HOW AUTONOMOUS VEHICLES CAN HERALD A NEW ERA FOR AIRPORTS



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AVS TO USHER IN A NEW AGE FOR AIRPORTS



Michael O'Shaughnessy
Deputy Aviation Director for Operations, Phoenix Sky Harbor Airport

Michael O'Shaughnessy, the Deputy Aviation Director for Operations at Phoenix Sky Harbor Airport in Arizona, is facing a double header of increased growth and constrained space.

Measured at 3,400 acres, Sky Harbor is the busiest three-runway operation in the world with approximately 1,600 aircraft operations a day. In 2023, 48.6 million passengers passed through its terminals but numbers are expected to rise to over 50 million this year.

"We're experiencing growth which is a blessing and a curse," he says. "We want to continue to grow and attract more business. It's about maintaining our cost structure which attracts more airlines but also to maintain our service levels."

O'Shaughnessy is not the only airport executive facing such a challenge. The International Air Transport Association (IATA) predicts that air travel will double over the next 20 years - from 4 billion travelers in 2019, to 8 billion by 2036. This will impact the pressures on all aspects of airports - from terminal operations to landside transportation options.

Autonomous vehicles (AV) can help relieve these constraints. According to the Airport Cooperative Research Program, just by reducing the number of vehicles operating airside, airports will be able to repurpose the newly freed up real estate to create parking space to accommodate AVs used for ground handling, passenger transportation and employee shuttles.

At airports such as Singapore's Changi, Auckland, Hawaii and Schipol in Amsterdam, AVs are being deployed airside and within terminals in a variety of roles. This includes self-driving wheelchairs for passengers, autonomous tugs and baggage handling machines, robot floor cleaners and lawnmowers, and driverless shuttles between terminals.

Different forms of AVs have been in operation at airports for several years and in 2018, the IATA noted over 40 use cases of driverless technology occurring at airports around the world.

Yet, it was not until December 2023 that AVs became a public transportation option to get to and from the airport. It was then that Phoenix Sky Harbor became the first airport in the world to provide AV shuttles for passengers and create a revenue stream to and from the airport.

Between 10pm and 6am driverless Waymo SUVs can now collect and drop off passengers at Phoenix's terminals 3 and 4. Passengers had, until then, only been allowed to take an AV from outside the airport (for example from downtown) to two nearby Sky Train stations where passengers could board air trains that connect to terminals and the rental car center.

O'Shaughnessy calls this a crawl-walk-run approach. After the initial Sky Train phase, he wanted to look at the core of the airport.

"Our roadways haven't gone through a major expansion because of the space constraints that we have – there are only two ways in and two ways out," he says. "Our curbs can get very busy, our roadways can get very busy, and our terminals can get very full."

The airport took the same approach as the first phase – bringing in AVs with drivers at the helm to begin with, and only allowing a limited number of AVs to start mapping the terminal area to let the technology adapt.

"This whole two- and half-year period has been about us learning the technology and gaining more confidence," he says. "As our understanding grew, our confidence grew in the technology. It's better to make sure that this is a methodical approach to bringing AVs into an airport environment."

Passenger confidence in AVs has also grown, with Phoenix airport numbers averaging 200 autonomous trips per day. Monthly trips with the service have risen from under 1,000 at the launch in 2023, to more than 7,500 in March 2024.

When O'Shaughnessy first rode in an AV, the first thing that appealed to him was that it followed the exact rules of the road. It didn't speed, it respected Stop signs, it didn't switch lanes unnecessarily, and always used a turn signal.

"AVs are going to make our roadways smoother and safer," he says. "Around an airport where you have a large volume of traffic, a lot of congestion, with people in a hurry, that's when people make mistakes. I think we'll see [AVs] as a benefit to the flow at any congested airport."

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IMPROVING AIRPORT CUSTOMER EXPERIENCE

Interest in the Phoenix offering has spread across the country, with O'Shaughnessy receiving numerous calls from colleagues and peers interested in his findings to implement something similar at their own airports.

David Carroll, from May Mobility – an AV provider that has successfully partnered with transit agencies, cities, states and The University of Texas, Arlington – says interest from airports is increasing and reveals that at a recent airport conference, even though there were no specific sessions on AVs, driverless vehicles came up in almost every session.

"Airports are looking to improve, and there's been a mindset change that, 'Hey, if we can make it better for our employees and for our customers, if it's safer and cost effective', you'll naturally see [AVs] rise at more airports," he says.

Since 2017, May has successfully launched in partnership with numerous public transit operators and cities, and given that many airports are linked to public transportation, the company sees airports as a natural progression.

"Airports are a crucial component of our communities," Carroll says. "They connect the world and they bring people together. My biggest concern is that airports haven't thought about the potential of AVs apart from robotaxis. The travel experience is a stressful one so how can automating various aspects of it make the travel experience better? We want to not only provide the convenience of an AV but minimize congestion and encourage people to take shared trips to and from the airport."

The company aims to assist airlines and aviation organizations solve their toughest transportation challenges with first- and last-mile, on-demand and circulator services.

Carroll reveals that he is working on a project to move employees from public transit to the restricted cargo entrance area where badge checks and sign-in takes place.

"Having an autonomous micro-fleet available all the time and on demand, will move workers back and forth, predominantly within the airport grounds, so they don't have to walk as far," he says. "We also have a few airports interested in putting license plate recognition onto our vehicles so they can be used in a number of ways. Not just moving passengers but also managing parking."

For airport executives, travel experience is important and all want to ensure that from the moment a passenger arrives at the airport until they leave, they have an experience that is both positive and predictable.



David Carroll
May Mobility Director, Sales and Business Development, Commercial



THE ROADMAP TO AUTONOMY



Jodie Brinkerhoff
Vice President of Innovation,
Dallas Fort Worth International Airport

At Dallas Fort Worth International Airport, Jodie Brinkerhoff, Vice President of Innovation, is focused on a roadmap to autonomy that will de-risk the future of the airport. In addition to driving technologies and programs forward, her role is to think about new business models, new ways to interact with customers, and to grow a culture of innovation at the airport.

As early as 2018 the airport drew up a strategic plan that included the future of autonomy.

"We're developing a future with realistic business use cases that can impact the airport in a reasonable period of time," she explains. "How might we take advantage of everything that technology offers to enhance the customer or employee experience?"

With 30,000 employees and a landmass larger than the island of Manhattan, the airport is keen to focus on the use of AVs to better manage curbs, move staff and optimize parking.

"When you think about the number of operations that take place at our airport, moving people and things, there is tremendous opportunity to leverage autonomous technology as it evolves," she says.

The key for Brinkerhoff is to ensure that Dallas Fort Worth Airport is able to take advantage of these technologies when they become viable in an airport environment.

"An airport cannot just sit back and let the ecosystem advance without it," she says. "We have to partner with providers to help guide development, operational strategies and safety protocols unique to our environment."

FLEXIBLE TECHNOLOGY

Pittsburgh International Airport's xBridge program is testing and demonstrating new technologies for the global aviation industry, not only for the all-important customer experience but to positively impact revenues, operations, security, and sustainability.

"An airport is like a small city," says Cole Wolfson, Director of xBridge. "It is kind of the perfect environment for real world testing for technologies. We don't advocate for any particular vendor, we're looking to test and show the capabilities of technology and how that impacts the way an airport operates."

Until now, a lot more time, resources and research has been conducted into the use of AVs airside which is more complicated, slower moving and more highly regulated. Wolfson says this is now changing as the organisation will soon begin trials landside.

"A lot of our work has been to crack the nut of how to do AVs and not just autonomous robotic systems within the security envelope of the airport," he said.

He calls for flexibility when thinking about the future. xBridge engages with technologies that can operate without necessarily having to be integrated into ongoing operations at the airport.

"That's critical from a number of perspectives," he says. "If you integrate it and it goes sideways, it can spell trouble. Or it could be the best thing since sliced bread, or it might fizzle out. We just want to show the capabilities of technologies and how that impacts the way in which airports operate."



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Cole Wolfson
Director of xBridge



WHAT THE FUTURE HOLDS

In Miami-Dade County, the Aviation Department that manages Miami International Airport is overseeing a US$7 billion overhaul that will utilize significant wireless infrastructures including 5G and Citizens Broadband Radio Service.

"It allows us to plug and play, and do more trials on the fly with this new system," says Maurice Jenkins, Chief Innovation Officer, Miami-Dade County, Aviation Department.

While most AVs do not require any additional infrastructure or technical work from a partner, Jenkins envisions a future where AVs could potentially play a bigger role than just dropping people off by using the airport's network to talk to other robots and services.

"I think ticket counters are *passeé*, so what does that mean for the future?" he says. "Do you check in from the carpark or do it at a skytrain? Do you do it from the car rental center? Do I put check in areas at the carpark and use AV shuttles for passengers to find their car or bring their car to them?"

The Johns Hopkins Applied Physics Laboratory is looking further ahead. Alongside its Institute for Assured Autonomy, the teams take "off-the-shelf" AVs and undertake robust experimentation. One such internal research project was looking at "screening at the speed of light".

Ed Pavelka, Senior Professional Staff at the lab, explains that they were trying to envision a future where people could depart their house and get onto an aeroplane or other mass transit conveyance and not have to queue up.

"There are a lot of choke points in the process of getting from my home to a parking lot, through security screening and ticketing, and then onward through the airport, to the jetway and ultimately getting on the plane," he says.

He is looking into the opportunity that AVs could assist in screening and vetting prior to arriving at the airport.

"There are some very interesting ideas coming out of that and how AVs could smooth that process," he adds.



WHAT HAPPENS TO PARKING?

> We're starting to see mixed-use parking take place a bit more where in the past it was really standalone garages

David LoCoco
International Parking & Mobility Institute

As well as taking up a phenomenal amount of space, according to the Airport Council International (ACI), airport parking is only second to retail concessions as the primary source of non-aeronautical revenues.

"We're starting to see mixed-use parking take place a bit more where in the past it was really standalone garages," says David LoCoco from the International Parking & Mobility Institute.

Although AVs pose a potential threat to parking, LoCoco sees some advantages for airports, as parking spaces could be dramatically reduced. Without a driver, doors do not need to be opened on both sides.

"That means the denser we can park, the less area that would be needed," he says. "That would be very attractive to airports because parking is expensive to build and is tough on performance and budgets."

An ACI report also highlights the benefits of AVs to airports despite the reduction in demand for parking and the effect on parking revenue.

"AVs may also move onto the next scheduled trip or park farther away from the terminal at much lower expense," the ACI notes in its 2019 *Autonomous vehicles and systems at airports* report. "In order to offset this, airports need to rethink their business models by modifying current infrastructure (fewer parking spaces required, other types offered), creating dedicated AV parking facilities or charging a fee per drop off or pick up so as to maintain or generate additional revenue."

Similarly, there may no longer be heavy demand to provide parking close to terminals, and that valuable real estate could be freed up for new terminals or operations.



HUMAN CONSTRAINTS



Maurice Jenkins
Chief Innovation Officer,
Miami-Dade County, Aviation Department

As well as providing assistance in terms of space and curb constraints, the ACI also sees benefits from AVs for human resources.

In a recent report, the ACI forecasted a demographic switch as baby boomers retire from the industry, and automation may assist in the challenge of finding new recruits.

Since the pandemic, many airports are finding it difficult to recruit due to greater job market and wage competition, the hassle of in-depth background and security checks, and intense levels of training.

"We're coming to realize that within our airport space there's not a significant amount of human capital resources available at times to support the demand and need," says Miami-Dade's Jenkins. "It's not about autonomous vehicles or robots replacing human capital but enhancing the functionality and the business requirements of human capital and being able to create a better synergy to get optimal performance."

This is particularly the case for those jobs at airports that are repetitive, dirty and physically difficult. There will always be a need to do those jobs and a need for some oversight, but technology can assist.

Wolfson from Pittsburgh's xBridge believes more automation integration is needed and agrees that it is about supporting human resources to provide better services.

"It's not about staff reduction, it's about improving the customer service and efficiency," he says.



BECOMING THE NORM, NOT THE EXCEPTION

Autonomous vehicles have already proven that they can do more than navigate city streets. Specialized autonomous microtransit can deliver on-demand mobility services within specific zones that help people have quick and reliable access to critical locations around a community or organization. Parking shortages, shuttle reliability and traffic congestion can all impact travel experience, not to mention the challenges that come when using a wheelchair.

"Whichever airport you fly out from, their numbers are growing tremendously," says Jenkins. "If you're looking at the airport footprint, you can only do so much in the finite footprint. To leverage technology, business process improvements, that's where innovation [such as AVs] can come in and be able to deal with that increased throughput of individuals."

Although many airports are still working on the business case to help predict the future in terms of opportunities to scale AVs, the impact of driverless vehicles could go well beyond offering a mobility service.

O'Shaughnessy believes Phoenix has helped break the mold in understanding how the technology can be applied.

"I've been around this industry for 35 years and autonomous vehicles are the way of the future," he says. "We'll see them grow and expand, and with new vehicles and new capabilities. As people start to understand the benefits they can have to traffic, in years to come this will be the norm, not the exception." ■

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WHAT CAN AVS LEARN FROM AVIATION?



"Saying the driving task could be automated or could be turned over to autonomy isn't a big leap for me. My experience is heavily involved in aviation.

Depending on the aircraft or platform, it has different levels of augmentation. There exists everything from completely augmented, non-assisted controls all the way up to extremely large and extremely heavy aircraft that have detailed and fairly well swept up automatic flight control systems.

As an aviator you are assisted by digital avionics to assist in a flying task. For example, altitude maintenance, or course maintenance, you're able to upload that to a system that's able to do that for you in terms of an autopilot. And many aircraft have digital engine control systems, called FADEC that manage engines so that you're not having to tweak the RPMs or sync the propellers.

I grew up in the aviation industry where all of those flight controls were being implemented and got the ability to use those in many different manufacturers. It certainly got me interested, particularly as I've had children, to envision a world where they're driving and see some of the auto accidents that happen, many of which are preventable. I'm very interested in how to make our overall transportation system more safe, efficient and effective.

Ed Pavelka | Senior Professional Staff, Johns Hopkins Applied Physics Laboratory



"Probably 80 percent of most flights, from end to end are already autonomous in some form. The pilot enters the data and they are active on the take off and a little active on the landing but in between it's pretty automated. You may see just from a perspective of safety and efficiency, automating some of those ground movements from the logistics center where the pilot is not quite as involved.

A lot of public perception needs to be overcome. Because oddly enough, autonomous vehicles, if there's one accident it gets press coverage for several days. Meanwhile, there's thousands of other vehicular accidents throughout the same period of time and they get zero coverage.

It wasn't until about the 1950s or 60s before we got rid of the elevator operator. People today would think, why would you pay a guy to stand in there and push buttons?

Jim Sherman | Aviation Forum Executive, American Institute of Aeronautics and Astronautics