were made for curbside vehicle flow and passenger flow within the terminal, including post-security connectivity with walking access between terminals 1 and 2 and the other LAX terminals.

When originally constructed, the airport was a series of unconnected unit terminals. LAX evolved over a long period from an origin-and-destination airport into one of the largest international connecting hubs in the United States. During this transitional time, many international airlines continued to serve LAX, but passengers were forced to leave airport security in their arrival terminal then make an arduous transfer to the international terminal where they were rescreened by TSA. T1.5 provides both the security screening, ticketing and baggage claim functions formerly in Terminal 1 and a secure connection to Terminal 2 to avoid going through security screening again if connecting to another airline.

Mark Kuttrus: Terminal 1 is right at the entrance to the airport, which is quite an active area. The first door for Terminal 1 is where many people stopped for drop-off, resulting in backed-up traffic beyond the intersection of the Sky Way & World Way and congested access to the entire terminal facility. By shifting necessary functions and entrance doors about 500 feet to the west, which was an open space that became T1.5, congestion from various

standpoints could be addressed, including the interior layout of ticketing, security lines that backed up onto the sidewalk, and baggage-claim congestion. As a vertical structure with four levels, Terminal 1.5 provides increased capacity for Terminal 1 passenger processing. In turn, T1.5 has allowed the former processing space within Terminal 1 to be repurposed for concessions and remodeled for better passenger flow and an improved customer experience.

Planning the new structure as a vertical connector also built flexibility into T1.5 for future projects; to enhance passenger flow, T1.5 will link to the automated people mover [APM] system scheduled to open in 2023. The APM will connect people to a consolidated rental car facility, parking facilities, the LA Metro Rail system and the Tom Bradley International Terminal. When the APM is ready, the T1.5 structure is already prepared to link to it and support additional passenger flow, reinforcing ease of movement and intuitive wayfinding.

Arnie Rosenberg: It is difficult to overstate the importance of providing a calming experience for air travelers. Leaving the comforts of home, getting into transport, and potentially fighting traffic to the airport can be stressful activities. Making it easy for people to know what to do, where to go and how to get to there, within an appealing environment, can relieve pressure and put travelers at ease to complete the flight portion of their journey.

What were the major challenges of the project, and how did the planning team address them?

Arnie Rosenberg: There were several major challenges—meeting the goals the airport set, getting work done without disrupting the operations of Terminal 1 and Terminal 2 or dramatically impacting the traveling public, and meeting budgetary and schedule requirements.

None of the elements specified in the PPDs could have been developed in a vacuum. Planning is a collaborative process—among team members, between teams and with the airport client; everyone has a valued position because everyone has something to add, and by contributing, everyone improves the planning process. As we moved through this collaborative process, issues were identified and considered relative to how they would impact other aspects of the planning process; we addressed the issues as a team to bring about the best result.

Mark Kuttrus: Ongoing collaboration of a complete team of experts that values different perspectives for the good of the project and client is required from the start—for projects to be successful.

Our planning group assembled a highly talented group of specialists, from blast and security experts to architects, structural engineers and construction managers, to develop comprehensive project definition documents. One of the stated challenges was the need to minimize LAX's carbon footprint, which T1.5 achieved by being vertical versus linear, using highly efficient HVAC [heating, ventilation and air conditioning] and glazing systems and innovative terminal design. The thoroughness of the PDDs resulted in a smooth transition from planning to environmental approval, and reduced the timeline for Environmental Impact Report (EIR) approvals—in turn, allowing LAWA to move efficiently to full design and construction of the $478 million, LEED Silver certified terminal, which opened on June 4, 2021.

Contact



Mark Kuttrus
Assistant Vice President
Senior Aviation Planner
United States
Mark.Kuttrus@wsp.com

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Fuelling Airport Recovery Via Non-Aeronautical Revenue

Agile approaches to develop innovative services and enhanced experiences for passengers



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New non-aeronautical revenue streams are critical to airport recovery from the COVID-19 pandemic. Non-aeronautical revenue—airport revenue from sources other than airlines—typically includes retail concessions,[1] car parking, and property and real estate.

For aviation, global recovery to 2019 levels is projected to take several years, into 2023 for markets with significant domestic air travel, especially leisure travel, and 2024 for markets that have significant international traffic.[2]

John van Woensel
Vice President
National Aviation Planning Manager
United States

Tracy Beach
Senior Aviation Financial Planner
United States

Marco Mejia
Vice President, Aviation
Canada

1 Retail concessions include food and beverage as well as news and gifts.

2 Airports Council International (ACI), Advisory Bulletin, March 25, 2021.

How to improve revenue generation as demand rebounds is a key question for airlines and airports. Before COVID-19, global airport revenue was rising but with a decline in revenue per passenger. Major organizations, such as the International Civil Aviation Organization (ICAO) and Airports Council International (ACI), cite the importance of developing sources of non-aeronautical revenue to bolster revenue from aeronautical activities.[3]

In the following article—to help drive this process forward today—WSP aviation advisors explore how to develop innovative services to support enhanced passenger experiences and strengthen non-aeronautical revenue streams.

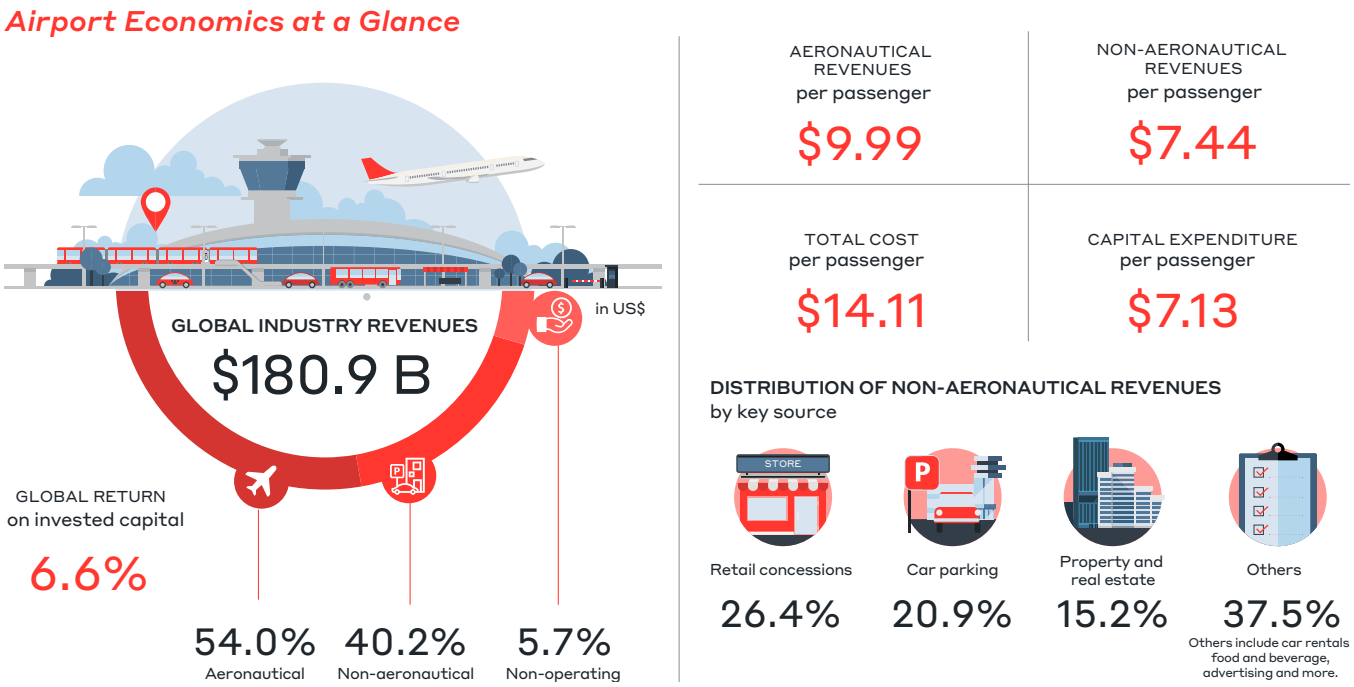


Figure 1- The numbers above are from the Airports Council International (ACI) global diagram for the financial year 2019.

For comparison, in the United States, retail concessions accounted for approximately 8% of non-aeronautical revenue in 2019, while car parking was approximately 43%. Source: Federal Aviation Administration (FAA) Certification Activity Tracking System (CATS) data

3 ACI, April 22, 2020; ICAO, Economic Development, Guidance on Economic and Financial Measures, p. 7.

What opportunities will exist for non-aeronautical revenue growth at airports around the world, and how can airports plan accordingly?

Marco Mejia: There will be a mix of opportunities for airports that will require flexible strategic planning and investments in technology and infrastructure, to enable airports to be more attractive, competitive and future proof. Areas to explore include diversification of airport land use, parking, central processing as well as new models for purchases such as food and beverage. Airports will need to be more agile to understand the passenger segmentation, to provide the services that are required for different travellers' wants and needs throughout the day.

In larger cities, airports should consider partnering with urban air mobility companies to transport passengers efficiently onto their premises. Partnering with air mobility companies will minimize the travel time to airports for travellers and the time at the airport, as all the passenger processing can be done in advance. Importantly, airports will have another way to generate revenue.

John van Woensel: Some US airports are rethinking tradition and taking over some services previously not controlled by them and from which they currently only derive a small fee, if that. In this way, airports can not only increase their control and involvement in operations but retain more of the associated revenue.

These services include baggage handling systems, which are usually run by the airlines through a consortium; ground handling services and fuelling, usually contracted by the airlines; and sometimes these services will be offered by fixed-base operators. Jet bridge operation is another potential opportunity.

Often, when considering nonaeronautical opportunities, the reference is to revenue that is in some way passenger dependent. An ideal nonaeronautical revenue source is one that is not affected by a downturn in air travel. One thing we are seeing more recently in the United States is an increased focus on airport resilience through diversification of land use.

As a result of the last Federal Aviation Administration Airport Improvement Program reauthorization, it has become easier for airports to respond quickly to opportunities to bring certain land parcels to market for uses not related to air travel. A potentially lucrative example is a plaza with a gas station and a convenience store located on a road that is on airport land. Many airports have roads on their property that are not or only partially related to airport traffic. Another example of a non-passenger-related service offering is pet-lodging facilities near the airport. These could be used by people on their way to the airport as well as area residents.

The United States is unique in that our airports are governmental units, but usually more independent and business-like than a typical local or state government department. They are primarily focused on providing adequate facilities for tenants and users, and, of course, a safe operating environment. Generally, US airports function as non-profit landlords and airfield operators more than service-providing businesses, whereas, in much of the world, airports are operated by privatized corporations that have always had an additional focus on making a profit and a return to shareholders.

How can airports develop revenue-generating services that will enhance the passenger experience?

John van Woensel: Overall planning and design should consider that patrons may want different types of experiences for say a meal. It is not always about providing more lavish environments; sometimes people want something specific quickly. Vending machines for electronics, for example, are very good revenue sources—especially when considering the small space they occupy, and they also provide another way to serve passenger needs. So, airports should provide passengers with convenient choices, whether sitting down for a meal, grabbing something on the go or having a meal or product delivered at the gate. To make these changes and choices possible, airports need to be flexible in their long-term planning.

Marco Mejia: In order to target a more personalized environment for passengers, there is opportunity for airports to repurpose many areas and deliver a special touch—for example, by creating centralized kitchens and distributing food to different areas within the airport.

Tracy Beach: It's the wave of the future—ghost kitchens. They provide multiple types of food in one place and offer convenience for passengers, who can use an app to order or visit one location for their food preferences;

on the back end, this concept, while affecting planning for space, enables a more agile response from airports to passenger needs and expectations. These facilities can enhance passengers' perception of a safe and clean environment with contactless purchases and allow airport concessionaires to provide online food delivery services like Uber Eats or DoorDash from the ghost kitchen to the passenger at the gate.

Marco Mejia: A quick-change stand is another way to build agility in operations. The same stand can be reconfigured throughout the day to meet different demands, reflecting upcoming flight destinations; this is a flexible way for airports to target diversified groups of passengers.

Tracy Beach: One key thing to learn from downturns that have occurred in aviation is to be nimble. Moving away from longer-term leases and including opt-out clauses would allow airports to change the way a particular space in the terminal or land area on the airport is being used and maximize its revenue potential to react to the ever-changing environment of passenger demand and preferences. For example, these efforts may include moving away from contracting methods that include both a minimum annual guarantee [MAG] and a percentage of revenue. During the COVID-19 pandemic, many airports suspended the requirement for MAGs of their concessionaires and parking operators, and obtained revenue only from the percentage of revenue. In the future, increasing the percentage of revenue from the standard 7 percent to 10 percent could allow for the capture of revenue through a higher percentage fee.

One way to ensure an airport's concessionaires can meet passenger demand for retail concessions is to plan for a consolidated receiving and distribution facility. This type of facility allows the concessionaires to have consolidated warehousing space near the terminal building to distribute food supplies and merchandise efficiently and quickly, and it also alleviates traffic on airport roadways. In some instances, concessionaires are using terminal loop roads and other highly used roadways to get the merchandise to the terminal to stock the shops and restaurants visited by their consumers, the passengers.

Marco Mejia: Another area to consider is automation. Even as processes become automated—for example, potentially including more chat boxes for customer needs—valet services can complement automation, in case passengers need extra help with a booking or any other type of assistance.

How can airports address the future impact from mobility-as-a-service options, such as ride-hailing, on parking revenue?

Marco Mejia: Ride sharing initially caught everybody off guard, and airports saw taxi revenue and parking drop. However, as these services have matured, two things have happened—most airports now derive a fee from the ride-share transactions, at least making up for the loss in taxi revenue; and as the percentage of people parking cars dropped with the shift to ride sharing, overall travel grew. So, from 2015 to 2019, though parking revenue decreased, the number of travellers grew substantially. Most airports saw their garage occupancy recover because of this uptick. Parking demand remains strong in the United States and Canada, and many airports are now considering parking management systems to optimize associated revenue.

John van Woensel: The emergence of sophisticated parking management systems has allowed airports to get a handle on the different types of parking preferences people have and understand how different pricing can be applied to optimize parking revenues—while increasing options and the level of service to passengers.

Marco Mejia: With the increasing adoption of electric vehicles, airports should examine how to incorporate sufficient electric vehicle charging stations as part of a wider electrification strategy, which would include assessing the airport's ability to handle this type of amenity.

The presence of ride sharing has put added pressure on airports, as parking is still the most important non-aeronautical revenue source for an airport; for that reason airports need to protect it, attracting the traveller to look for a combination of services inside the airport such as "park and eat." In that way, airports will encourage passengers to have both services at a more affordable price, which will generate both a better passenger experience and more airport revenue by maximizing the use of the facilities.

What are the ways that data and predictive analytics can help airports strengthen non-aeronautical revenue streams?

John van Woensel: More than ever before, more and more data can be gleaned from passengers and at a lower cost to airport operators. Technologies range from intelligent cameras to Bluetooth [anonymized] tracking. More efficient processes such as self-checking baggage can reduce space needs. So far, though, while various technologies have become more common since the 1980s, terminal building area per passenger in the US has not shrunk, like you would expect; in fact, terminal areas have increased somewhat, most likely due to increased concession space. However, from an infrastructure perspective, new technologies still offer the potential to reduce the space for certain terminal processes, providing the operator with more flexibility in allocating space in the terminal for revenue-generating purposes.

Tracy Beach: Going forward, airports will need have a better understanding of passenger spending choices and patterns to target the best returns on investment for non-aeronautical revenue maximization. Apps used for pre-ordering food for delivery at the gate and pre-selecting a parking space can be a gateway to obtain this data from passengers and customers. Something like adding a simple question related to travel purpose to the app—concerning business or leisure—can allow airports to understand the behavior of these two market segments better and what options appeal to each segment. The data can provide opportunities for repeat purchases, thereby improving the customer experience and creating revenue-generating opportunities for airports.

Contacts



John van Woensel
Vice President
National Aviation
Planning Manager
United States
John.VanWoensel@wsp.com



Tracy Beach
Senior Aviation Financial
Planner
United States
Tracy.Beach@wsp.com

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