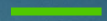




Seattle-Tacoma  
International  
Airport



# Integrating AI into Airport Operations and Services

Fall 2024 Meeting

Friends & Partners in Aviation Weather

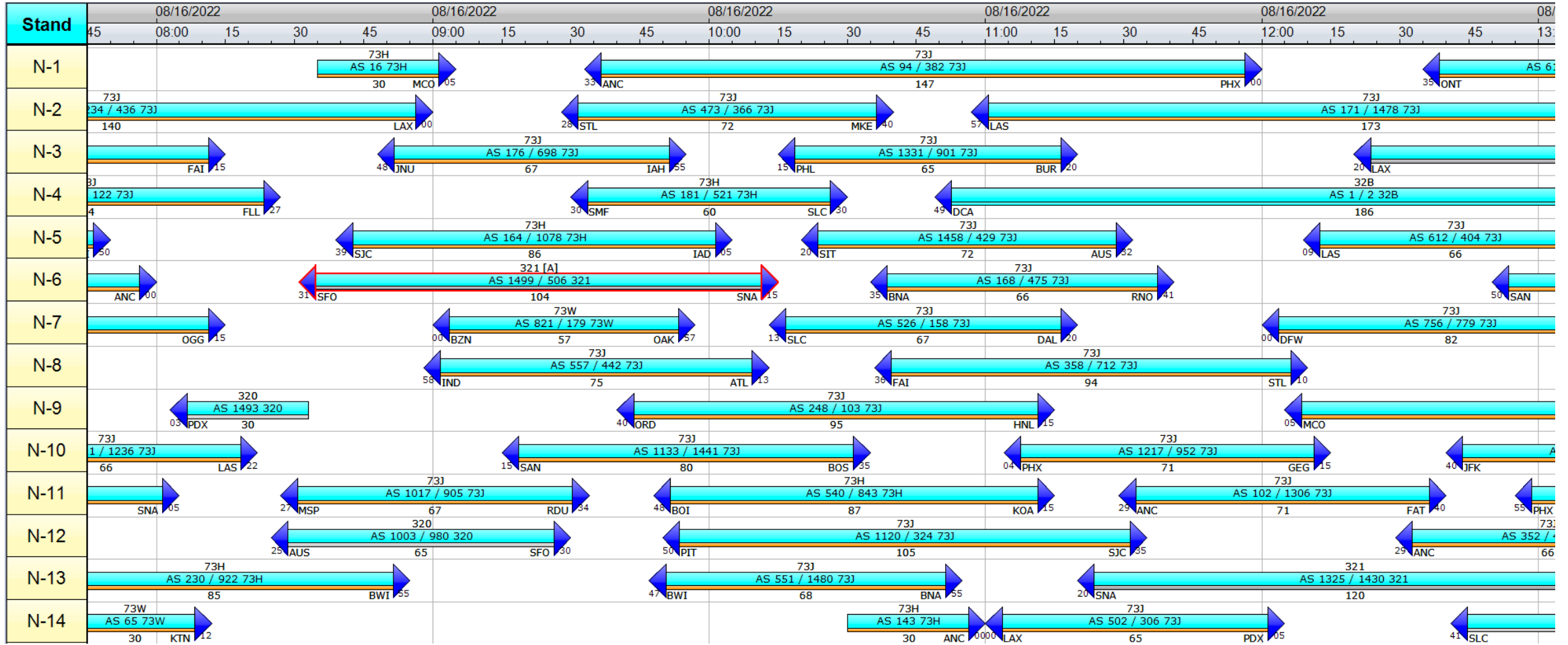
Samer Tirhi | Port of Seattle



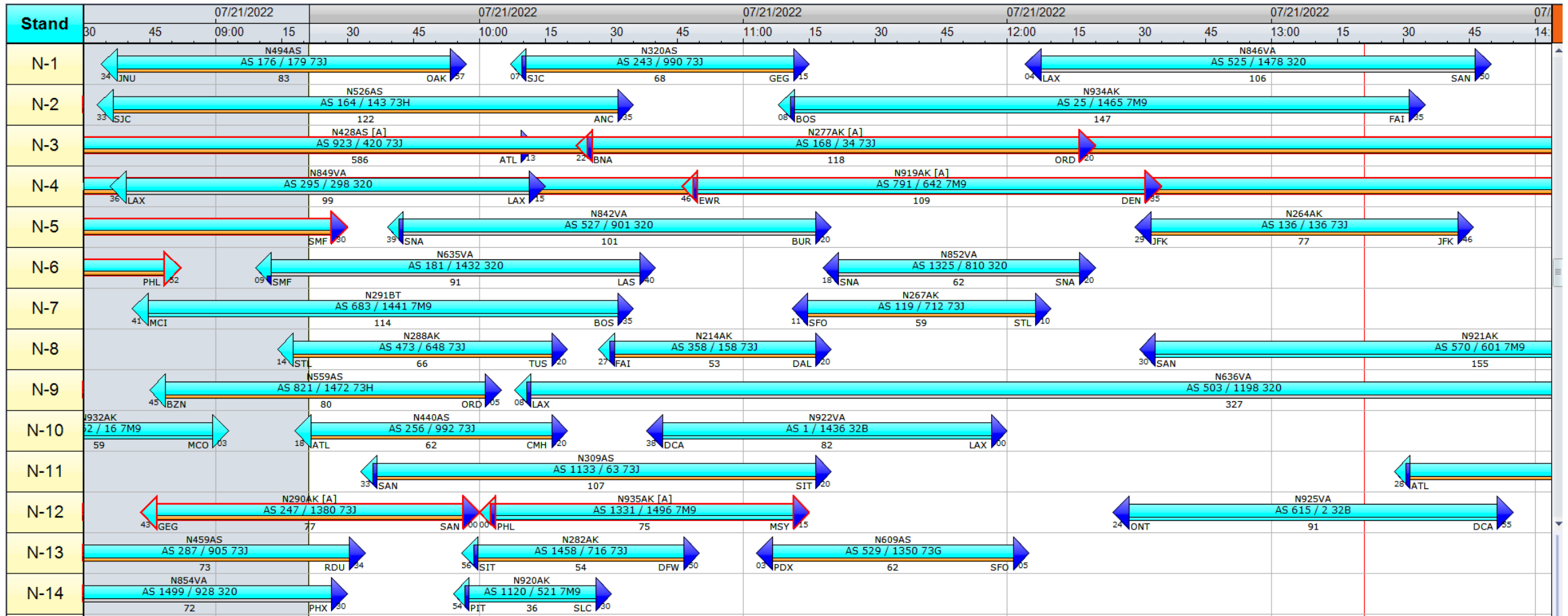
# Constrained Footprint

- Physically limited space.
- Flanked by obstructions.
- Getting smarter with limited resources

# Resource Management - Planning



# Resource Management – Day Of



# Project Goal: Surface Area Management System (SAMS)



Reduce Emissions



Improve Efficiency



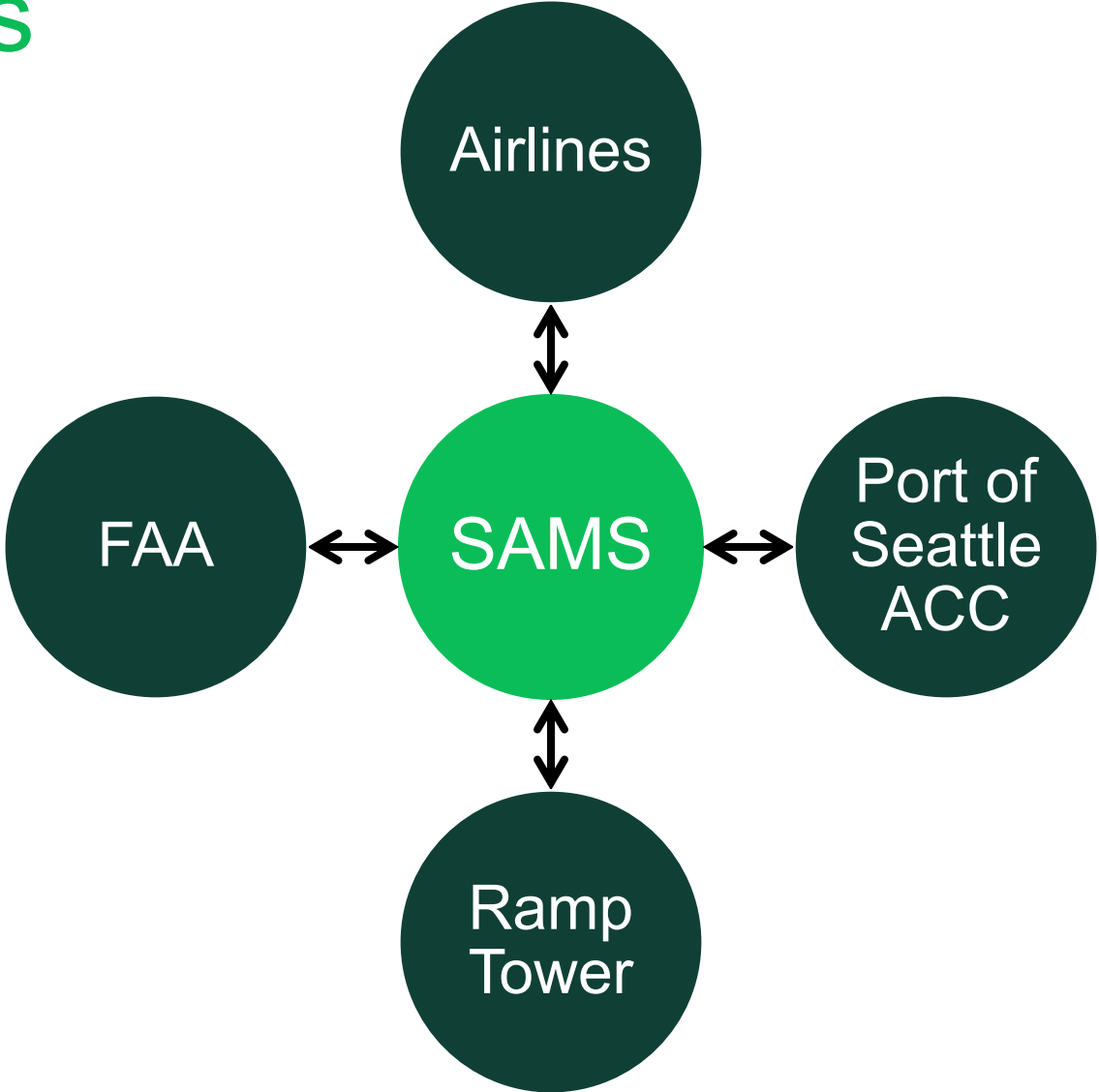
Enhance Safety



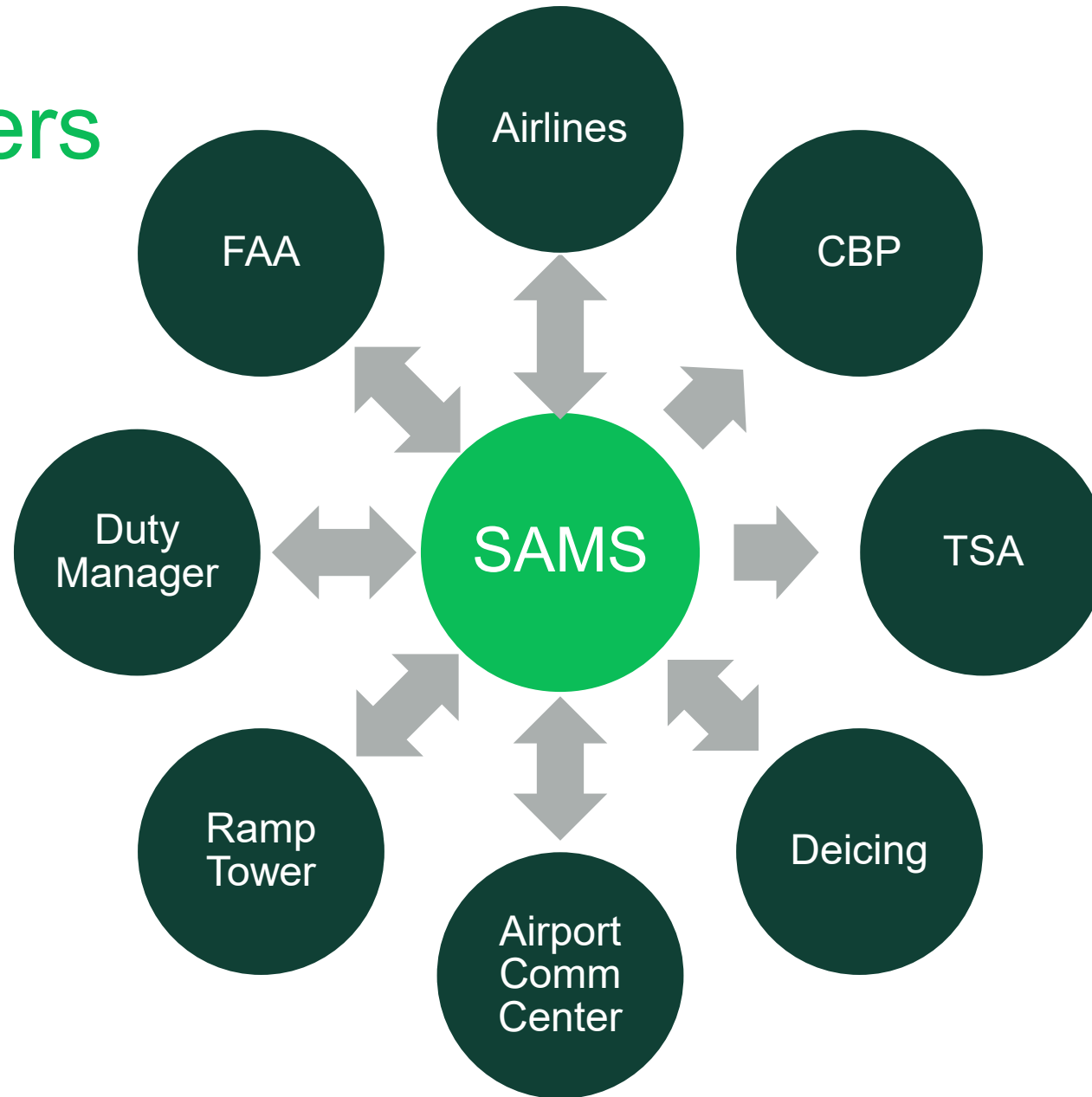
Proactive &  
Collaborative  
Decisions



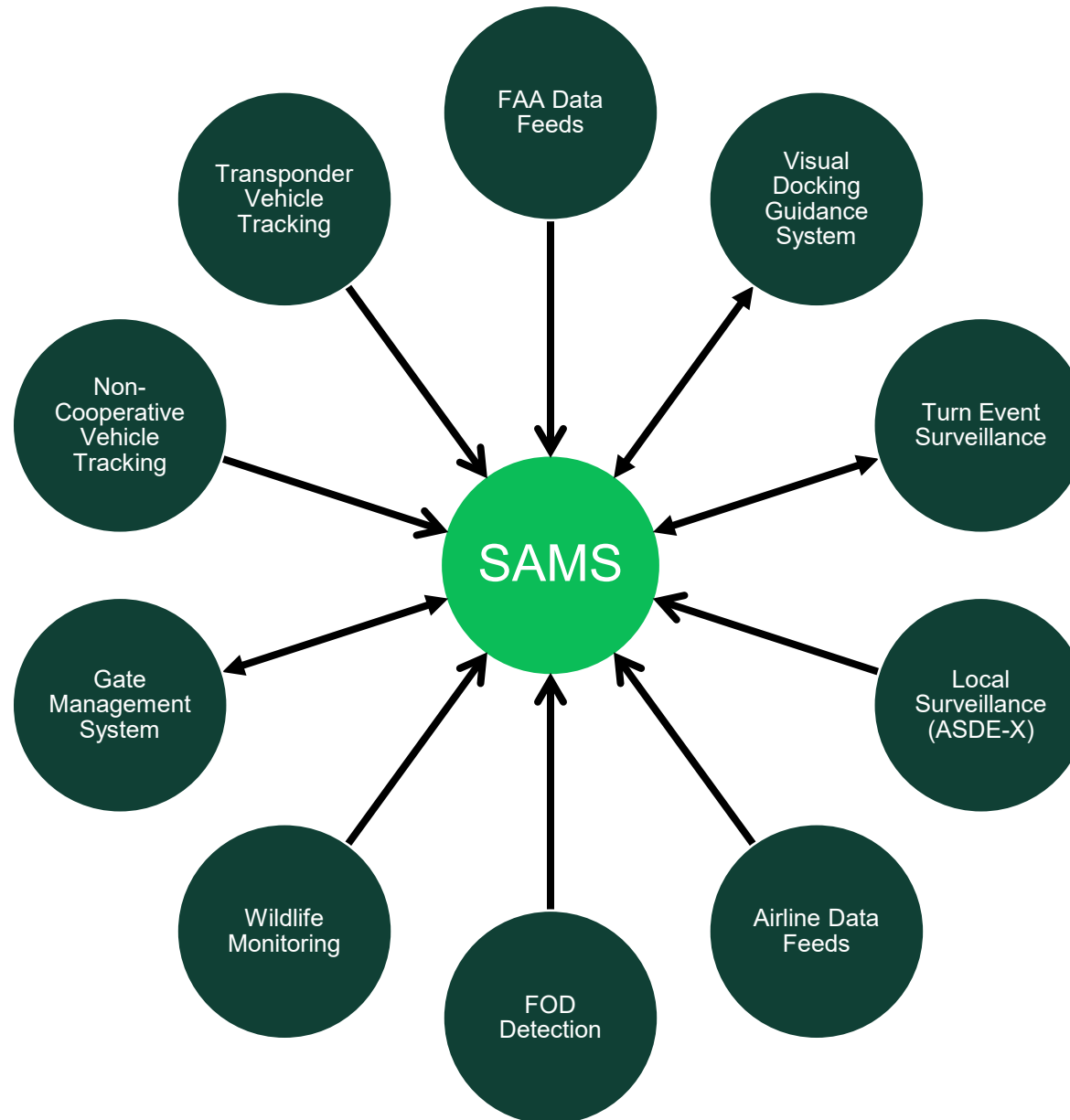
# Stakeholders Interaction Post-SAMS



# Stakeholders

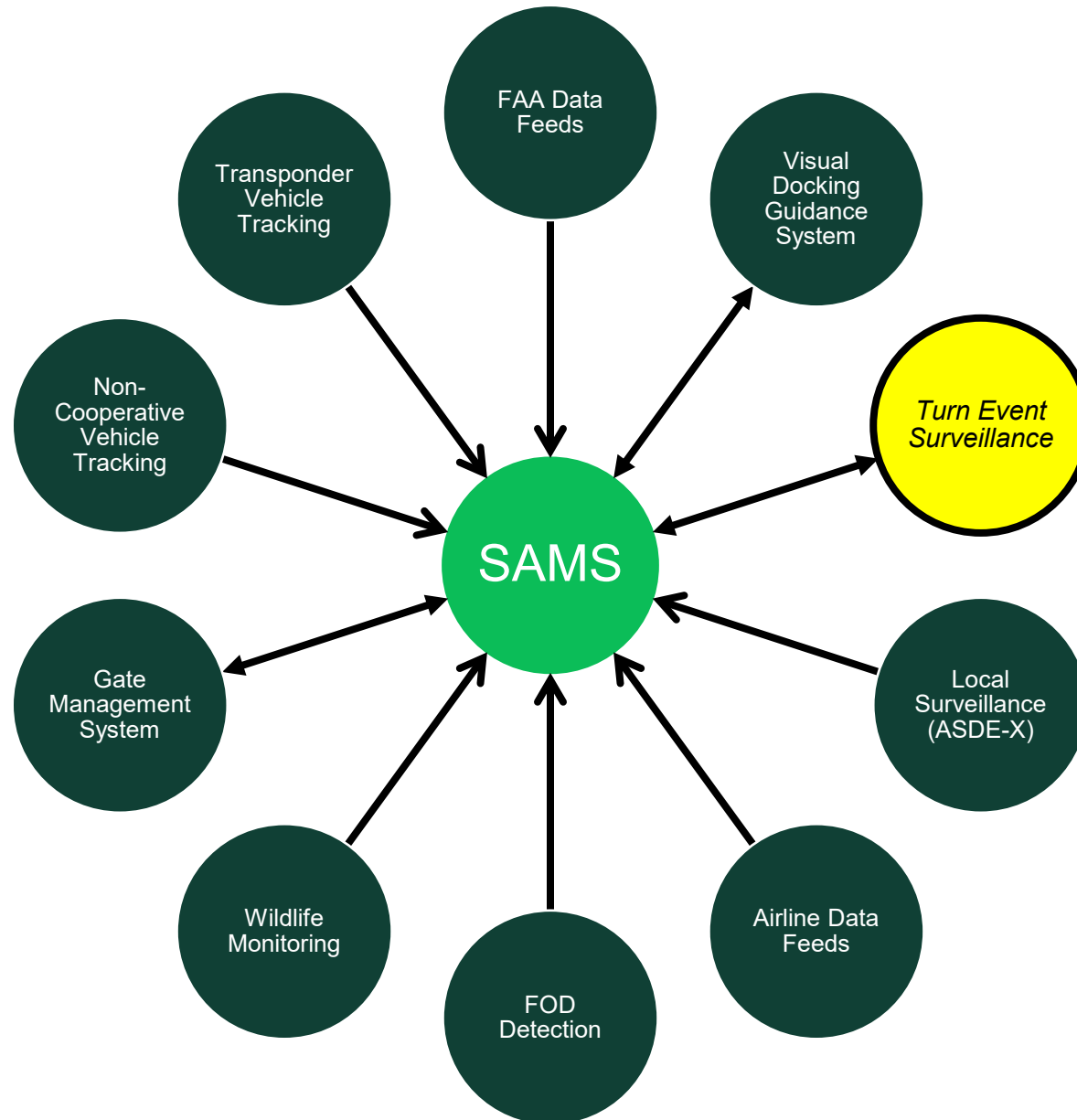


# System Interaction





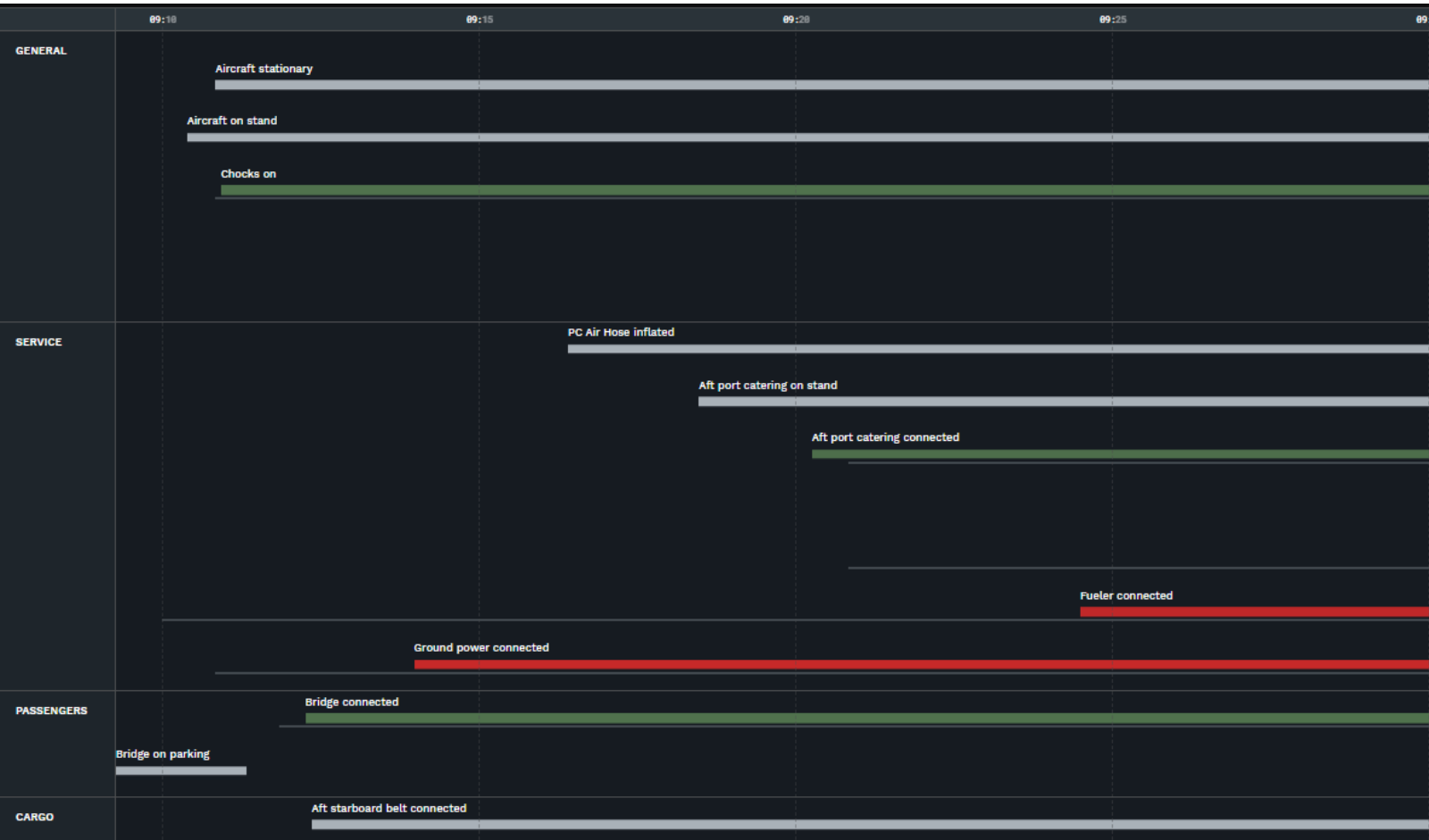
# System Interaction



# Turn Event Monitoring



# Turn Event Monitoring



### Ground power connected

EVENT	CONF	TIMESTAMP	
Ground power connected	83%	21 Jul 2022 09:13:59	▶

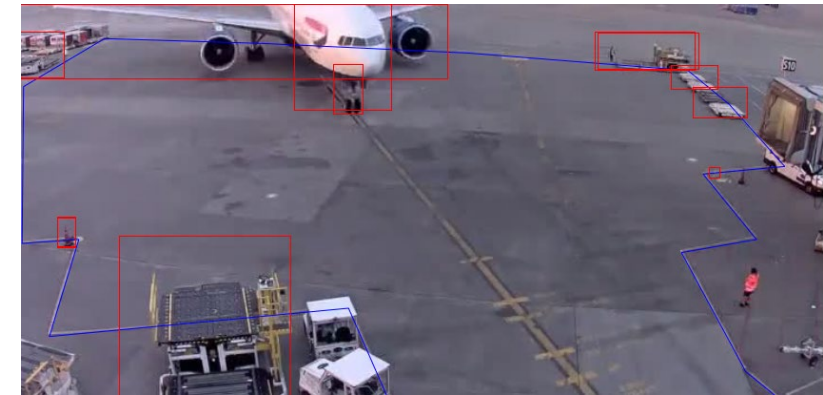
VIDEO D4-S D4-F D4-P

21 Jul 2022 09:13:59

⏪ ⏩

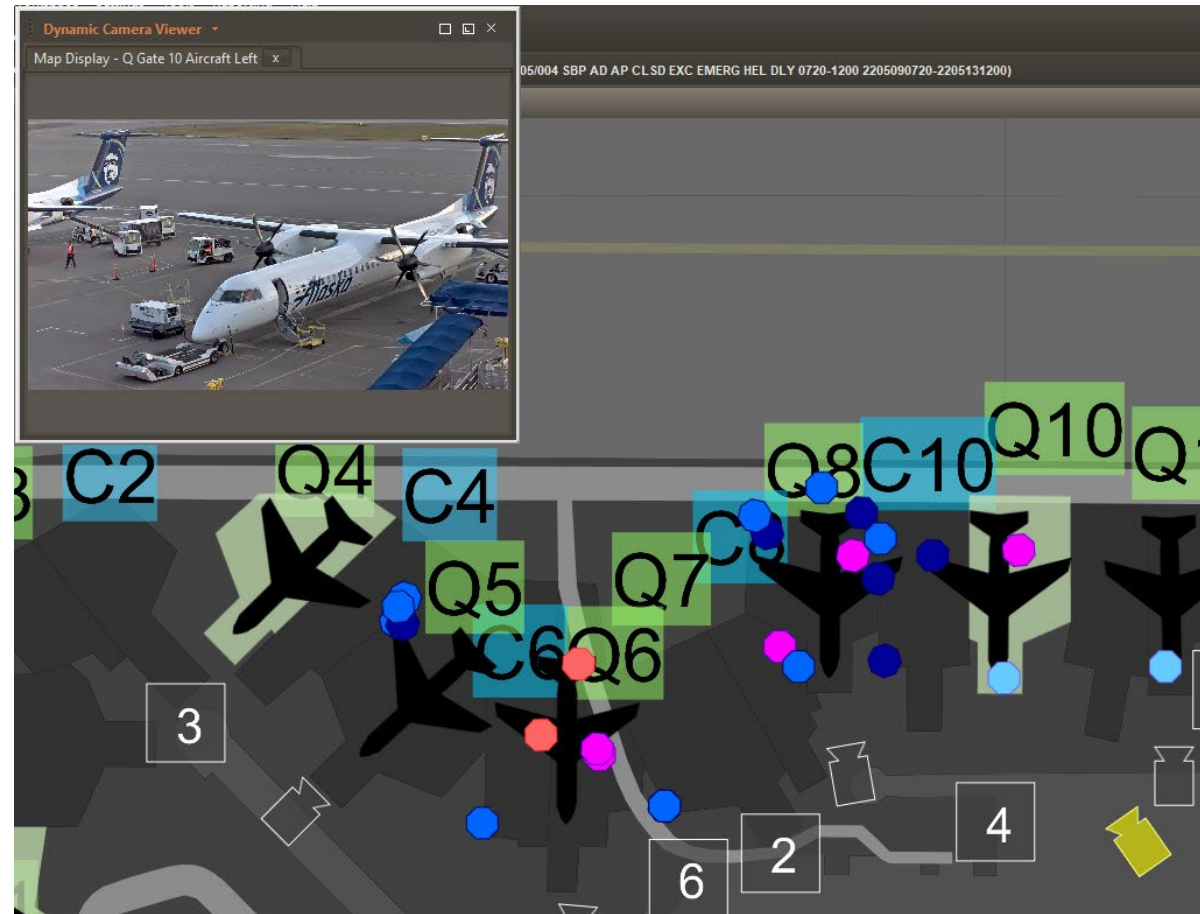
# Stand Clear AI Tracking

- Utilizing Assaia's Apron AI from Ports Surface Area Management System (SAMS) to track if a stand has equipment parked on the tarmac prior to a flight's arrival.
- Being tested on S-10, S-12, S-15, & S-16.
- In the process of capturing more data to produce a month-long system test report.
- Assaia's Initial tests prior to trial showcased 158 correct detections out of 160 test cases.
- Intend to use Misdetections and Time errors as main KPI's when testing Assaia's AI neural network.
  - Misdetections = events that were not detected by the Assaia system.
  - Time Errors = Inaccuracies of reported timestamps compared to when event actually occurred.



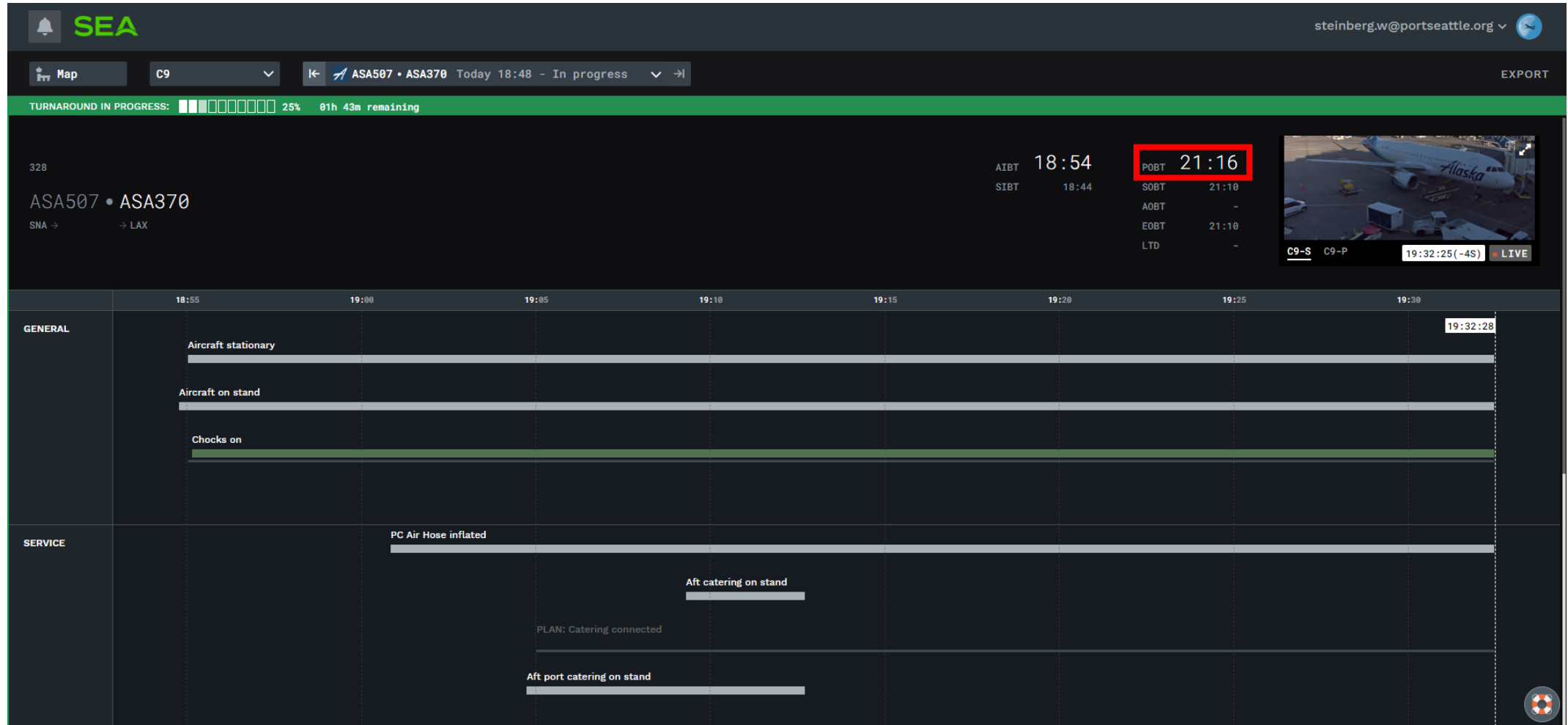
# Non-Cooperative Vehicle Tracking

- Vehicle Tracking via Port cameras.
- Removes need for transponder.
- Increases ramp safety.



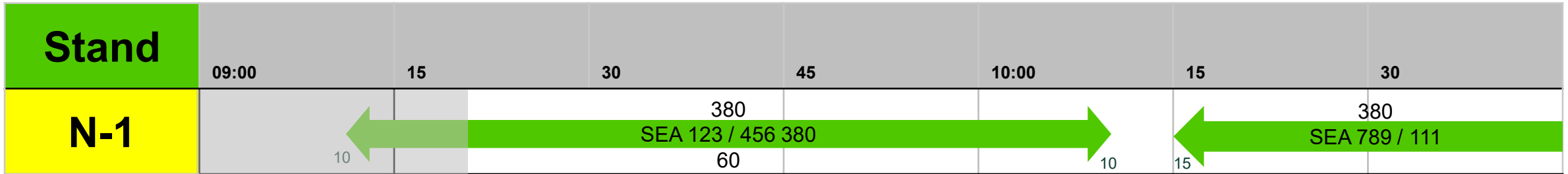
01	Aircraft
02	Bus
03	Cobus
04	Van
05	Fueling
06	Lift Truck
07	Deicing Truck
08	Other Big Vehicle
09	Fire Truck
10	Ambulance
11	Car
12	Water Truck
13	Tractor
14	Belt Loader
15	High Loader
16	Pushback Tug
17	Other Small Vehicle
18	Police
19	ULD
20	Luggage Cart
21	Empty Dolly
	SMR

# Predictive Off Block Time (POBT)



# POBT Impact on Resource Management

Airline Estimated Times



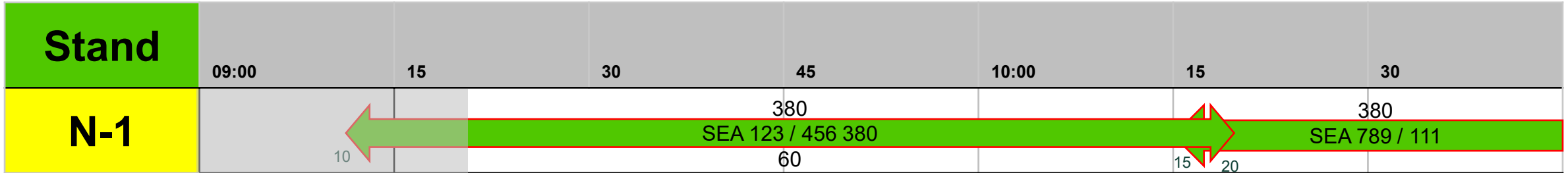
Flight Number	SEA 123
Stand	N-1
SIBT	09:00
AIBT	09:10
Flight Link	SEA 456

Flight Number	SEA 456
Stand	N-1
SOBT	10:00
EOBT	10:10
Flight Link	SEA 456

Flight Number	SEA 789
Stand	N-1
SIBT	10:15
EIBT	10:15
Flight Link	SEA 456

# POBT Impact on Resource Management

Predicted Off Block Times



Flight Number	SEA 789
Stand	N-1
SIBT	09:00
AIBT	09:10
Flight Link	SEA 456

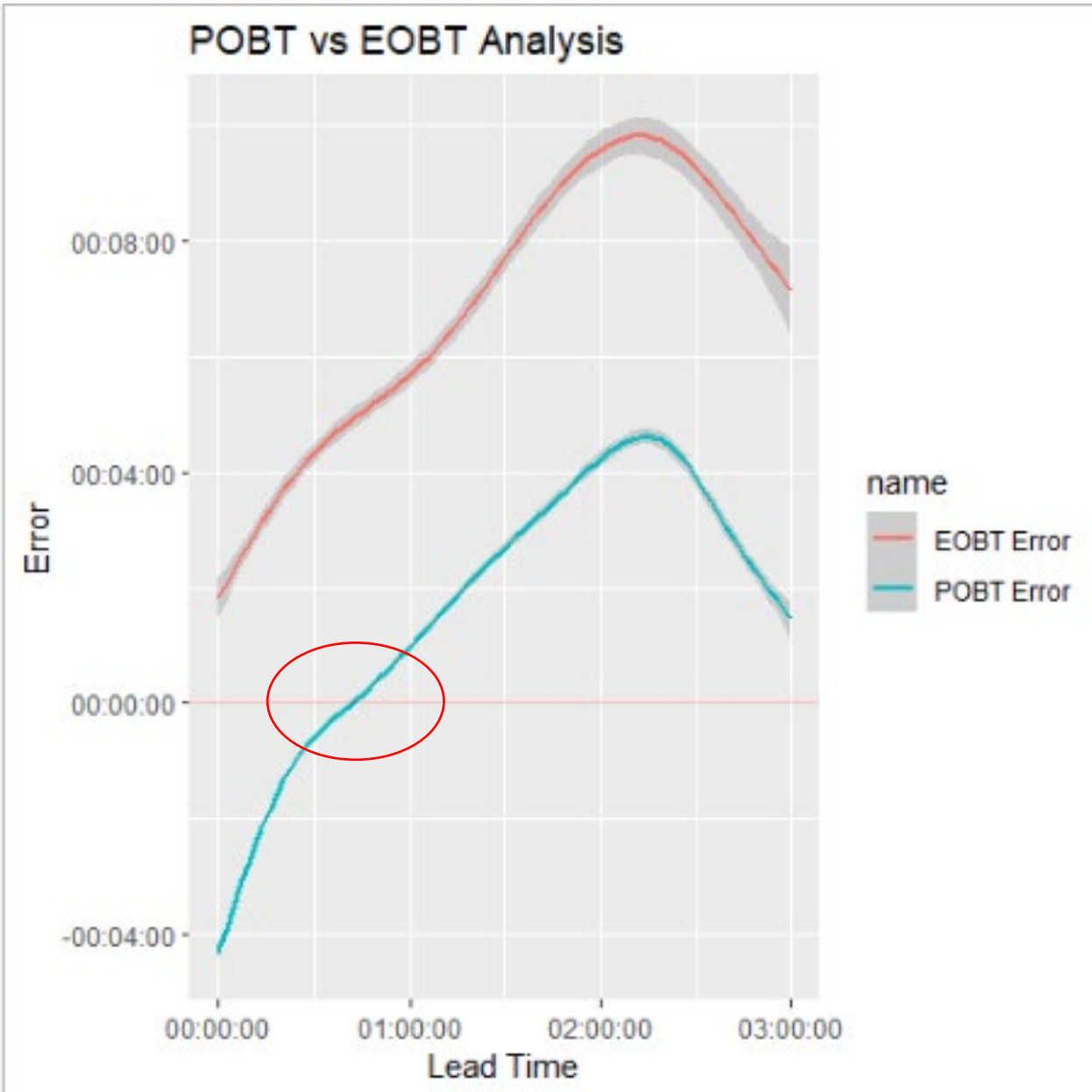
Flight Number	SEA 456
Stand	N-1
SOBT	10:00
EOBT	10:10
POBT	10:20
Flight Link	SEA 456

Flight Number	SEA 123
Stand	N-1
SIBT	10:15
EIBT	10:15
Flight Link	SEA 456



# POBT vs EOBT Evaluation

- EOBT predicts ~2 min earlier departure at AOBT
- POBT predicts ~4 min later departure at AOBT
- At 40 minutes to departure POBT has zero error.



# Surface Area Management System

**System Time**  
17:58:34 UTC

**Selection Details**

Passenger Connections | Flight Crew | Turn Events  
Workflow State History | Flow Restrictions  
Properties | Taxi Route | Active Rules

Field	Value
Direction	
Aircraft/Vehicle Type (Aeroba...	
Registration (Aerobahn)	
Call Sign (Aerobahn)	
Carrier Code Operating	
Flight Number	
International or Domestic Indi...	
Origination Airport	
Destination Airport	
Origination Airport (ICAO)	
Destination Airport (ICAO)	

**Surface Display**

(Production)

**Enroute Display**

**Operations Timeline**

Estimated Landing Tim... Estimated Take Off Tim...  
Arrivals on All Runways | Departures on All Runways

ASA25	ASA506
ASA102	ASA714
FFT2167	ASA508
JAL68	ASA1380
ASA119	QXE2022
KAL19	SKW3464
SKW3951	ASA521
UAL748	ASA648
AAL1240	ASA992
DAL656	QXE2542
QXE2185	DAL1430
ASA1445	ASA412
	ASA85

**Holding Aircraft**

(104 Flights) (Filtered to 9 flights) All Flights, Holding For Gate

Arrival ...	Departure...	Flt ID (Aero)	Reg (Aero)	AC Type (...)
00:56:52	00:00:00	ASA9	N557AS	73H
00:44:34		ASA526	N491AS	73J
00:37:13	00:00:00	ASA399	N318NN	73J
00:27:49		ASA173	N834AS	73J
00:10:23	00:00:00	ASA171	N837AK	7M9
00:04:07		ASA1255	N813AA	73W
00:05:40	00:00:00	ASA1325	N841VA	73W
00:00:33		ASA25	N486AS	73J
00:00:00		ASA506	N466EV	73W

**Inbound - Early Flights**

Flt ID (Aero)	E/AIBT (Aero)	SBT (Aero)	Inbound - E...
UAL1237	(10:58)	11:23	38
ASA1255	(11:03)	11:29	24
ASA1325	(11:04)	11:20	15
ASA25	(11:06)	11:11	7
ASA902	(11:08)	11:29	18
FFT2167	(11:09)	11:53	43
ASA119	(11:13)	11:29	8
UAL748	(11:17)	11:42	24
DAL656	(11:20)	12:06	45

**Gate Monitor - Cargo**

Gate	Status	Curr Flt ID...	Flt Out Ti...	Overlap Ti...
Cargo2_1	●			
Cargo2_2	●			
Cargo2_3	●			
Cargo2_3R	●			
Cargo2_4	●			
Cargo2_4R	●			
Cargo2_5	●			
Cargo2_6	●			
Cargo2_9	●			

# POBT Impact on Gate Holds

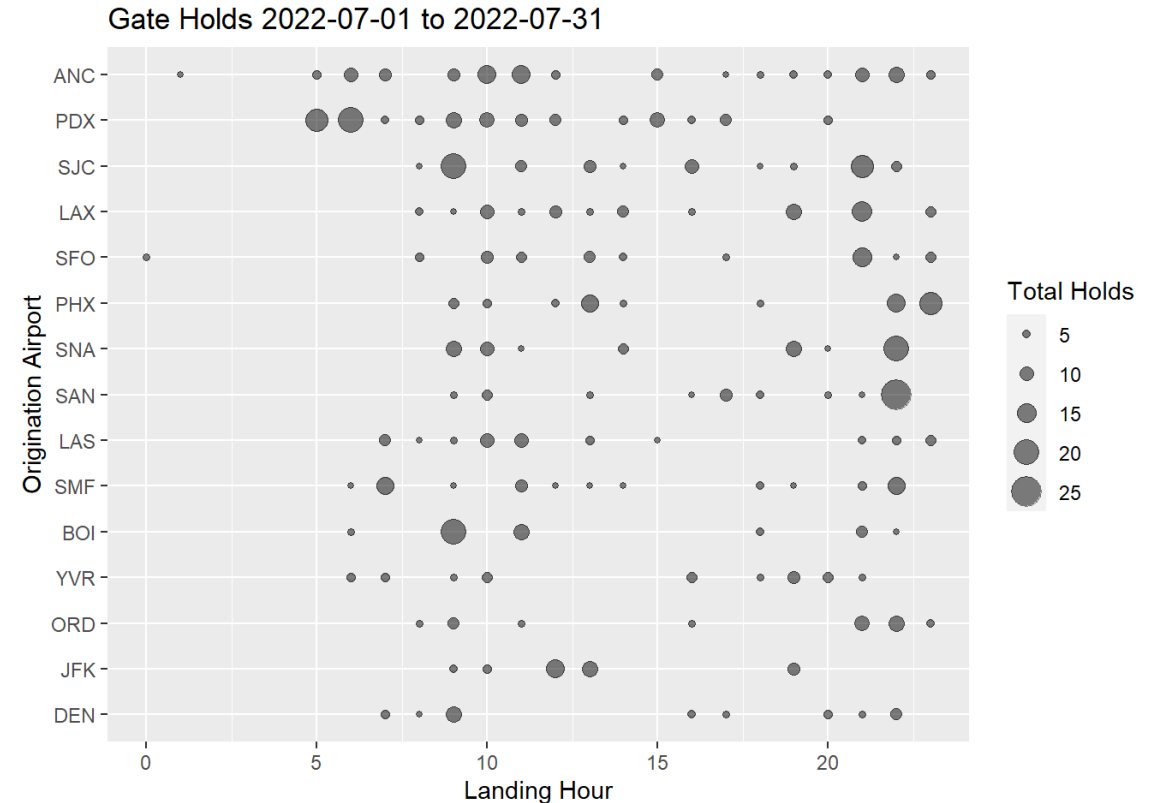
- Allow aircraft to begin taxiing prior to gate open based on POBT and estimated taxi in time
- Reduces Gate Holds by 9 minutes (avg taxi in time)
- Potential for additional turns
- \$5 million in savings for 2021



# Gate Holds Analytics

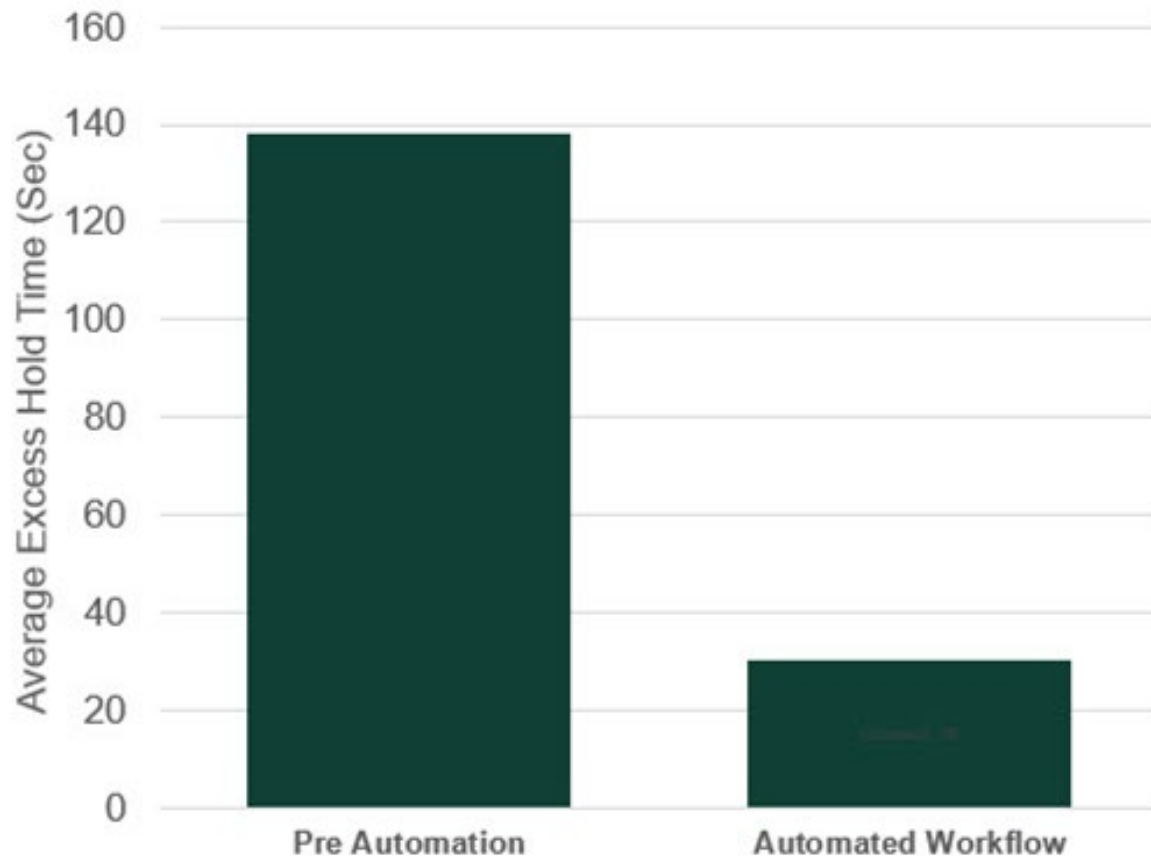
## Gate Hold Summary – July 2022

- 2,652 holds out of 19,009 arrivals
- 159 Holds over 30 mins
- 14% of aircraft holding
- Average Duration: 12 minutes
- Total Duration: 31,942.3 minutes
- Estimated Total Hold Cost: \$77,745.59 (A4A Estimates)
- Estimated Total Hold Emissions: 1,151,035 kg CO2 (A4A Estimates)
- Gate Hold Index: 1.49 (Goal is 1, 10% YOY Reduction)



# Gate Hold Operational Improvements

Automation Impact



## Applying savings to 2021

- 14.7% gate hold reduction
  - 677 total hours in 2021
- \$975,249 in airline savings
  - 1,462,867 kg CO<sub>2</sub>



# Thank You!