VIRTUAL QUEUING GUIDEBOOK

APRIL 2021

Introduction

This Guidebook aims to represent aspirations and processes envisioned for Virtual Queuing (VQ) at security check points within the airport environment.

- This document also includes:
  - A summary of existing (traditional) queuing processes within airports.
  - A study documenting the impact of a reduction of passengers at peak times on wait times.
  - Examples of VQ pilot projects within various airports, their respective vendors, systems/processes, and key takeaways.
  - Challenges anticipated and/or experienced in relation to VQ.
  - Communications planning/efforts for distribution of information for internal and external participants.

This document is intended to be "living" and will be updated as more data becomes available regarding the latest technologies, results of pilot projects, and policy updates as they occur.

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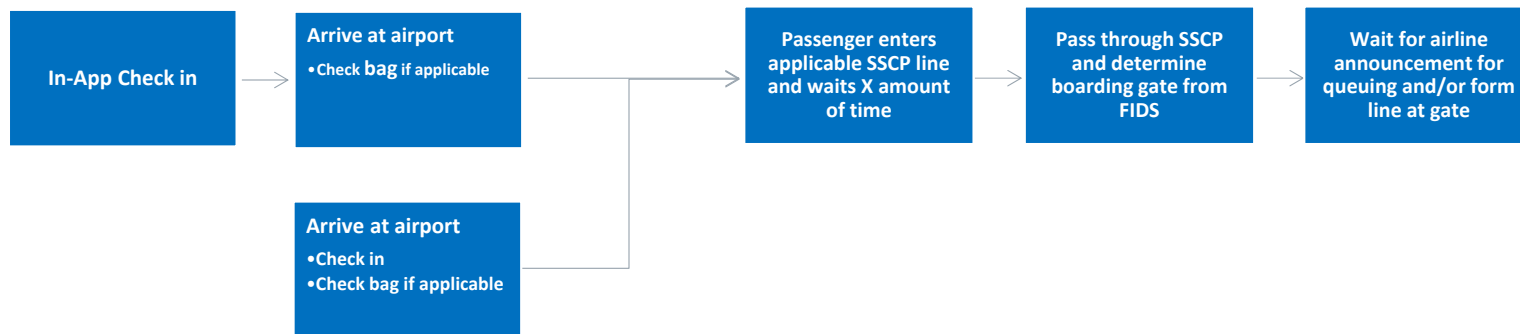
Communicating Efforts

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CURRENT VS PROPOSED QUEUING PROCESSES

Part One

Existing Security Screening Process

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┌─────────────────┐     ┌─────────────────────┐                          ┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│                 │     │ Arrive at airport   │                          │ Passenger enters    │     │ Pass through SSCP   │     │ Wait for airline    │
│ In-App Check in │ →   │ • Check bag if      │                          │ applicable SSCP line│ →   │ and determine       │ →   │ announcement for    │
│                 │     │   applicable        │                          │ and waits X amount  │     │ boarding gate from  │     │ queuing and/or form │
│                 │     │                     │                          │ of time             │     │ FIDS                │     │ line at gate        │
└─────────────────┘     └─────────────────────┘                          └─────────────────────┘     └─────────────────────┘     └─────────────────────┘

                        ┌─────────────────────┐
                        │ Arrive at airport   │
                        │ • Check in          │
                        │ • Check bag if      │
                        │   applicable        │
                        └─────────────────────┘
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The screening process to date has not changed drastically since the post-9/11 overhaul. The process can be clunky despite technological intervention such as wait-time monitoring, crowd data, and predictive modeling. Passengers dread the rows of lines they have now become accustomed to and have shown a willingness to pay more in order to avoid them (ex. TSA pre-check).

The current process requires passengers to plan accordingly for wait times by intuition alone, knowing that 1.5 hours before boarding for domestic flights and 3 hours before boarding for international flights is recommended. Upon arriving to the airport, passengers are guided to their respective group lines for General Public, Trusted Traveler Programs, or Airline Elite Status. They then physically wait in line to have their identification checked against their boarding pass.

Pre-COVID, airports were already searching for solutions to long lines, and now with the advent of social distancing, those concerns loom over returning travel crowds as vaccine rollouts are underway.
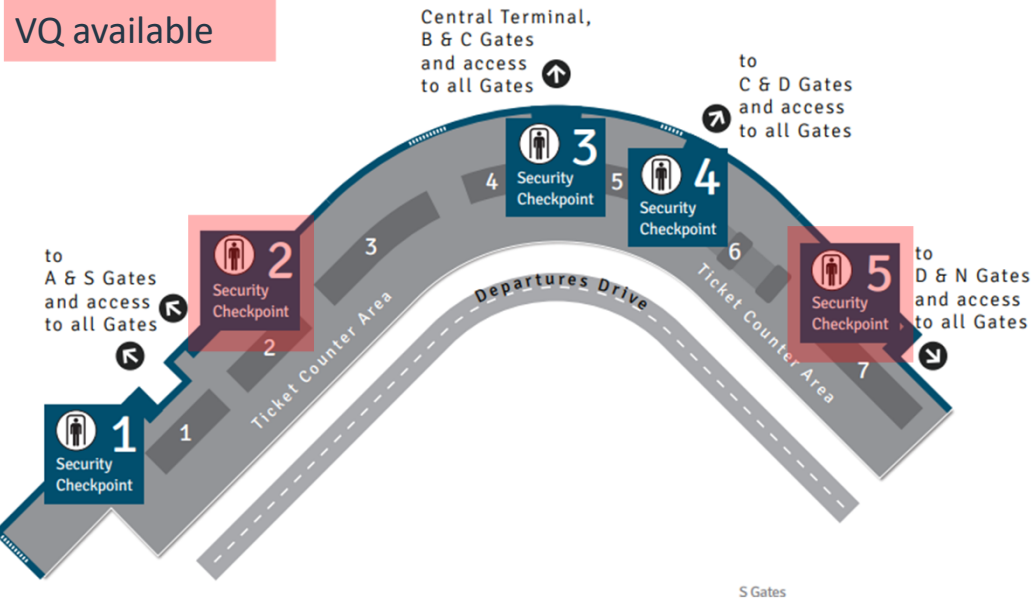
Flattening the Peaks – SEA Case Study

◦ Under the framework of assumptions developed to approximate a reasonable concept of operations for the VQ implementation at SEA, simulation modeling demonstrates evidence of a potential benefit to passenger experience and security checkpoint operations.

◦ The benefit observed due to VQ implementation relies on the ability to shift passenger arrival times at the curb and SSCP by providing a more predictable/reliable journey time for passengers; in the absence of this show-up flattening, these benefits may not be realized.

◦ This is an exploratory study based on planning-level simulation model using data and parameters to simplify a relative complex passenger flow operation at SEA with multiple checkpoints, load balancing, staffing variabilities and other active operational strategies; all aspects of these day-to-day realities are not fully captured in this study.

Photo Courtesy of Bart Everson via Flickr

Executive Summary – SEA Security Checkpoint

VQ available

Central Terminal, B & C Gates and access to all Gates

to C & D Gates and access to all Gates

to A & S Gates and access to all Gates

to D & N Gates and access to all Gates

Ticket Counter Area

Departures Drive

S Gates

Source: Port of Seattle Website.
https://www.portseattle.org/sites/default/files/2018-02/Security-Checkpoints.pdf

Departure Concourse	SSCP Regular Passenger Assignment	SSCP PreCheck Passenger Assignment
A, S, U	2*	1
B, C, Q	3	4
D, N	5*	4

*15% regular pax from A, S and U gates use SSCP 3 and 5% regular pax from D and N gates use SSCP 3

SSCP Lanes Available				
SSCP	Total Available*	Precheck 240pax/hr/ln	ASL 180pax/hr/ln	Standard 150pax/hr/ln
SSCP 1	3	3	0	0
SSCP 2	8	0	4	4
SSCP 3	7	0	5	2
SSCP 4	6	6	0	0
SSCP 5	6	0	3	3
Grand Total	**30**	**9**	**12**	**9**

*anecdotally not all available lanes are staffed at SSCP

Executive Summary – Demand

At-Gate Originating Passenger Demand S2019 Flight Schedule**
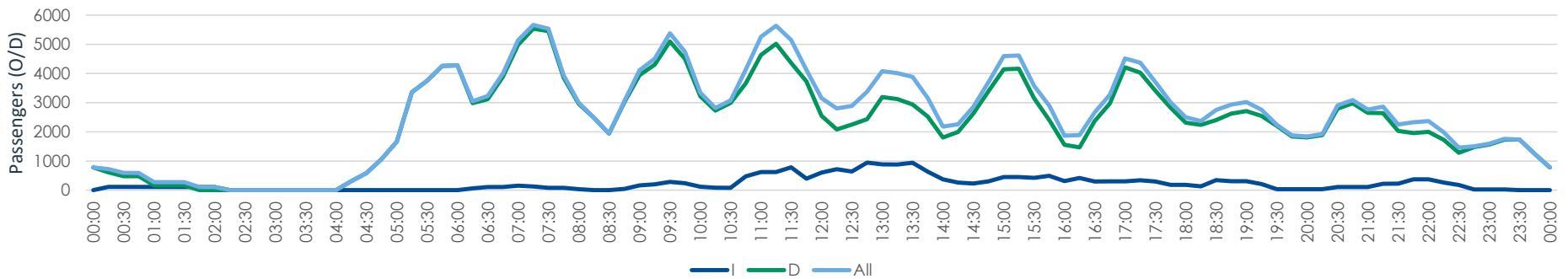
**96% LF; connections – AS: 18%-77%; AA 4%-8%; DL: 25%; Other DOM: 20% 9am-9pm; Foreign Flag International: 30%

Overall* SSCP Passenger Throughput Calibration S2019 Flight Schedule

Calibrated values are 93% on average of historical
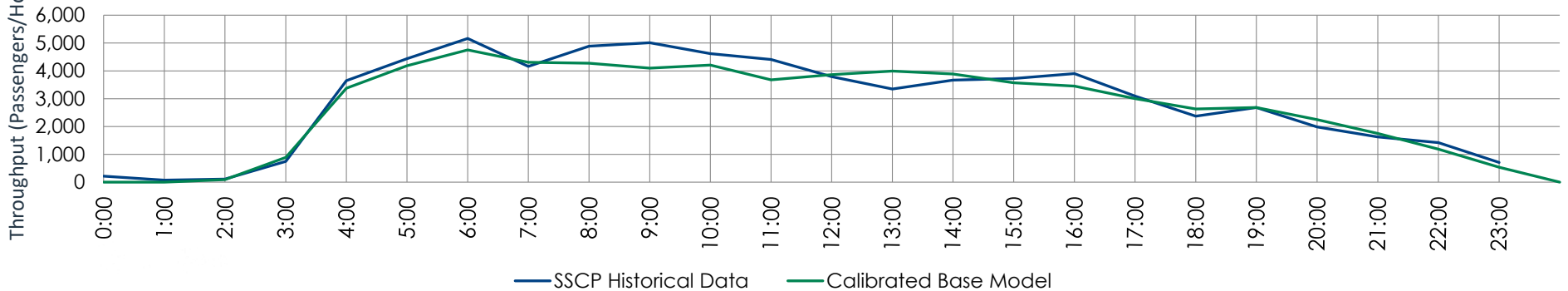
*Throughput by SSCP area provided in Appendix for additional reference; Source: Port of Seattle, Seattle Coordination Center: Historical data from 'Throughput – AirportCheckpointHourly.xlsx' for Aug 16, 2019

Executive Summary – VQ Concept

VQ Registration
20% or 30%
After check-in
Receive time slot

Unregistered and
>60 minutes prior
to departure
time?

VQ Registration
20% or 30%
Prior to arrival
Receive time slot
Influences passenger
show-up time

Check-In
Arrival at airport
20% INT bypass
40% DOM bypass
Others wait 5-15min

VQ Activation
After check-in
Get QR code

Wait for Appointment
Time slot
Proceed to SSCP within 10
minutes of getting notification
to proceed

Security Checkpoint
SSCP 2 and 5
Enter VQ priority: **5-min wait**
Assumed 0% cancellations and
on-time passenger arrival

Executive Summary – Show-Up

Show-Up Profile - DOM

33% Appointments 45-60mins

No Appointment Zone

67% Appointments 120 -165 mins

50%
40%
30%
20%
10%
0%

0 - 30   30 - 60   60 - 90   90 - 120   120 - 150   150 - 180   180 - 210   211 +

Time Before STD
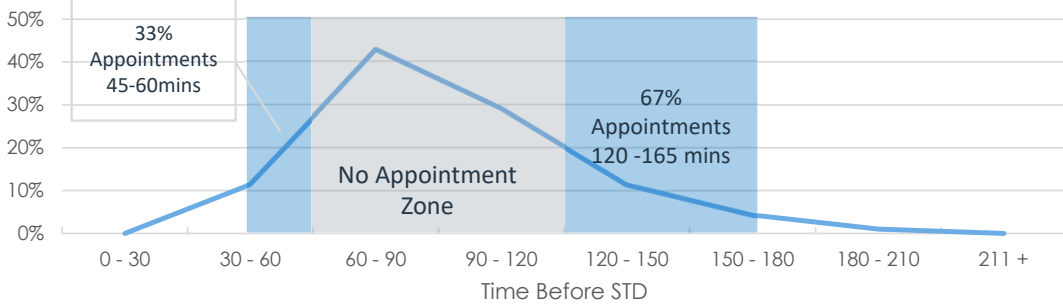
DOM 7am - 9am Show-Up

VQ Time Slots – Prior to Arrival

Show-Up Profile - INT

51% Appointments 180-210mins

35% Appointments 90-105mins

No Appointment Zone

No Appointments

50%
40%
30%
20%
10%
0%

0 - 30   30 - 60   60 - 90   90 - 120   120 - 150   150 - 180   180 - 210   211 +

Time before STD

INT 7am - 9am Show-Up

14% Appointments 150-165mins

VQ Time Slots – Register at Airport
(Sample)

Arrival Time at Airport
(>60 min Before STD)
8:00am

Departure Time
10:30am

25% Appointments

25% Appointments

25% Appointments

25% Appointments

No Appointment Zone

0 - 30   30 - 60   60 - 90   90 - 120   120 - 150   150 - 180   180 - 210   211 +

Time before STD
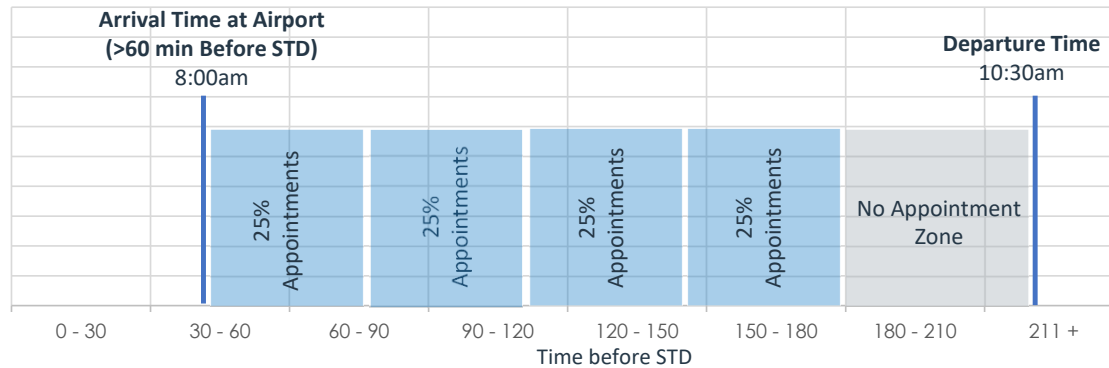
How Virtual Queuing (VQ) Works

Rethinking the concept of queuing

- How have other industries tackled queuing and what can we gain from it?

- Restaurants, amusement parks, stadiums?

- What systems are already in place at airports that can be leveraged?

- Mobile check-in?

What benefits do we gain?

- Reduction of peak wait time

- Development of pre-security lounges, dining, and retail for passengers

- Increased information about passengers and their location within airports

On-Going Pilot Project – DEN Verifly

App, Airport, Main process	VQ Journey	Database/ Crowd Data	Partnerships
Verifly, DEN, Security Checkpoint	Enrollment at reservation, health requirement checks Dedicated TSA screening (15min reservation window) Reservation on train to concourse using QR	No	Daon
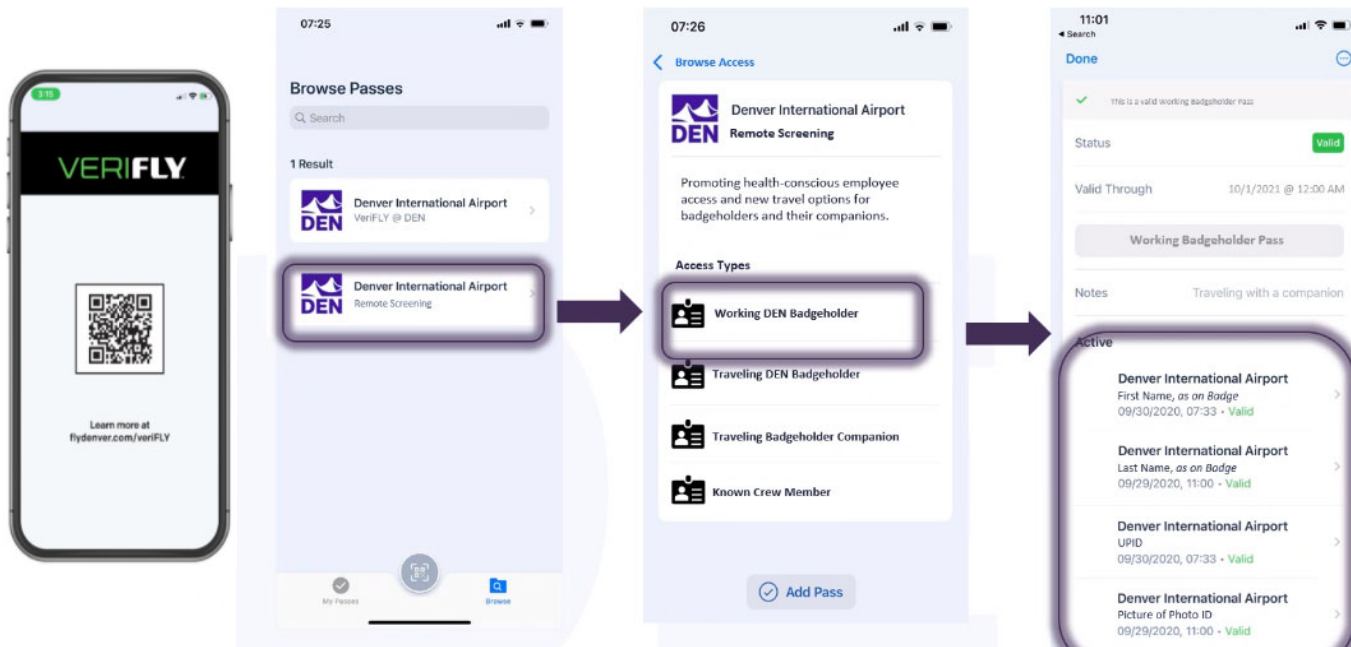
Key Takeaways
o Important to build a network that is standardized to ensure passenger confidence
o Important to provide an incentive-based, opt-in service
o Broad applicability across the airport environment and beyond
o High-levels of customer satisfaction:
    o Net promoter score over 70
    o Like to re-use/recommend over 90 precent

On-Going Pilot Project - YYZ

App, Airport, Main process	VQ Journey	Database/ Crowd Data	Partnerships
WIPRO, YYZ, Boarding	Sign up for VQ at testing or at check-in, enrollment with phone > notification for testing/ check-in > physical queuing > VQ for security >VQ for boarding	Assists airlines to manage crowding at boarding	Wipro
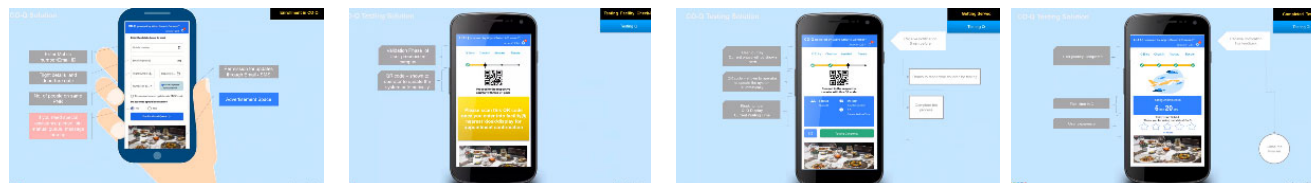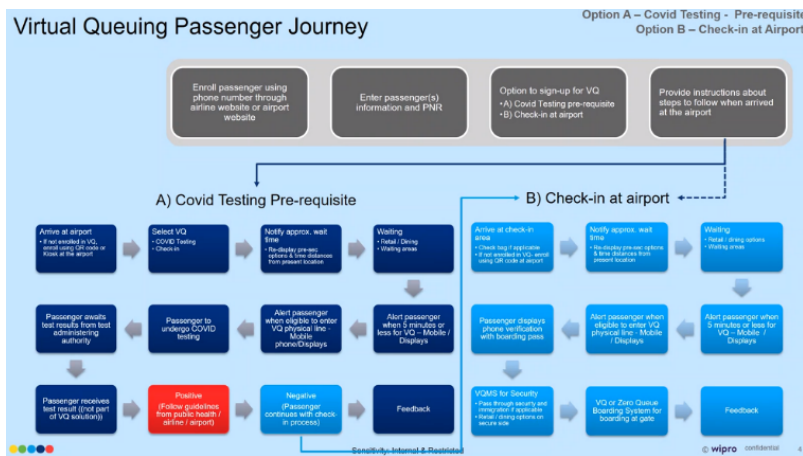
Key Takeaways

o VQ at boarding allows for an efficient way to board passengers by quickly moving along those in proper order

o Managing pre-departure Covid test schedule through a mobile platform ensures a better throughput at queues

o Airlines may have more flexibility in boarding operations using a mobile app

On-Going Pilot Projects – SEA

App, Airport, Main process	VQ Journey	Database/ Crowd Data	Partnerships
Pangiam, SEA, Security checkpoint	Check-in queue reservations; alerting passengers via email; QR code registration	Not in pilot	Alaska Airlines
VHT, SEA, Security checkpoint	Check-in queue; alerting passengers via SMS; QR code registration	Not in pilot	Delta Airlines

60 Min Pax - Demand VS Counts

Legend:
- Pre-Covid 8/16/19
- 11/29/20 43% LF
- Pre-Covid 8/16/19 TSA Counts
- 11/29/20 TSA Counts
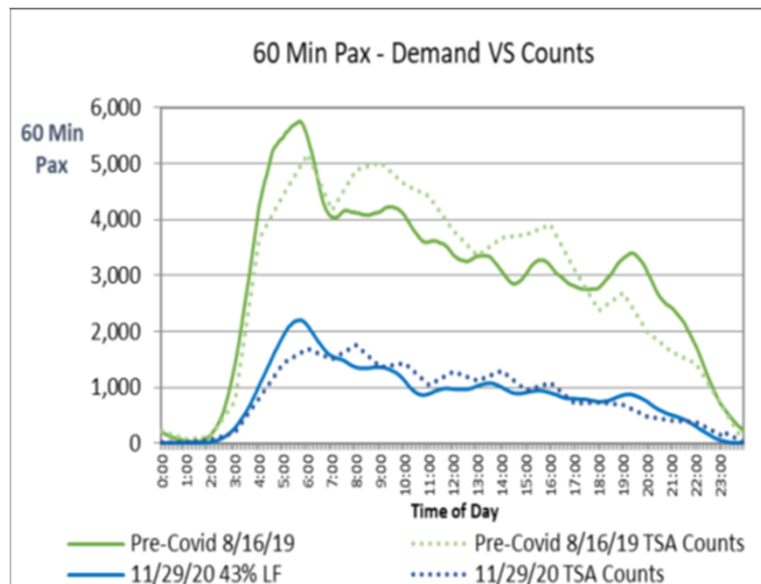
Key Takeaways
- o Encouraging passengers to arriver earlier then they normally would assist in lowering queue demands at peak times
- o Attention should be paid towards where people dwell if queues are full. Option for travelers to wait in car or airport to provide kiosks to serve food & beverage

Objectives/Goals
- o Respond to impacts of physical distancing
- o Manage SEA's physical space limitations
- o Enhance passenger experience
- o Provide advanced reservation option
- o Developing a long-term plan for VQ
- o Balance checkpoint loads (long-term)

On-Going Pilot Projects – SEA
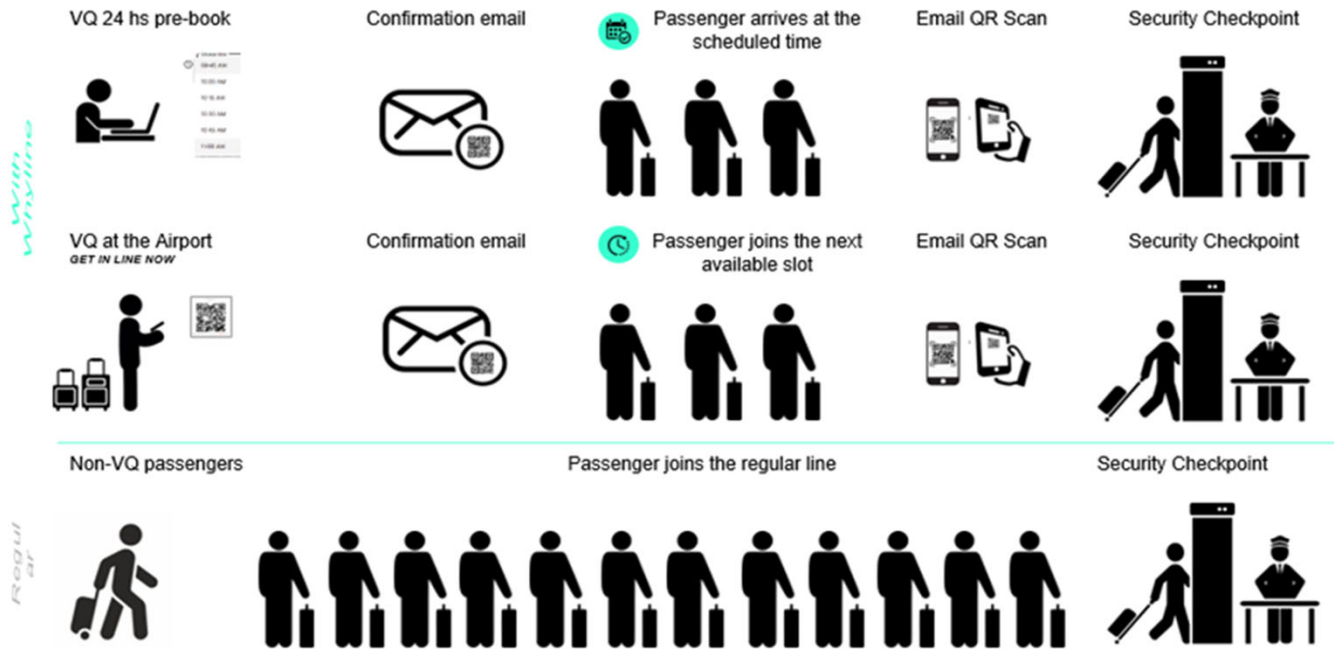
On-Going Pilot Projects – SEA

Checkpoint #5

◦ For the VQ trial, the Port of Seattle and Pangiam agreed to not modify the existing queue system consisting of three queues before the TDCs: General, Premium and Clear.

◦ The VQ flow will be merged with the Premium passenger flow and both will use the same queuing space but will have a different checking process for accessing the queue.

◦ During the trial, the queue configuration will be reviewed and adapted if necessary.

On-Going Pilot Projects – SEA

1. Input data in Better Forecast	2. Prepare plans in Better Security	3. Provide VQ passenger access	4. Monitor plans in Better Security	5. Optimize process and recalibrate
•Input schedules •Decide flight eligibility	•Decide number of TDCs to open for VQ	•Scan QR code •Monitor queues	•Monitor the number of passengers booked in VQ	•Lane throughput •Passenger split •Lane configuration •VQ booking agenda

On-Going Pilot Projects – SEA

On-Going Pilot Project – SEA

Start May 2021	June 2021	July 2021	August 2021	End (120 Days) September 2021
Project Initiation/Development	Build and Design	Testing and Training		Live Testing

Working Groups:

Data/Reporting:
1. Code/Reporting Req'ts
2. System Architecture
3. Messaging
4. Pathways/Outcomes

Product Testing:
1. Test Plan
2. User Acceptance testing
3. System Administration

Queue Configuration/Mgmt:
1. Overview of User Interface
2. Queue lane configuration
3. User training

Traveler Outreach:
1. Collaborate on branding
2. Spot Saver Program
3. Sign content/placement
4. Airline Integration

On-Going Pilot Project – SEA

Draft Communications Plan – Website and Signage

On-Going Pilot Project – SEA

Success Criteria	Criteria Measurement
Develop a VQ & VQ reservation product for passenger queuing at the security checkpoints	Validate the system is operating as designed at 100% functionality
Manage passenger throughput for checkpoint queuing	Travelers are sequenced in order of their flight departure times
Manage facility capacity available for passenger queuing	Able to process all checkpoint passengers to avoid any overflow queuing
Improve passenger experience	70% of VQ traveler surveys are positive about the program (based on passenger feedback and survey questions)
Work to develop a VQ advanced reservations system for passengers	How proposals best meet the long-term goals of the VQ Program
Provide a long-term plan solution to add value to passenger experience	

CHALLENGES

Part Two

Process Diagram

| In-App check-in | Option within App to sign up for VQ

• Display pre-security retail/dining options & entrance door | Arrive at airport

• Check bag if applicable | | Scan QR code to begin VQ | Give approx. wait time

• Re-display pre-sec options & time distances from present location | Alert passenger when 5 minutes or less for VQ |

| Arrive at airport

• Check in
• Check bag if applicable | Airline employee/ kiosk to inform passenger of VQ option | | Alert passenger when eligible to enter VQ physical line | Passenger displays phone verification with boarding pass | Pass through sec and be given boarding gate assignment & retail/dining options |

| VQ for boarding gate? |

VQ as applied in a security screening process context is still being developed with very few operational trials being undertaken. With technologies and processes being evaluated during the latest trials, the description above is a baseline recommended process that can be adapted to each specific airport VQ requirement.

Dwell Time

◦ Physical distancing (all stages)

◦ Monitoring capability to manage queues in real time
  ◦ Manage and monitor target enrollment levels to ensure service levels can be met in both virtual and regular queues

◦ Revenue opportunities (advertising on App, promotion of F&B, retail, airlines, others)
  ◦ Can VQ provide revenue opportunities via value-add services
  ◦ Observation in early boarding pilot increased visibility and uptake of upgrade opportunities.

◦ Constraints within the pre-security areas;
  ◦ Seating space to wait for turn to enter queue
  ◦ Lack of retail in these areas for passengers to pass time
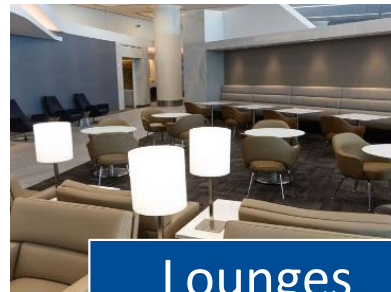
Lounges

Seating

Dining
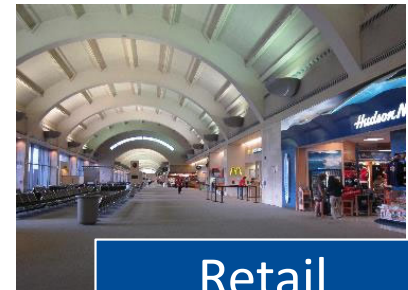
Retail

Communication

○ Coordination with all airport stakeholders to ensure common messaging
  ○ Airport Operations, Security (TSA/CATSA), Airlines
  ○ Employee groups for related VQ processes (i.e. testing, vaccines, pass management)
  ○ Retail, F&B partners to collaborate on revenue opportunities

○ Depending on where VQ is adopted, create linkage within existing processes (i.e. online check-in, testing registration)

○ Promote via airlines with frequent fliers (ex. lounge access for VQ passengers, discounts on meals)

○ Dedicated, high visibility placement on airport websites with relationship to "Healthy Airport" processes

○ Can a sign-up enable enhanced customer data or rewards program?
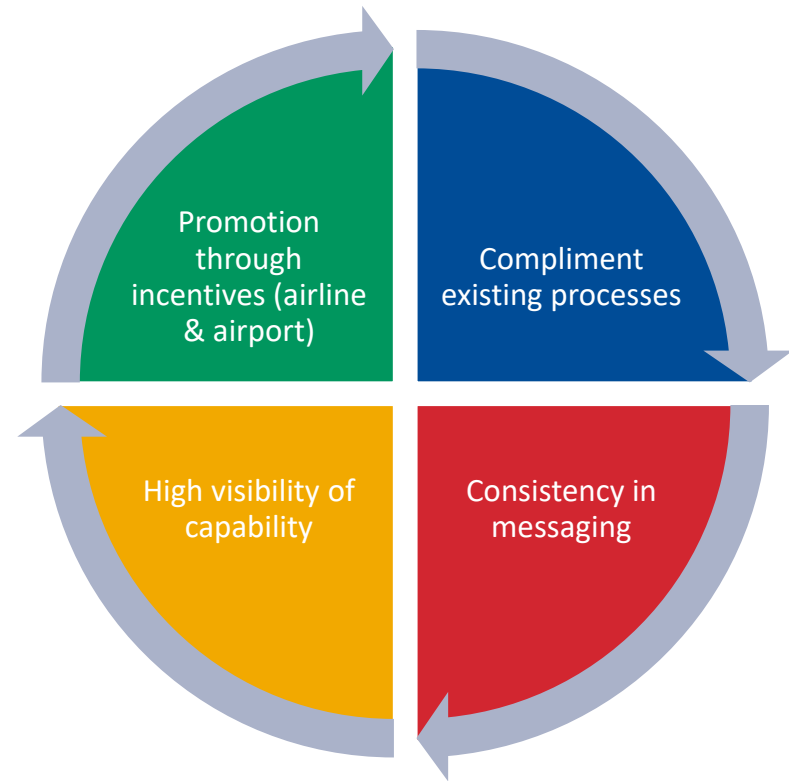
Stakeholder Engagement

◦ How to expose the service to passengers?
  ◦ Airlines have historically owned this relationship but depending on the service offering, this offering could change the typical behavior.

◦ Create compelling context for all involved
  ◦ What's in it for me?
  ◦ Linkage to "Healthy Process" and reduced congestion

◦ Work closely with all groups involved in process flow
  ◦ Manage the implementation in an agile manner, adjust and improve progressively
  ◦ Ensure alignment of objectives, outcomes, and service levels
  ◦ Create working groups to capture learnings and recommend adjustments (including consumer directly)

◦ Advertise the successful outcomes (internal/external)

Passengers

IoT & Technology Partners

Airlines

Airport Operations

TSA

Airport Dining & Retail

Technical Concerns

Questions	Answers
Q: Multiple airlines using same queue • Need all airlines to participate (can't give one airline preferred queue space) • Airlines would need to use same API, software. Airline owns relationship with passenger and has access to them via contact info	A: Coordination with airlines to create interface between airline database and airport database for input and retrieval of real-time data.
Q: How to prevent missed appts and loss of capacity	A: A.I. to adapt algorithms based on historic and real-time data. Some time required to calibrate and collect sufficient data to create more efficient processes.
Q: Internet Connectivity • Access to reliable signal for VQ updates for international passengers and/or passengers without phones	A: Use of combined cellular and internet capability within airports. General public checkpoints to remain for phone-less passengers.

Physical Concerns

Questions	Answers
Q: Lack of queueing space where both VQ and non-VQ space is needed	A: Expansion into entrance hall/ticketing areas in worst case scenarios
Q: Pre-security space for passengers	A: Allocations of outdoor spaces for wait time? Potential development of seating, lounges, and dining/retail pre-security to offload VQ crowds from non-VQ lines.
Q: Multiple entry points Main (Non-VQ) • VQ, TSA Pre-Check, First Class, Clear, Employee	A: Coordination with internal stakeholders to combine pre-existing priority groups and allocate VQ passengers where capacity is available.
Q: Social distancing (COVID)	A: VQ and social distancing are complimentary in many ways, VQ customers can be re-located to larger waiting spaces.

TECHNOLOGIES

Part Three

Key Components

Establishing an end-to-end process

- Integration of VQ into existing data ecosystem within airports
- Incentives for airport stakeholders to share data with VQ system include:
  - Real-time information pertaining to passenger location within the airport (pre-security vs post-security)
  - Ability to schedule employees based on historic VQ & Crowd Management data
- No additional hardware/sensors needed for cloud-based solutions where Crowd Info solutions have already been deployed
- Location info can be a component of VQ or provided as a separate input based on preference

Airline App Initial Info
- Flight info
- # of persons
- Text/notification info

Airlines
- # Passengers before Sec
- # Passengers thru Sec
- Airport arrival time
- Pass-thru time

Crowd Info
- Crowd data (Past, Present, Predictive)
- Non-VQ passenger flow

Queue Technology Integrator

Location Info
- In-person arrival time via scan
- Location in airport?
- # of persons

TSA
- Employee Schedules

VQ
- # Passengers before Security
- # Passengers thru Security
- Wait times/Flow rate

VQ
- Airline app input
- Scan input
- Crowd data input
- TSA scheduling input

Virtual Queue Technology Vendors

Technology Partners/Integrators	Virtual Queuing (VQ)	Optimization/Flow Management
• CLEAR	• Accesso	• BlipTrack
• Daon (VeriFLY)	• eGlobe IT Solutions	• Cisco
• Harman	• Lavi Industries	• Copenhagen Optimization
• Sedco	• Ombori	• CrowdVision
• Veovo	• Pangiam	• Mexia
• Wipro	• Qmatic	• Tobii
	• VHT	• Traf-Sys
	• Whyline	• VenueNext
		• Xovis

Categorizations are not definitive, and vendor roles are continually evolving to deliver the components of technology supported operational processes

Aviation Case Studies

Delta Airlines

◦ Delta passengers now notified when seat is boarding through Fly Delta App

◦ Latest step in Fly Delta's app transformation into a "digital concierge" which already integrates real-time TSA wait times in specific cities

◦ Customer feedback that passengers want a "home base" for managing travel day

Qtrac & Major Airline Customer Service

◦ VQ for passengers in need of customer service due to flight delays and cancellations

◦ VQ begins by passenger scanning boarding pass, creates slot in queue and transfers passenger flight info to service representative

◦ Passenger given estimated wait time, return at appointment slot time, phone then scanned and progress of flight issue solution given

SecurXpress at YUL

◦ SecurXpress is a web-based platform for security screening scheduling launched in 2013

◦ Passengers traveling on non-US bound flights register with their cellphone number and name on the YUL website and receive an appointment time

◦ 2500-3000 passengers registered between 2013 and 2018 for the VQ service

Other Industry Case Studies

Accesso @ Holiday World & Splashin' Safari

- Amusement Park (1.1M visitors annually)

- Normal pre-COVID lines fit 100 guests across a 300ft area, same line could increase to 700ft, need to accommodate social distancing

- inline Reservation platform, a custom-branded implementation of accesso LoQueue. Park re-opened to passholder June 14th, opened to general public a few days later

- Receive wristband with code, prompted to register and add 6-digit number, then make reservations through app, once ready, guests receive notification of their turn and park operators conduct a contactless scan of QR code on wristband

Results

- Increased guest spending due to less time waiting in lines

- Prioritization of rides; less frequented rides were removed from VQ to provide available options, while guests waiting for the VQ's on more popular rides
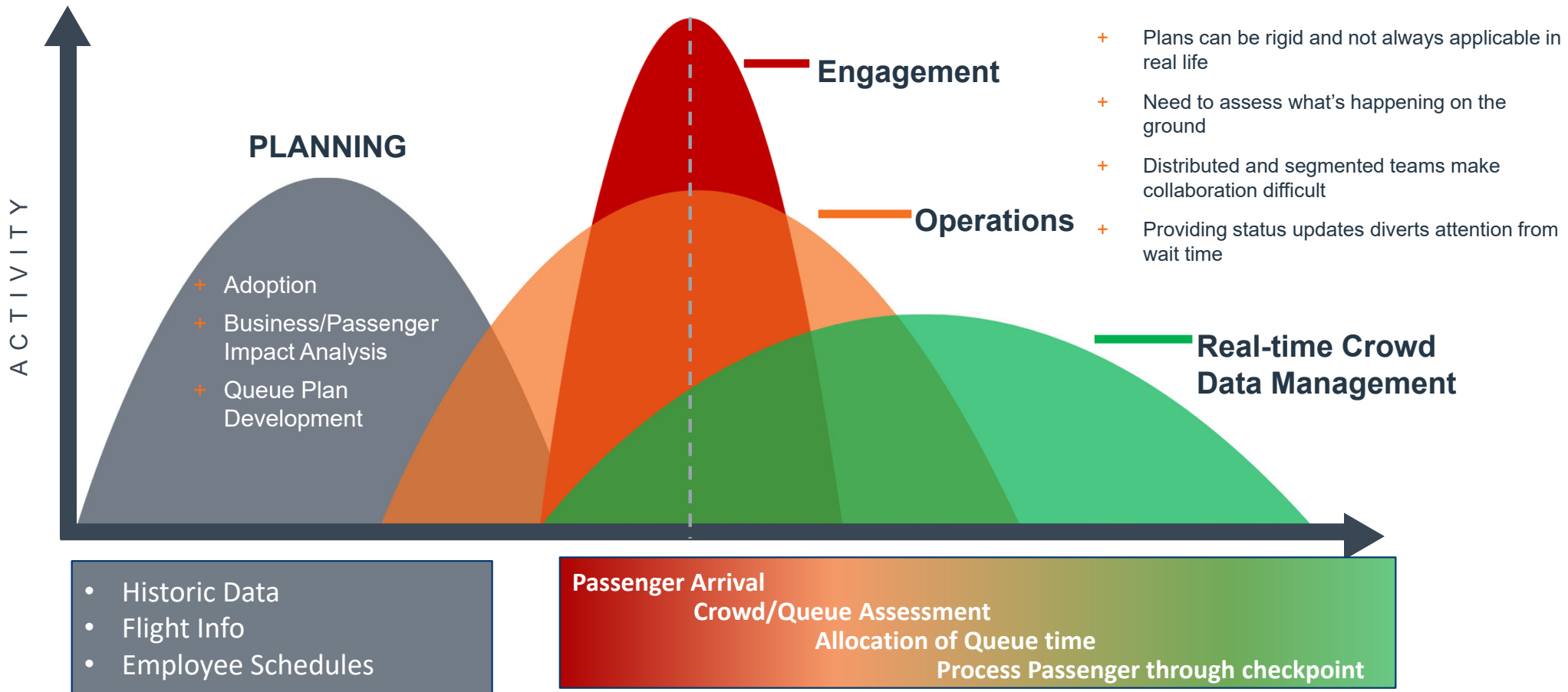
"

The implementation of Accesso LoQueue virtual queuing technology was the centerpiece of our COVID safe re-opening strategy.

– Matthew Blumhardt, Vice President, Park Operations

COMMUNICATION EFFORTS

Part Four

Communication Across Lifecycle of Engagement

PLANNING

+ Adoption
+ Business/Passenger Impact Analysis
+ Queue Plan Development

— **Engagement**

— **Operations**

— **Real-time Crowd Data Management**

+ Plans can be rigid and not always applicable in real life
+ Need to assess what's happening on the ground
+ Distributed and segmented teams make collaboration difficult
+ Providing status updates diverts attention from wait time

ACTIVITY

- Historic Data
- Flight Info
- Employee Schedules

Passenger Arrival
Crowd/Queue Assessment
Allocation of Queue time
Process Passenger through checkpoint

Communications Strategy

- Use of existing communication systems for internal stakeholders

- Use of SMS, webpage notifications, email, and/or app notifications for external stakeholders

- Ability to confirm passenger's attention/availability?

- Ability to communicate with applicable operations staff for abnormal conditions

Conclusion

◦ VQ solutions are considered essential by participating airports for ongoing passenger management if we are to maintain spacing necessary for current health and safety expectations.

◦ VQ branding is an effective mechanism for capturing passenger attention, necessary to drive enough use to make a difference (DEN Verifly, SEA Spot Saver, YUL SecurXpress).

◦ Theoretical potential of "flattening peaks" is proven by modelling – real world results are necessary to confirm this and will not be known until completion of initial pilot testing in Q3, 2021.

◦ Communications – SMS, mobile app, and web all provide mechanisms for passengers to enroll and be notified of updates and VQ entry times. We are determining what's optimal.

◦ Passenger dwell time prior to entering the VQ must be considered for enhanced passenger value to be realized. Using the dwell time effectively, rather than just waiting away from the main security queue, this offers potential for increased retail sales and an improved passenger experience.

The Virtual Queuing Working Group has been actively supported by a range of airports, terminal operators, and industry participants.

Airport & Terminal Participants

Industry Participants

Leadership

David Wilson
Director, Airport Innovation, Port of Seattle

George Merritt
Senior Vice President, Strategic Operations, Denver International Airport

Martin Boyer
Vice President & Chief Information Officer, GTAA

Paul Drury

Working Group Members

James Kissmer
Manager, Improvement & Innovation, JFKIAT

Robert Bergman
Senior Manager, Operations, JFKIAT

Dominic Jones