Operational Impact of the Baseline Integrated Arrival, Departure, and Surface System Field Demonstration

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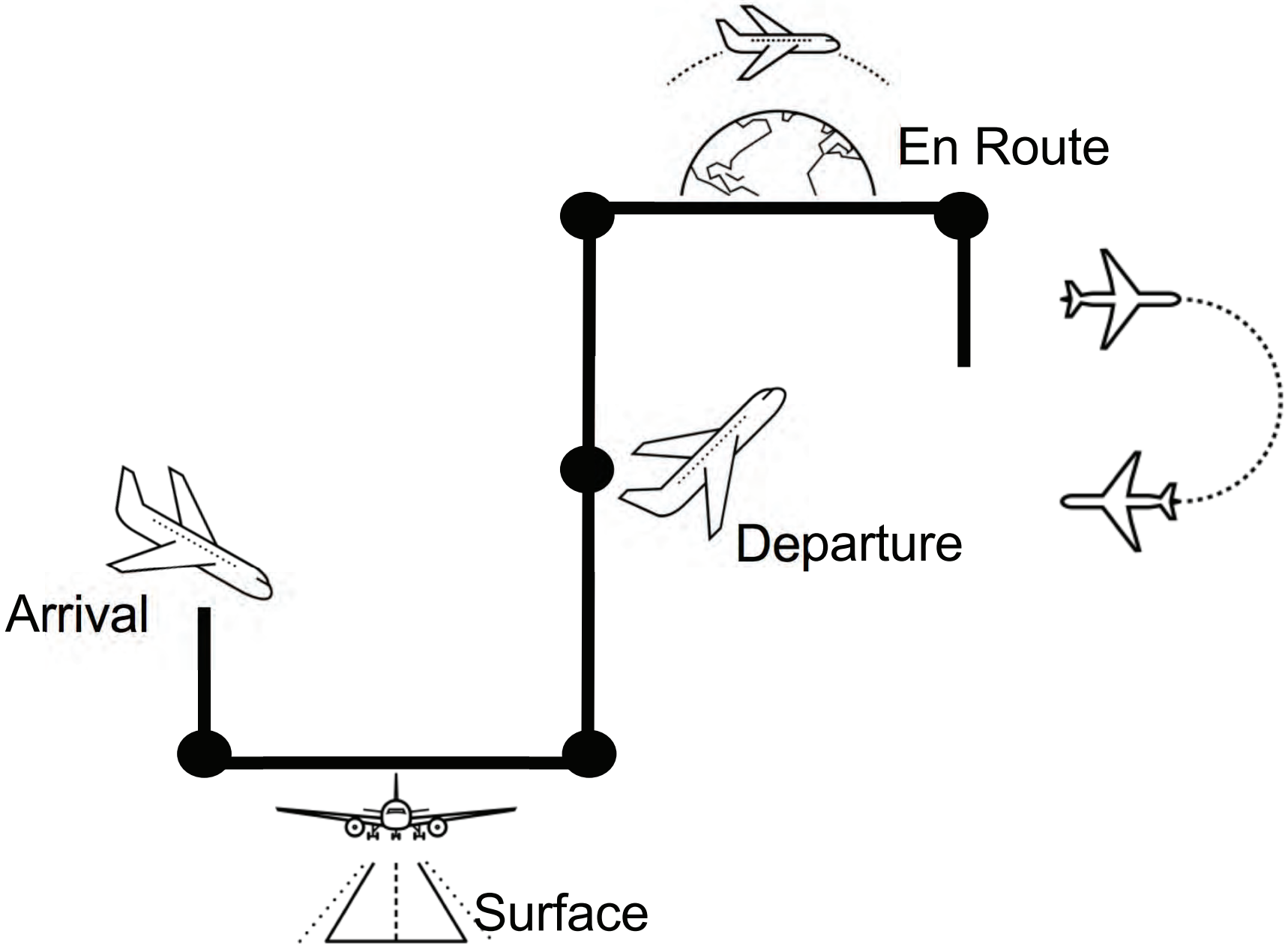
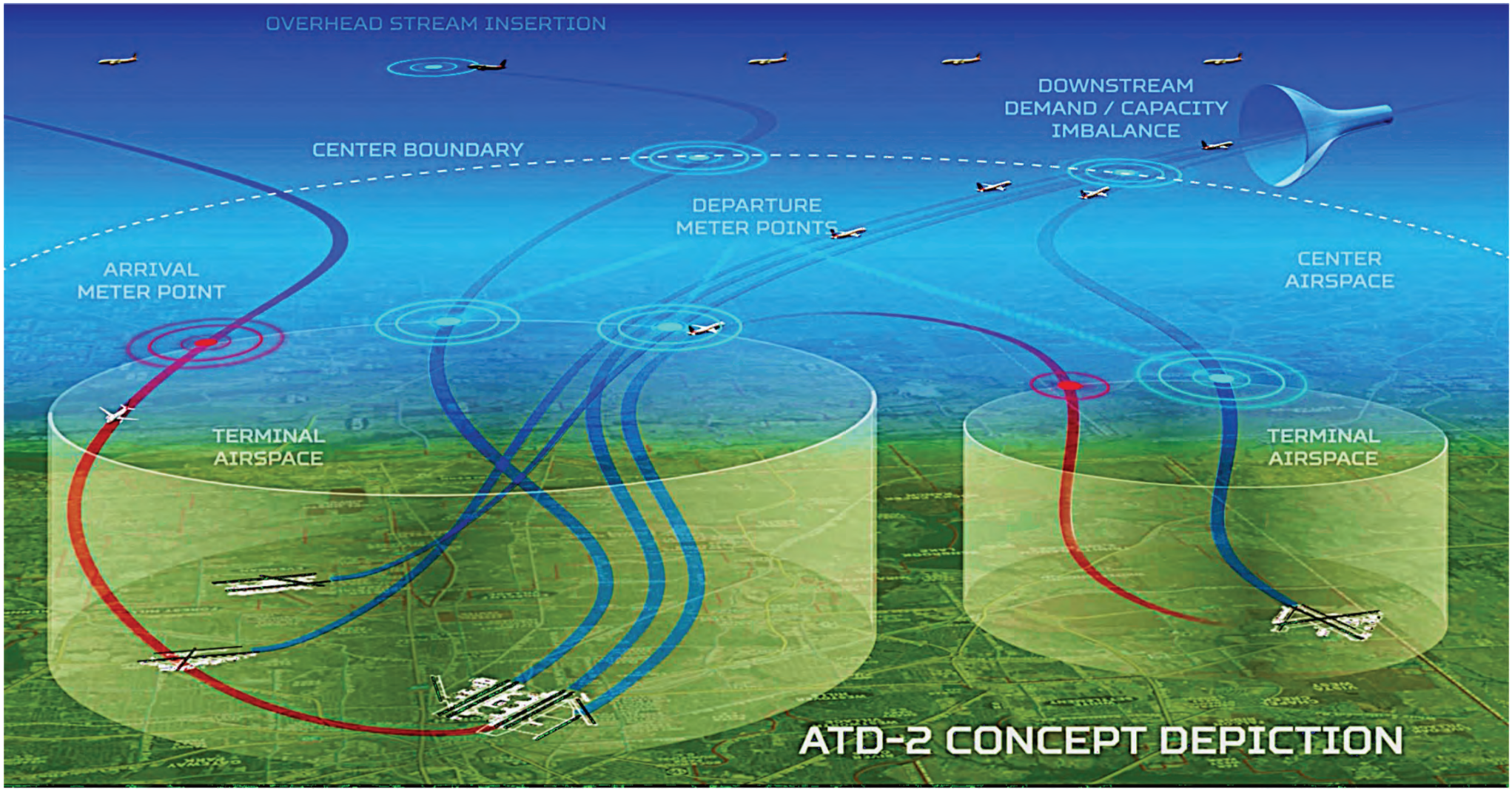
NASA

DASC 2018, Sep 25-27, 2018

Arrival, Departure, and Surface Operations

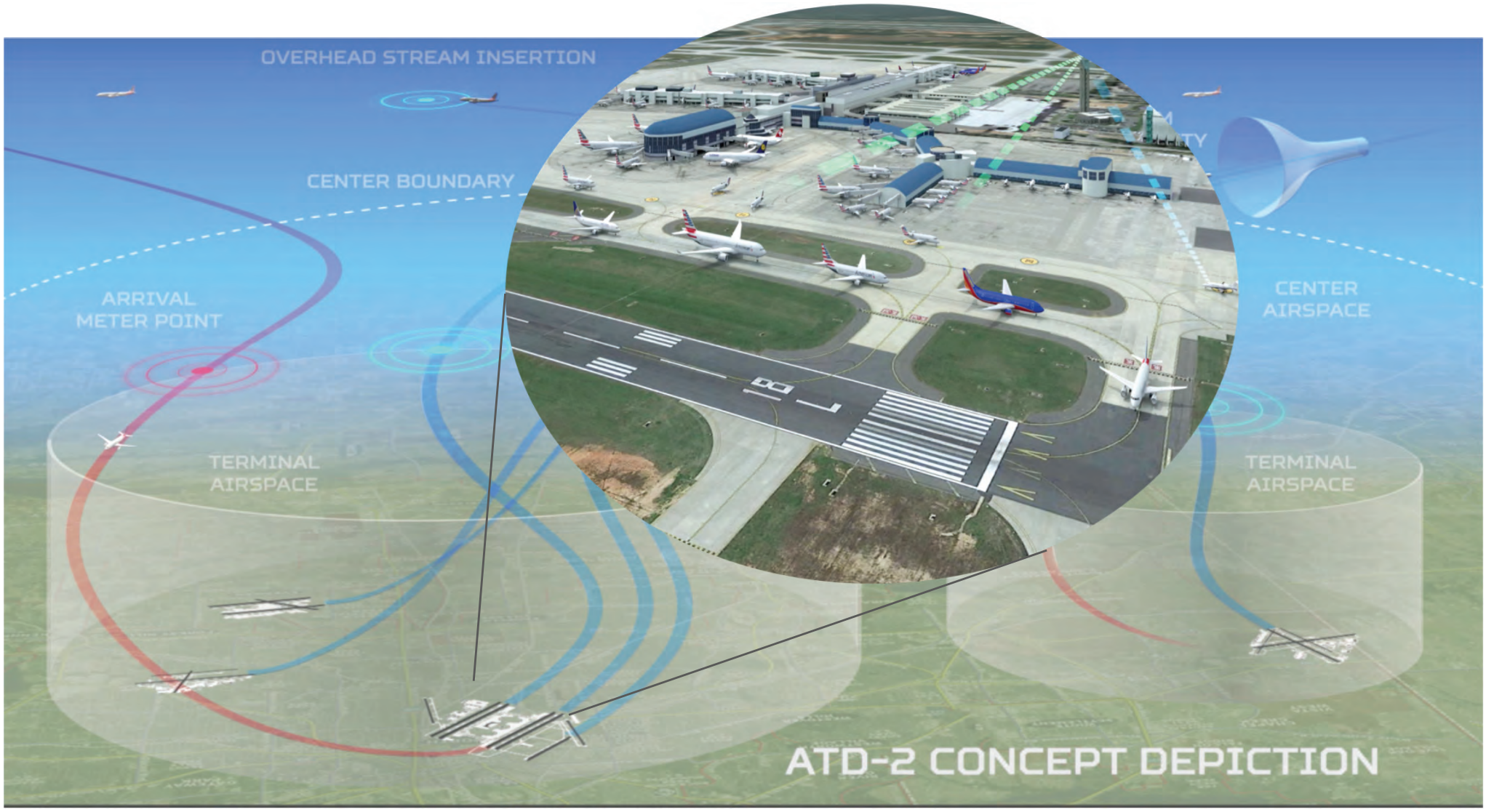


Integrated Arrival, Departure, and Surface (IADS) Operations

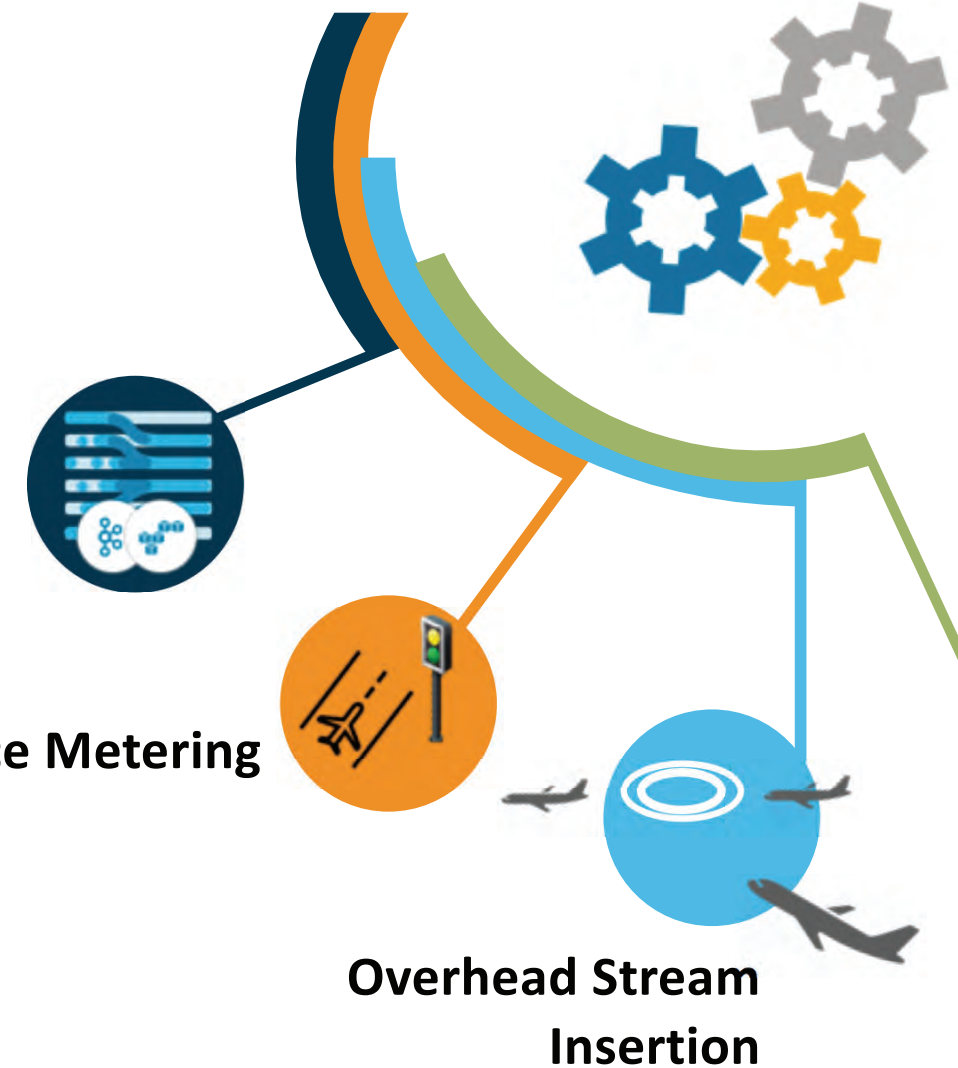


Airspace Technology Demonstration 2 (ATD-2)

Integrated Arrival, Departure, and Surface (IADS) Operations



IADS Phase 1 Capabilities



Surface Predictive Engine

Predict demand capacity imbalances

Real Time Metrics

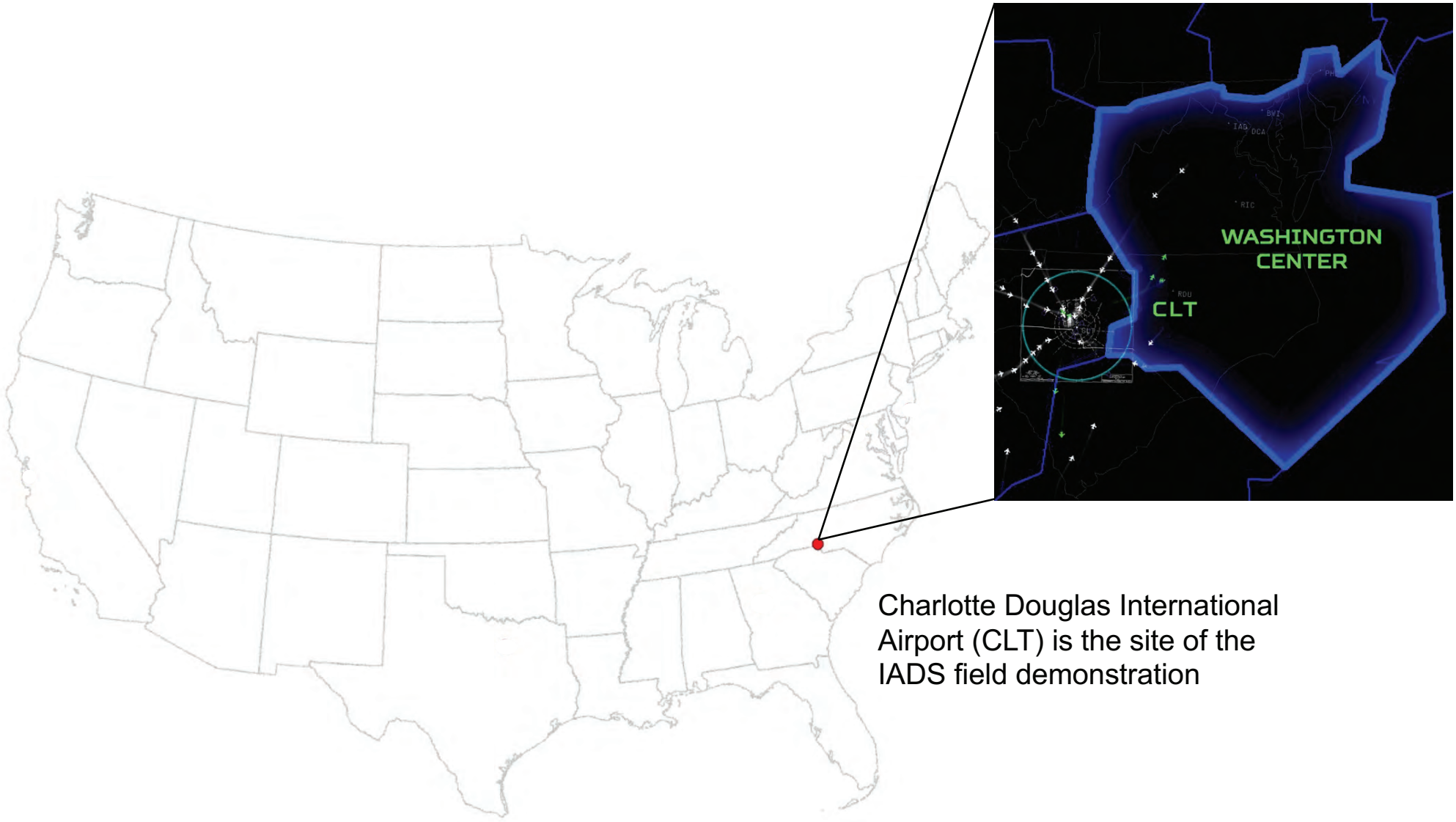
Surface Metering

Overhead Stream Insertion

Data Exchange and Integration

Shared situational awareness across the airport surface between ATC and operators

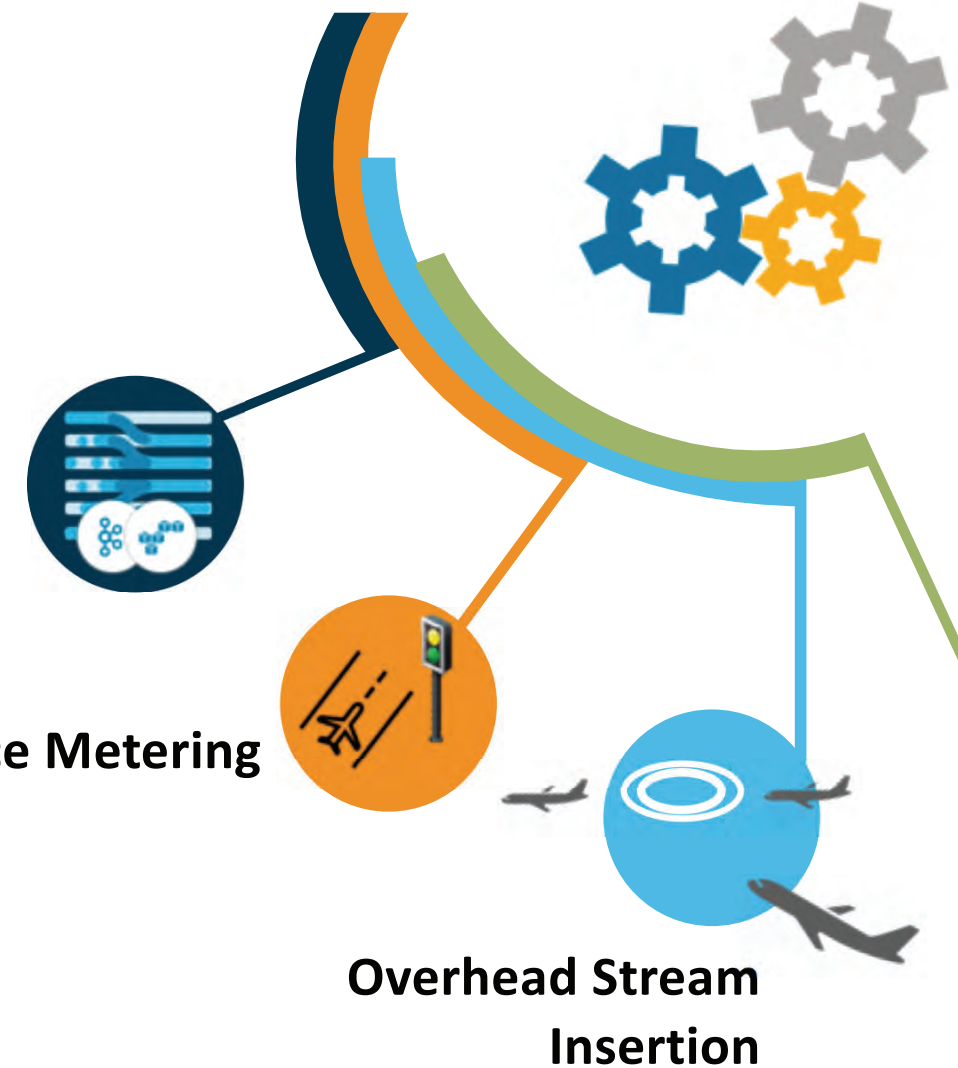
Phase I Baseline IADS System Field Demonstration



Charlotte Douglas International Airport (CLT) is the site of the IADS field demonstration

CLT is the seventh busiest airport in the world by total aircraft movements (553,812 takeoffs and landings in 2017)

IADS Phase 1 Capabilities



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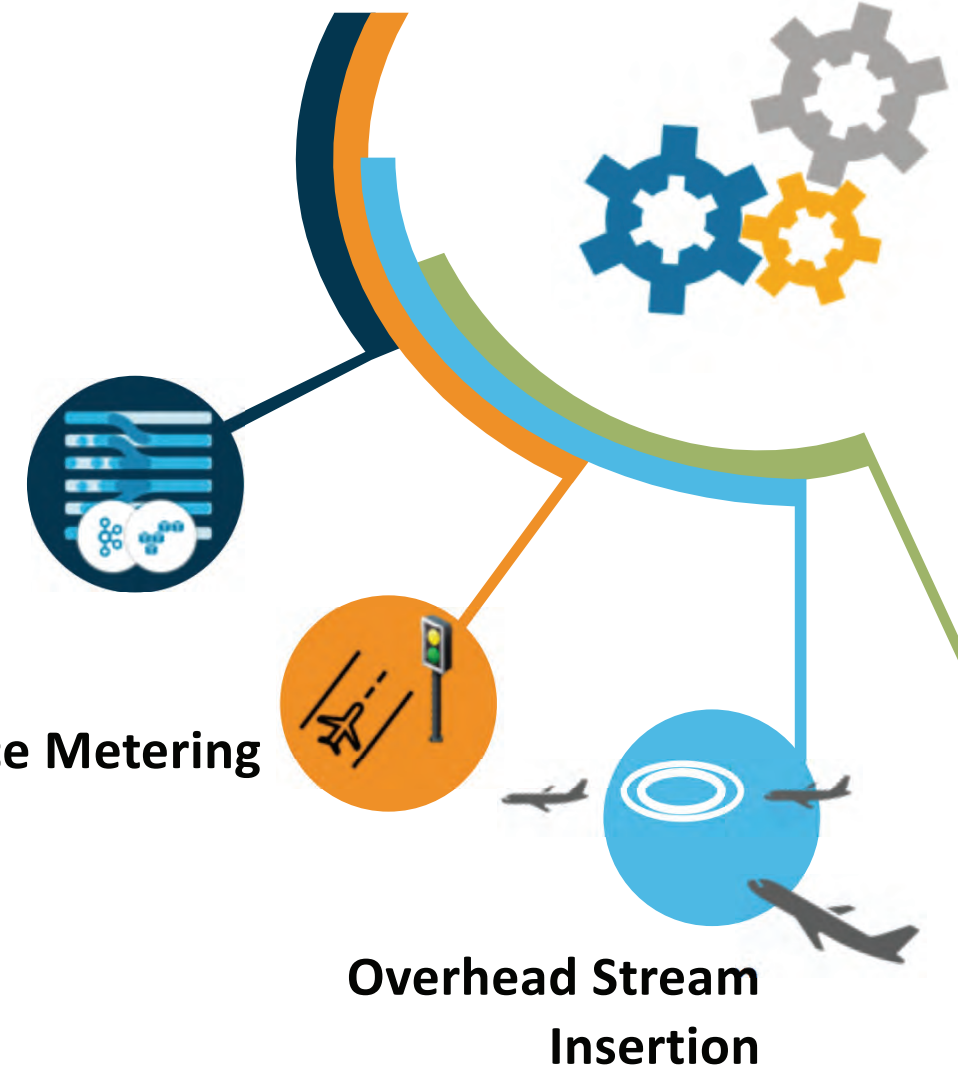

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Shared situational awareness across the airport surface between ATC and operators

Overhead Stream Insertion

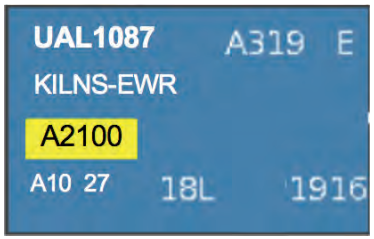
Phase 1 IADS Users

Data Exchange and Integration

ATC to Operator

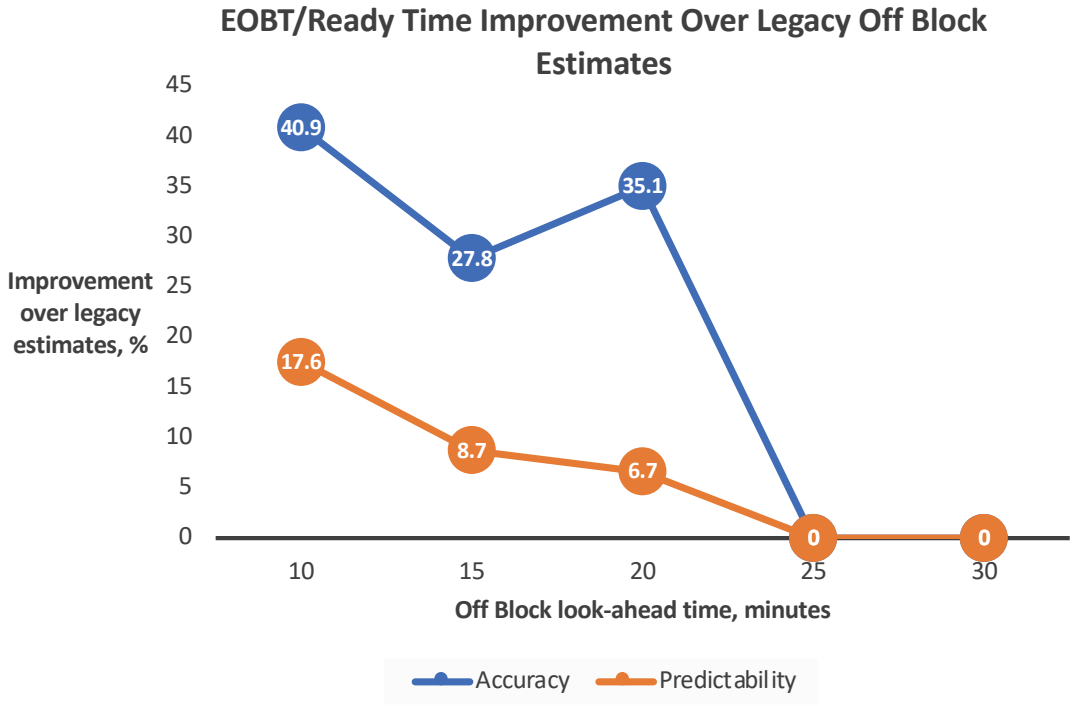
- Real-time traffic management initiatives
- Airport configuration coordination
- Runway intent information

Call for release or
Controlled Take off Time

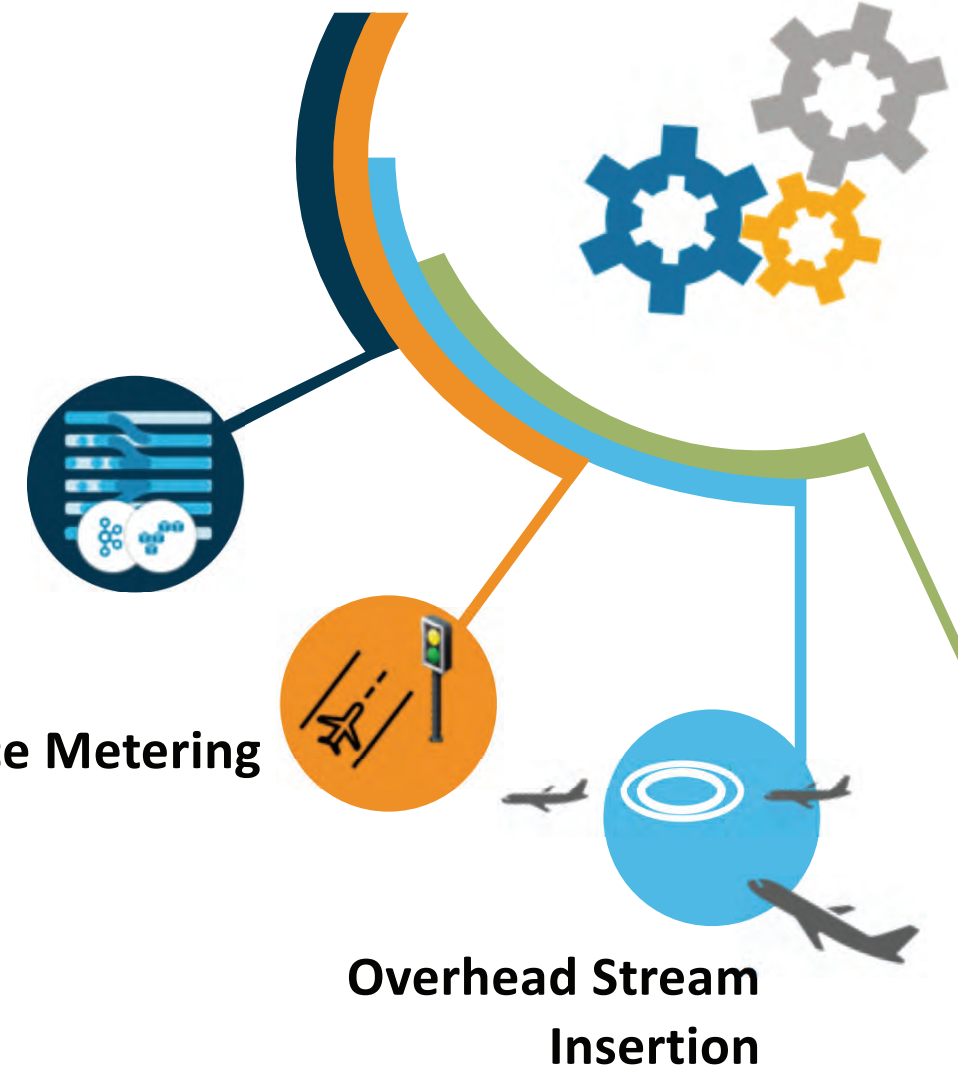


Operator to ATC

- Earliest Off Block Times (EOBT) or ready times enable better planning
- Ramp status coordination
- Gate conflict information



IADS Phase 1 Capabilities



Surface Predictive Engine

The IADS system leverages a surface predictive engine to ingest a variety of data feeds and inputs to produce an accurate surface model and associated schedule

Real Time Metrics

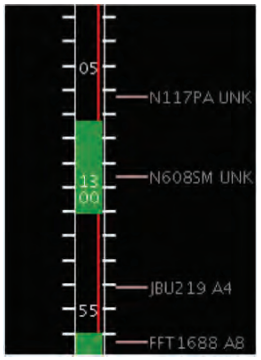
Surface Metering

Overhead Stream Insertion

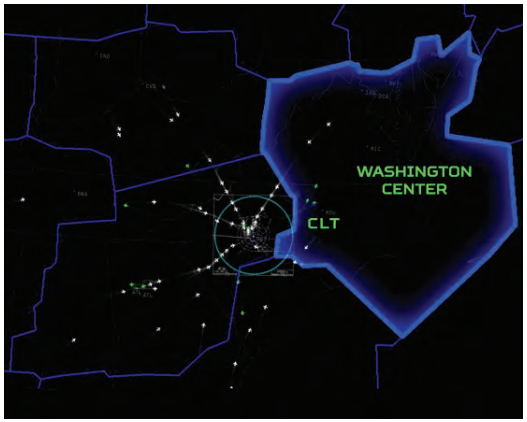
Data Exchange and Integration

Shared situational awareness across the airport surface between ATC and operators

Collaborative Nature of Overhead Stream Insertion

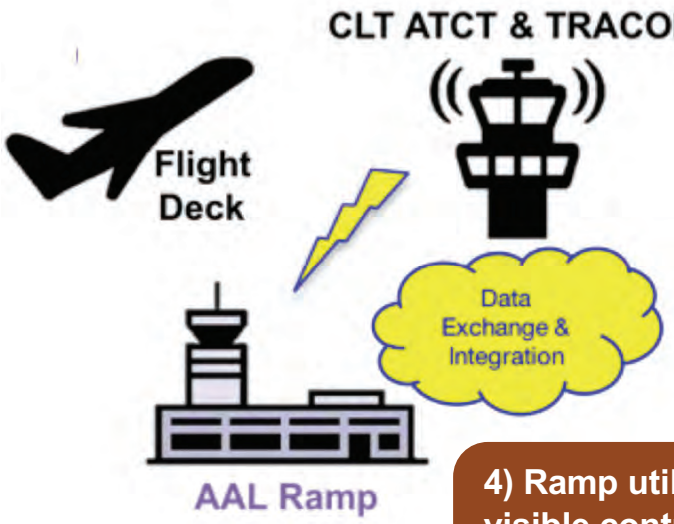


2) Electronically negotiate for a time based on red/green space



3) Center approves or adjusts the time based on center constraints

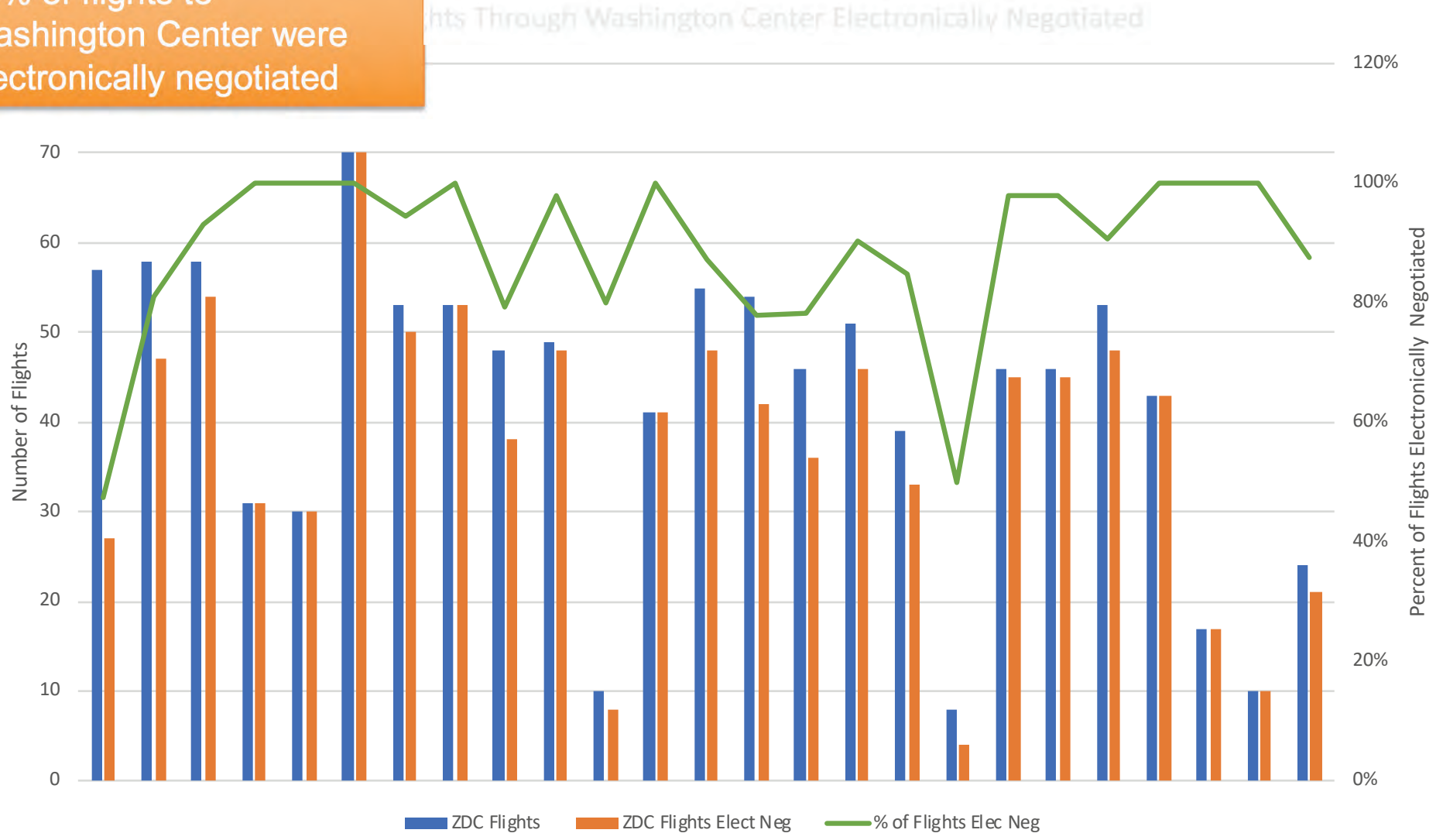
1) Pilot calls into clearance delivery approximately 10 min prior to push back for controlled times



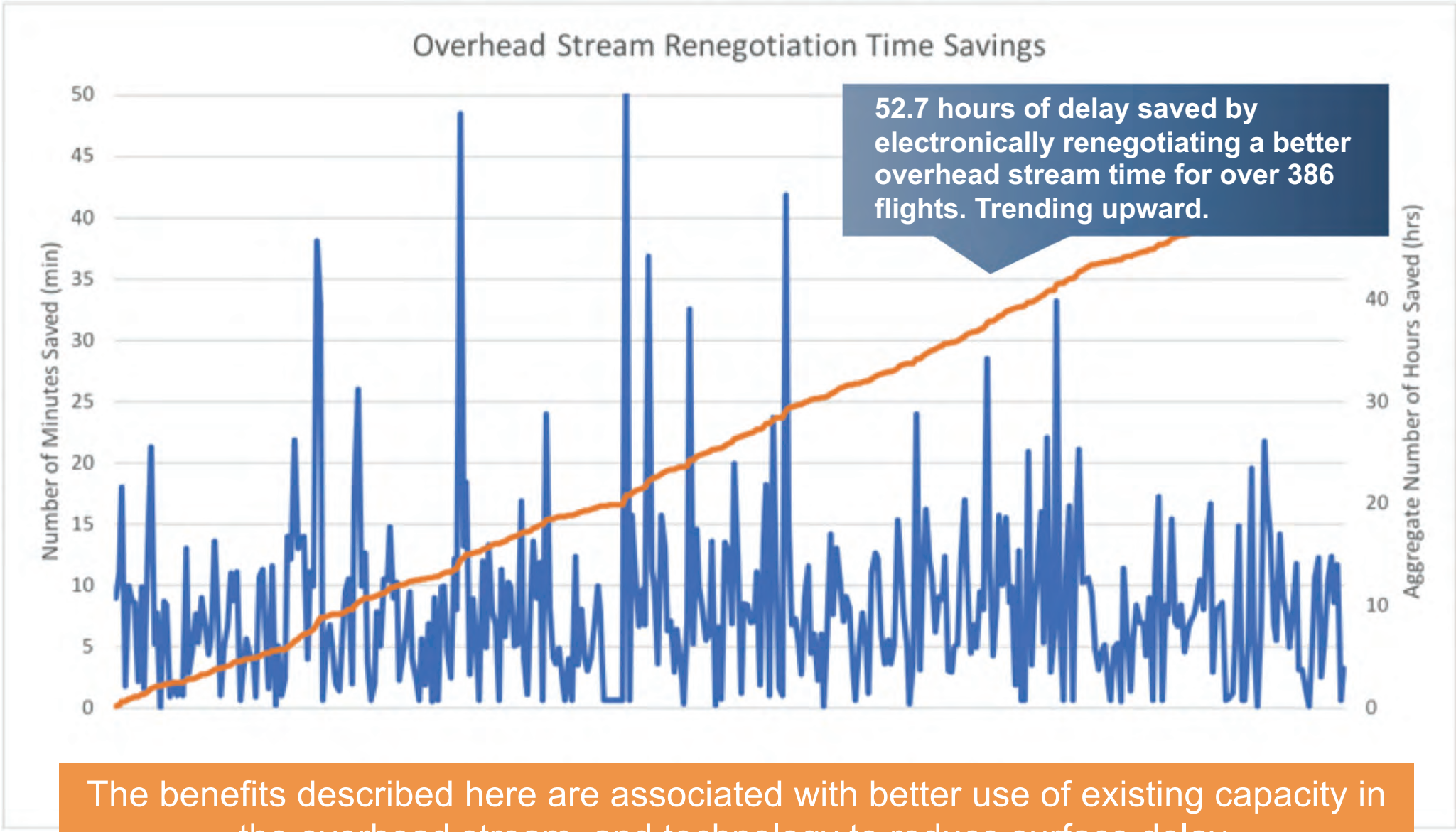
4) Ramp utilizes the now visible controlled time on their strips and pushback advisories

Overhead Stream Electronic Negotiation Operational Use

85% of flights to Washington Center were electronically negotiated

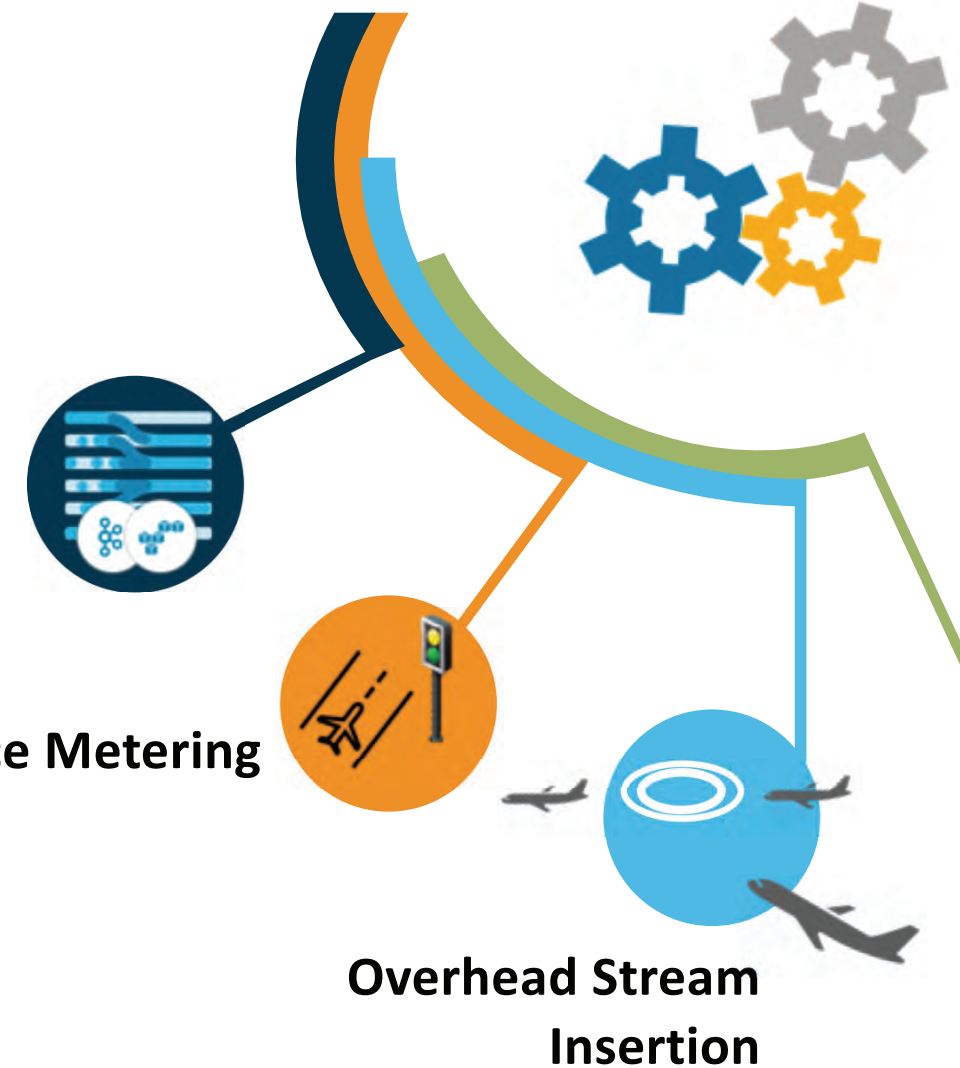


Overhead Stream Operational Integration Benefits



The benefits described here are associated with better use of existing capacity in the overhead stream, and technology to reduce surface delay.

IADS Phase 1 Capabilities



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The IADS system leverages a surface predictive engine to ingest a variety of data feeds and inputs to produce an accurate surface model and associated schedule

Real Time Metrics

Surface Metering

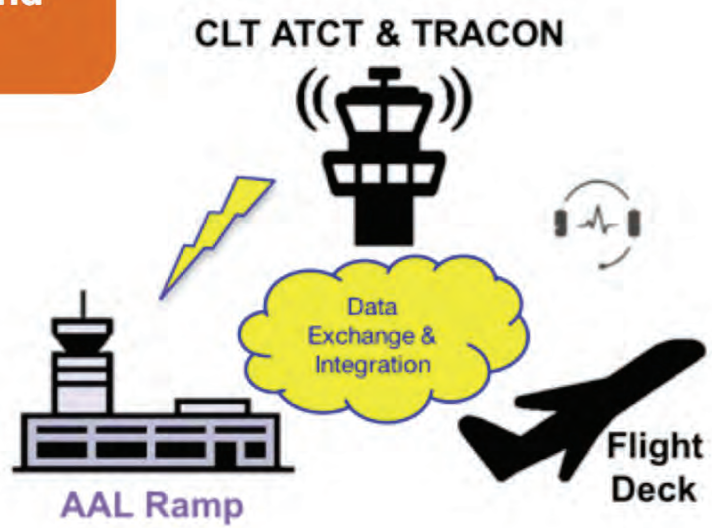
Overhead Stream Insertion

Data Exchange and Integration

Shared situational awareness across the airport surface between ATC and operators

Collaborative Nature of Surface Metering

1) ATC and Ramp operators utilize IADS displays to view demand capacity imbalances



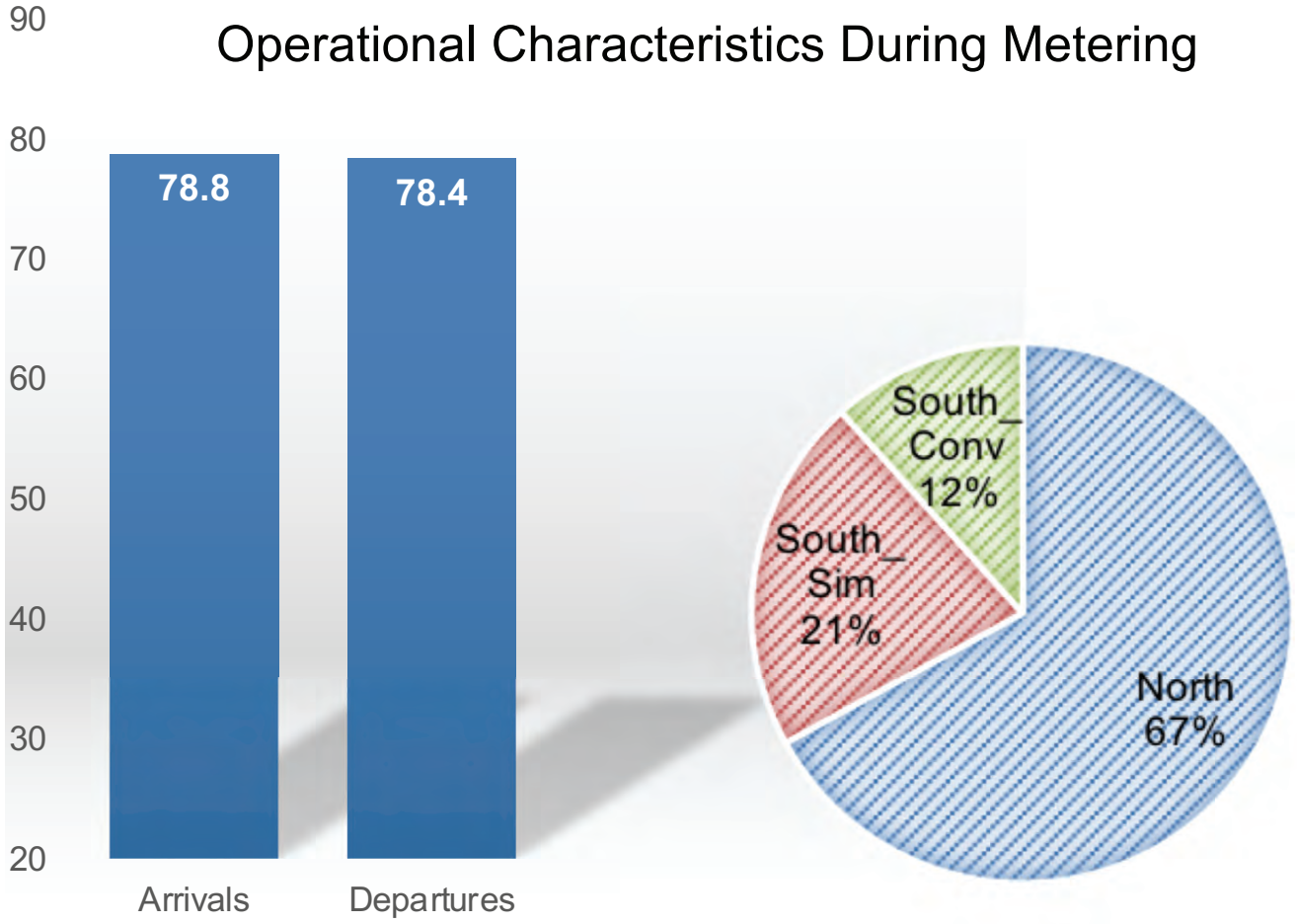
2) Surface metering hold levels are determined and implemented using IADS tools

3) Ramp issues metering advisories to the flight deck to shift delay from the runway queue back to the gate

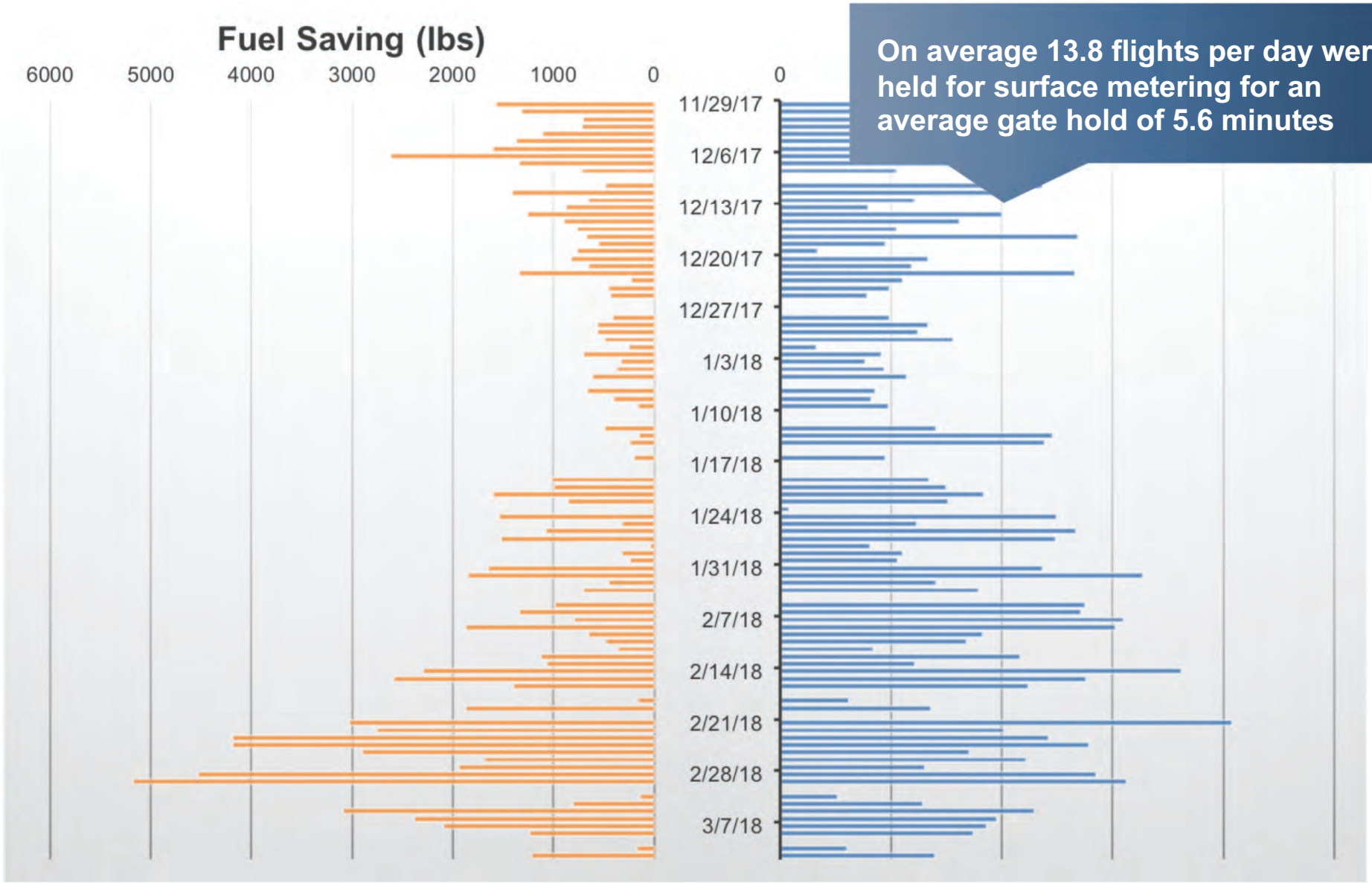
Collaborative Surface Metering Operational Use

Surface metering procedures were initiated on November 29, 2017

– Surface metering has been implemented 234 of 273 (85.7%) days



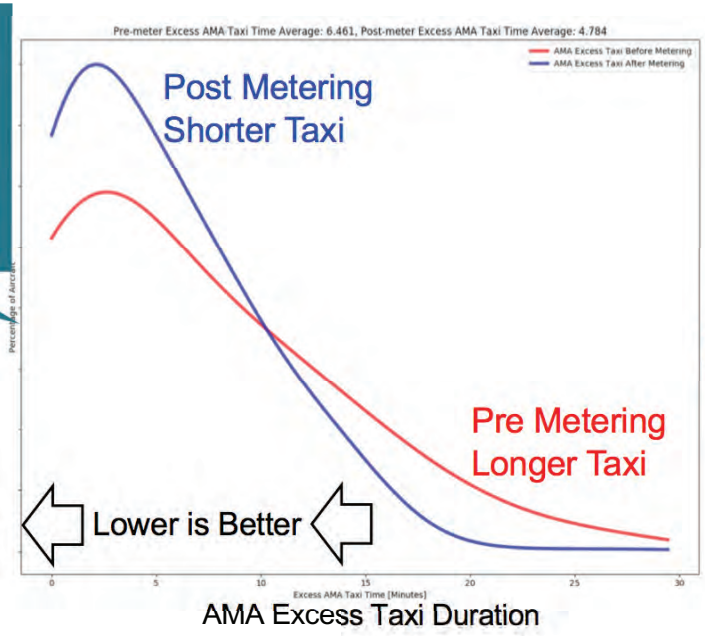
Collaborative Surface Metering: Gate Hold and Fuel Savings



On average 13.8 flights per day were held for surface metering for an average gate hold of 5.6 minutes

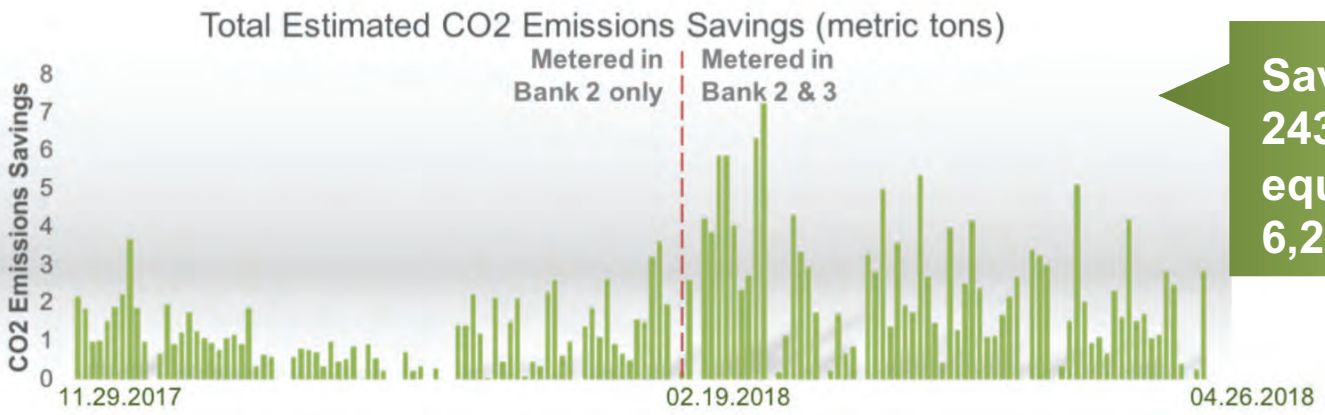
Collaborative Surface Metering Benefits

Reduced AMA taxi out times during its use via small holds at gate



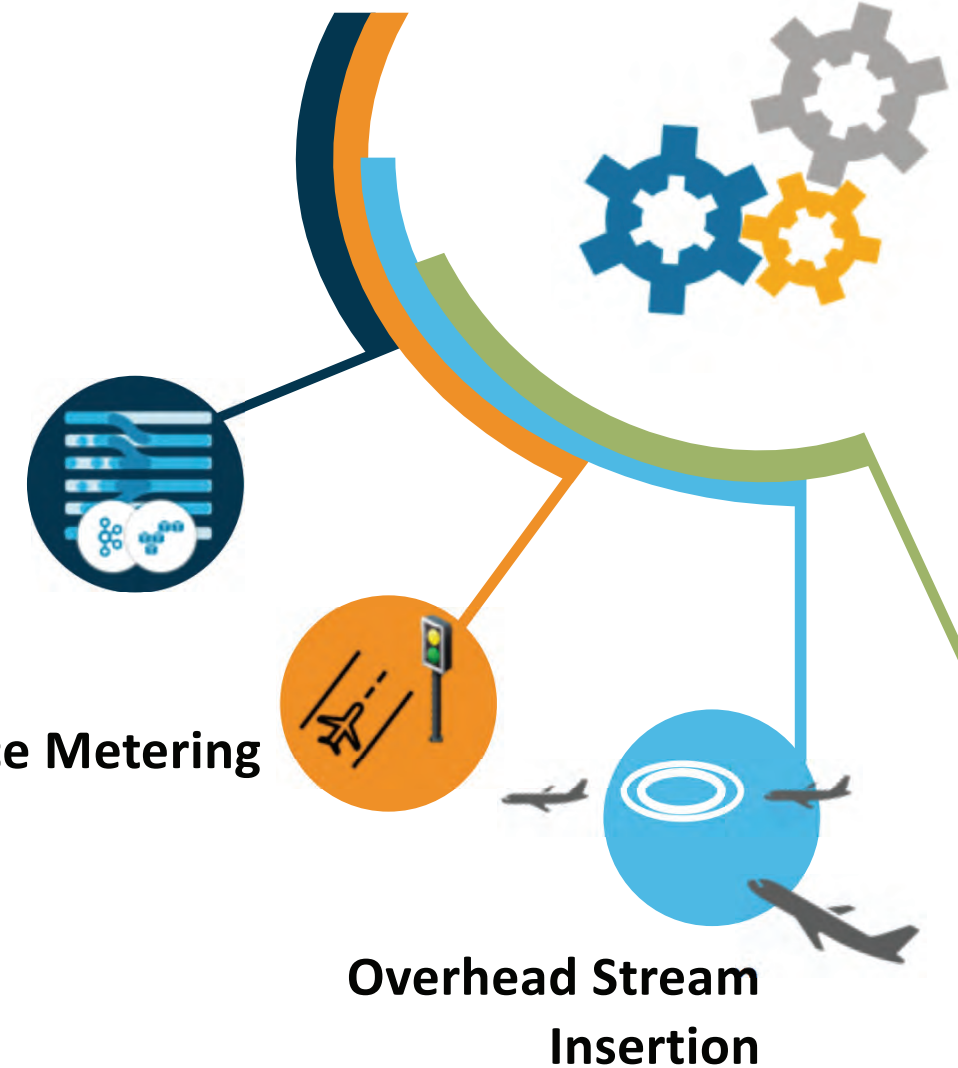
AMA Excess Taxi Duration

Saved approximately 173,801 lbs. of fuel by small holds at gate



Saved approximately 243 metric tons of CO2, equivalent to planting 6,226 urban trees

IADS Phase 1 Capabilities



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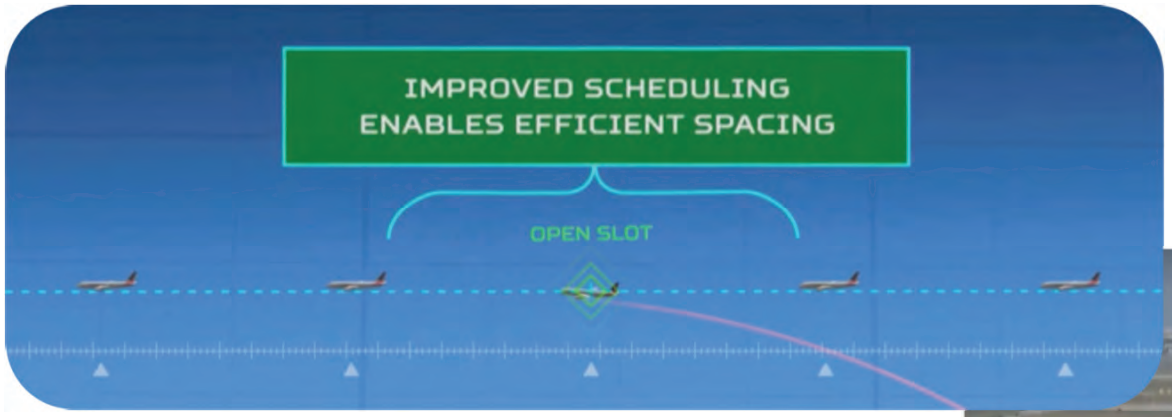


Looking Ahead – IADS Beyond Phase I

Phase 2 Development

Fused IADS Demonstration

- Strategic planning tools
- Atlanta airspace tactical scheduling
- Integrating with FAA Tools
- Providing Data to External Operators and Industry
- Expanding to the GA community

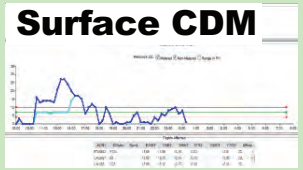
Backup material

Phase 1: Baseline IADS Capability

- CLT ATCT control positions
- Baseline electronic flight data capability via TFDM EFD

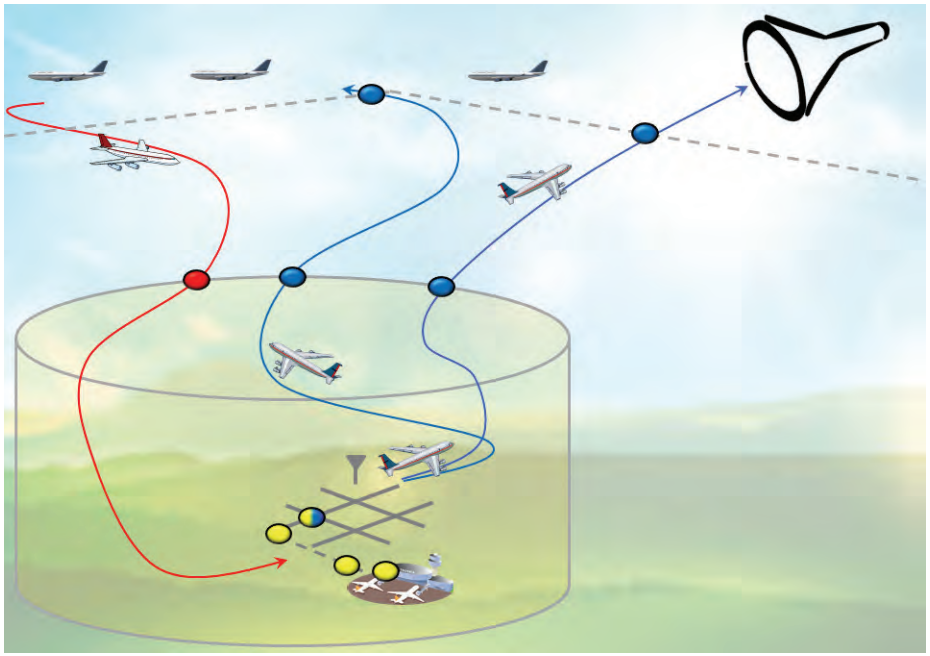
★ 

- AAL ramp controller and manager positions
- Tactical pushback advisories via RTC/RMTC display



- All positions as needed
- Predictive mode: strategic metering info for situational awareness and analysis

Surface Components



Phase 1 Demonstration Goals

- Evaluate the Baseline IADS capability
- Enhance American Airlines CLT “departure sequencing” procedure with ATD-2 surface tactical metering
- Demonstrate improved compliance for a significant percentage of tactical TMIs
- Mature strategic Surface CDM capability via operational use, analysis, and feedback
- Reduce ATCT workload by replacing paper strips with EFD

★ 

- CLT ATCT TMU position
- Tactical departure scheduling capability via STBO display

★ 

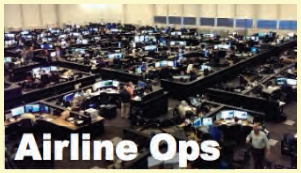
- ZDC TMU
- Tactical departure scheduling via modified TBFM/IDAC

★ 

- CLT TRACON TMU

Airspace Components

Interfaces to external systems via SWIM plus ATD-2 SWIM extensions

★ 

★ = IADS user interface

IADS Tactical Departure Scheduling

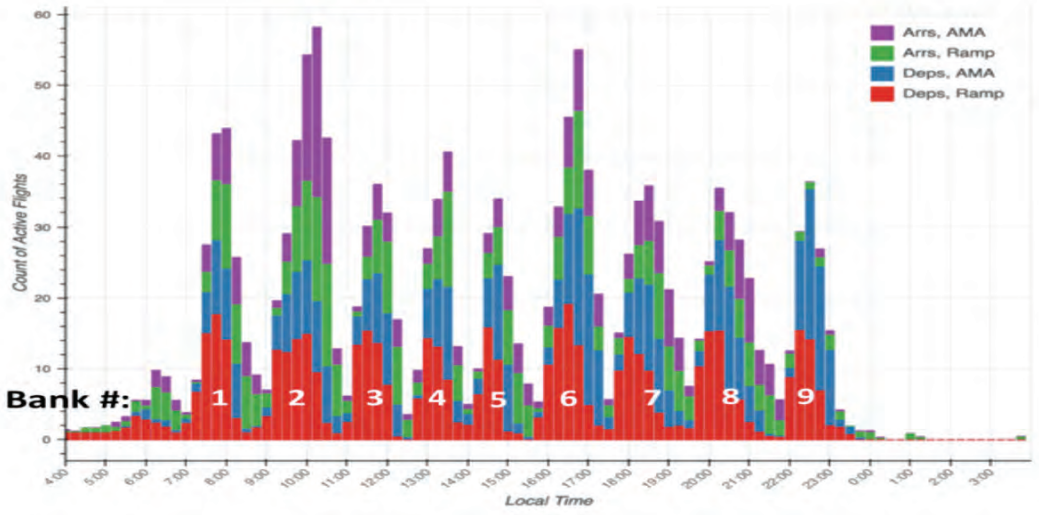
APREQ/CFR departures merging into overhead streams

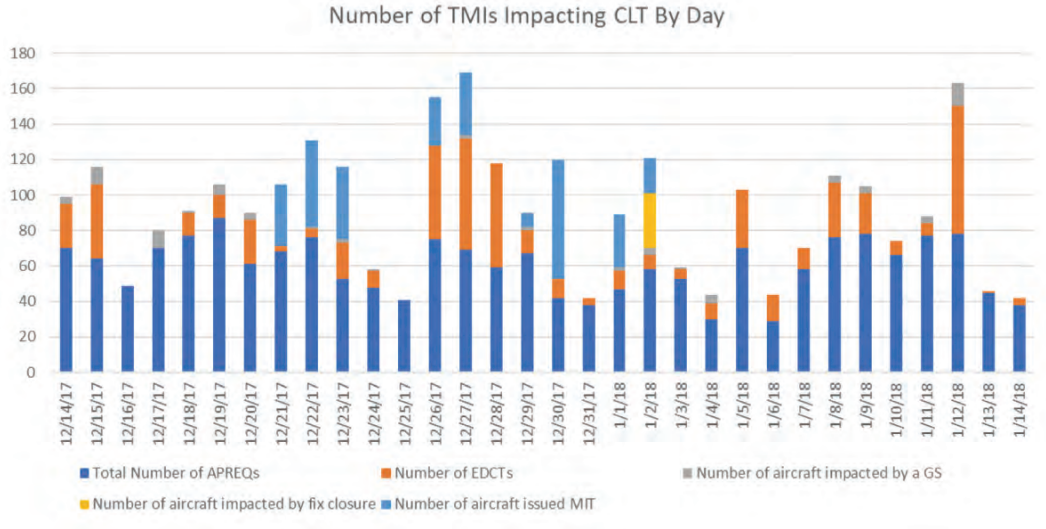
Flights subject to EDCTs due to downstream flow constraints

Washington ARTCC (ZDC)

IDAC-style scheduling between IADS at CLT and TBFM at ZDC

Charlotte Douglas International Airport Characteristics





CLT is the seventh busiest airport in the world by total aircraft movements (545,742 takeoffs and landings in 2016)

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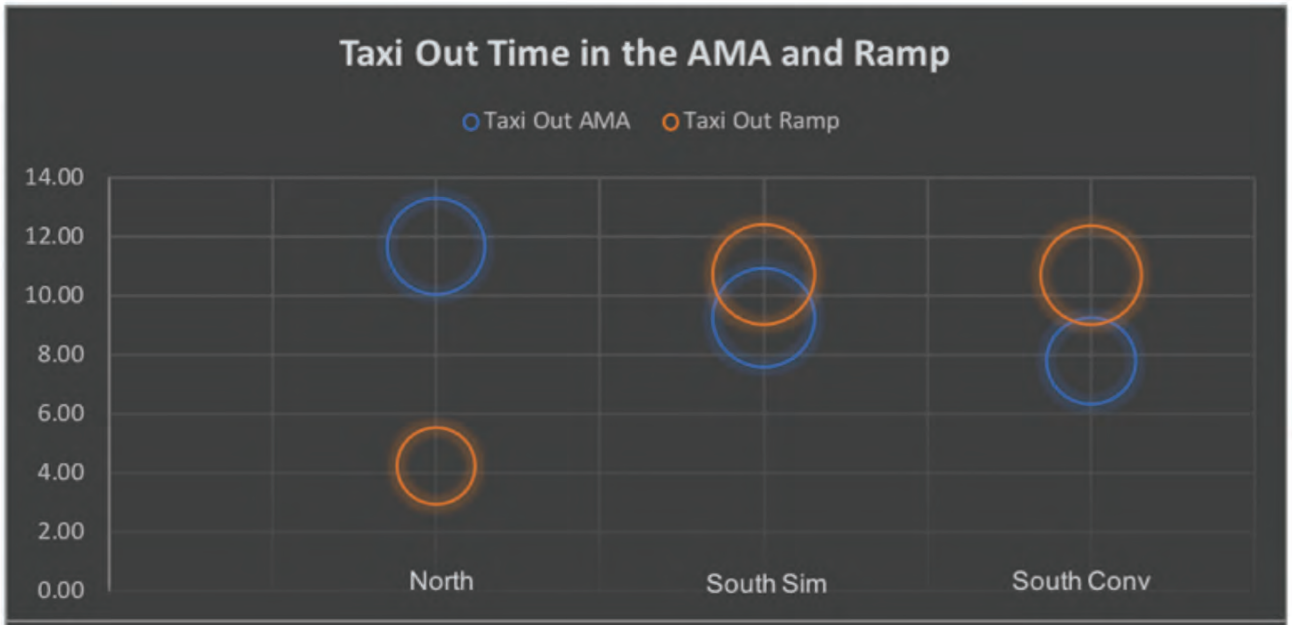
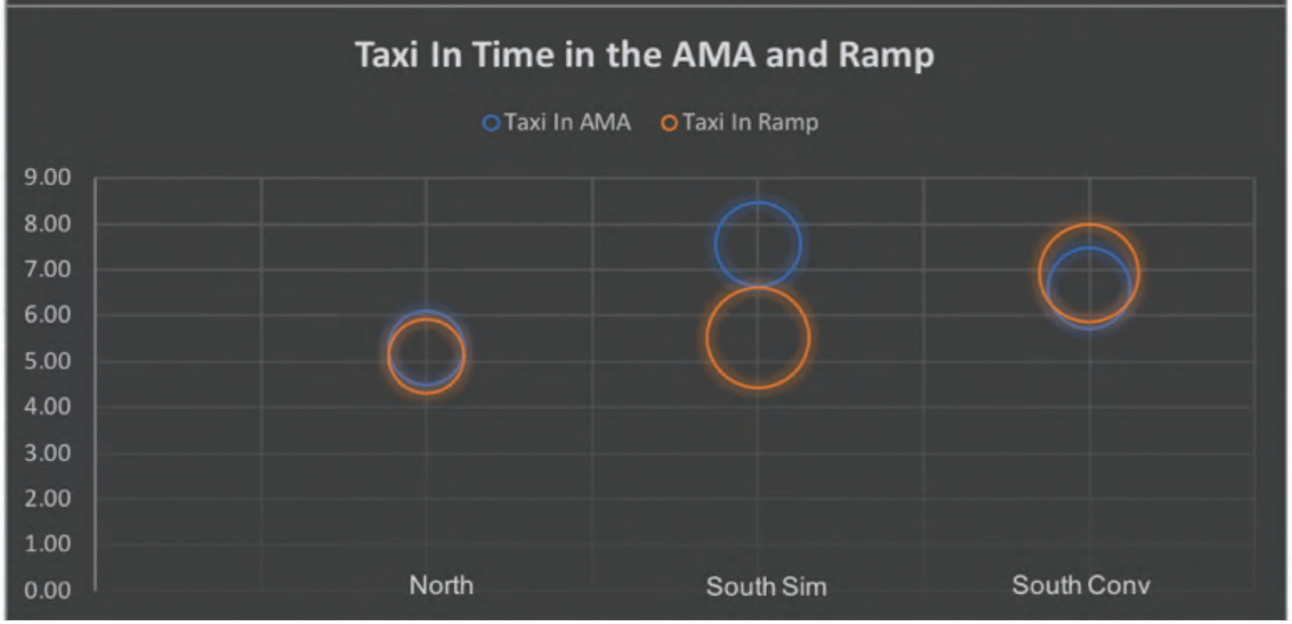




Automation Assisted Capacity Prediction

ATC TMC Runway Utilization Intent

TRACON controller runway intent

Highly accurate TBFM de-conflicted ON time estimate

TFM SWIM ETAs

TMIs. Controlled Take Off Times (CTOT)

Carrier provided EOBTs

Tactical airline intent (ramp controller)

Surface Automation Assisted Capacity Predictions

Surface modeling logic
- Earliest IN time estimate
- Earliest OFF time estimate
- Latest OUT estimate
- Pushback duration model
- Ramp and AMA taxi time
- Hovering logic

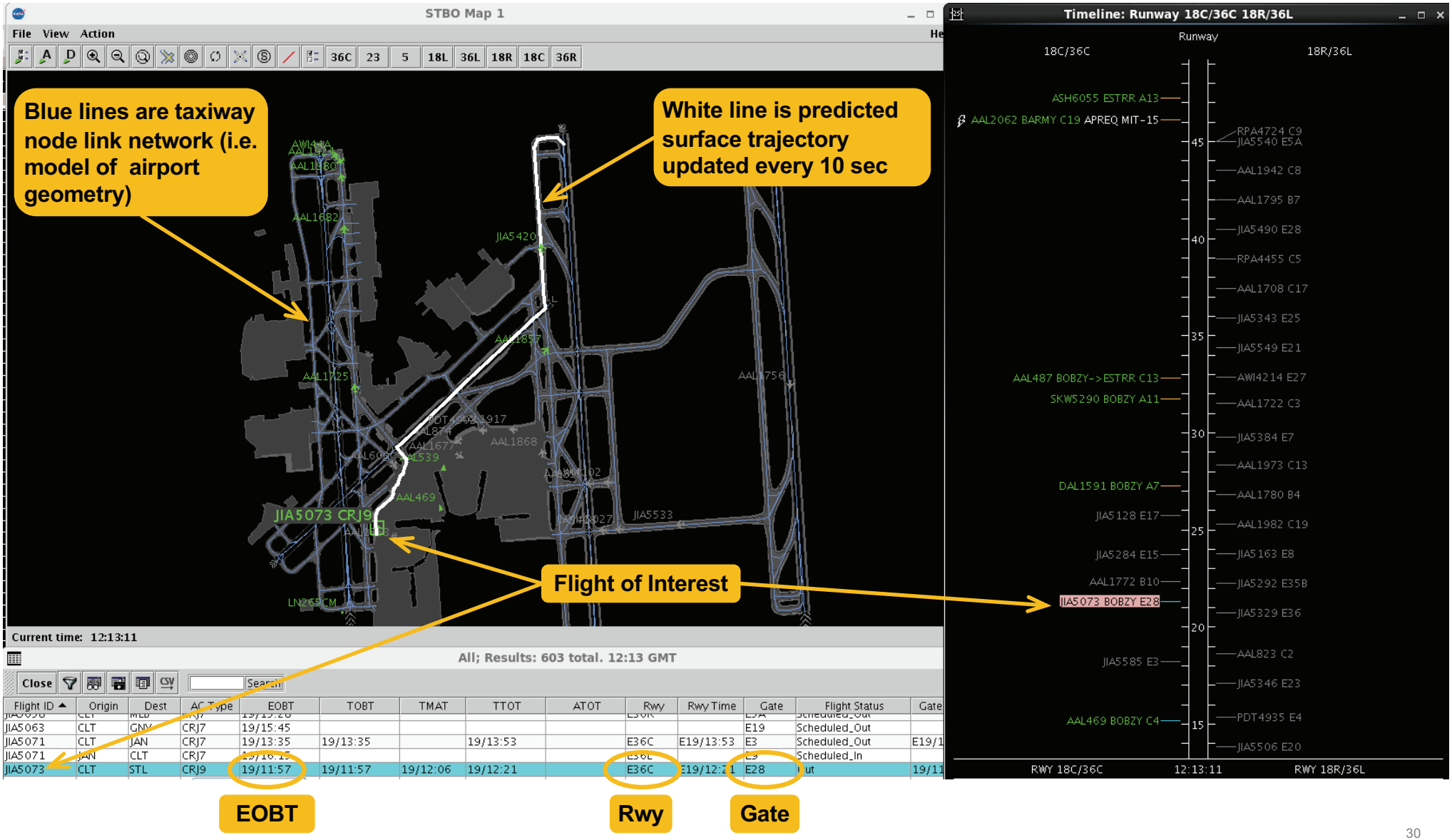
Scheduling Logic:
- Converging runways
- Flight spacing requirements
- Dual use runways
- Runway crossing delays
- Departure fix separation
- Use of flight state

Capacity predictions are calculated and automatically used in surface metering calculations without required manual user ADR input.

Helps answer the questions:
- How much runway capacity do I have for a specific flight, on a specific runway, at a specific time given the current runway utilization strategy?
- What queue time/length should this flight expect?

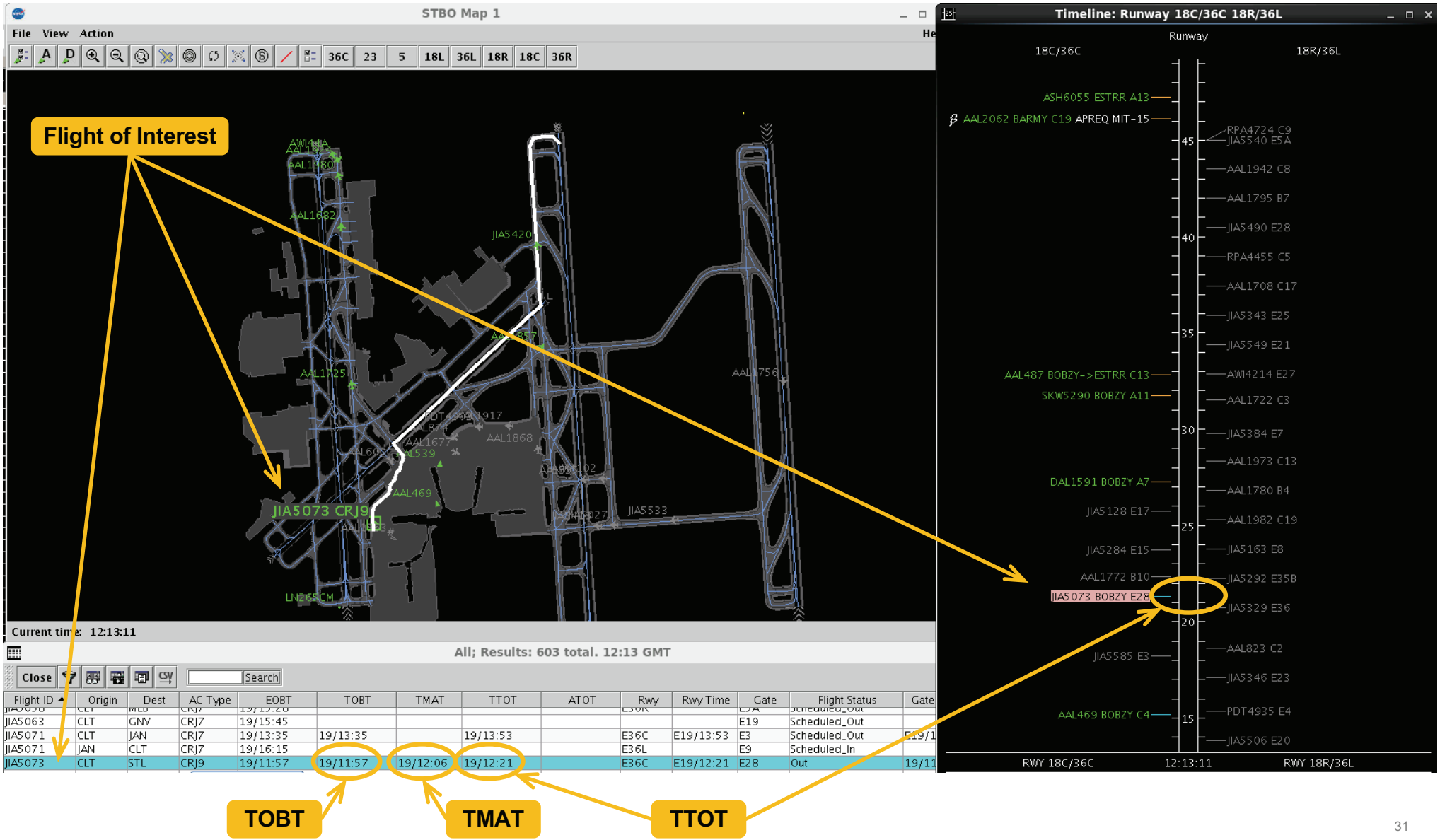
IADS Surface Modeling

The IADS surface modeler combines airport geometry with flight-specific intent and status information to produce continuously-updated 3D (x,y,t) surface trajectories for each flight.



IADS Surface Scheduling

The IADS surface scheduler uses surface modeler inputs to produce target times for takeoff (TTOT), movement area entry (TMAT), and off block (TOBT)



Surface Metering – Process Flow

1 Generate Demand and Capacity Predictions

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TRACON controller runway intent

Highly accurate TBFM de-conflicted ON time estimate

TFM SWIM ETAs

TMIs. Controlled Take Off Times (CTOT)

Flight Operator Provided EOBTs

Tactical airline intent (ramp controller)

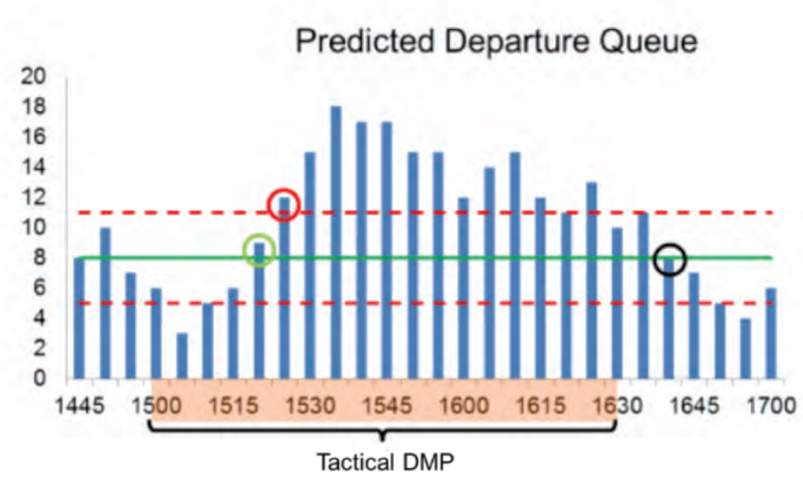
Surface Predictive Engine

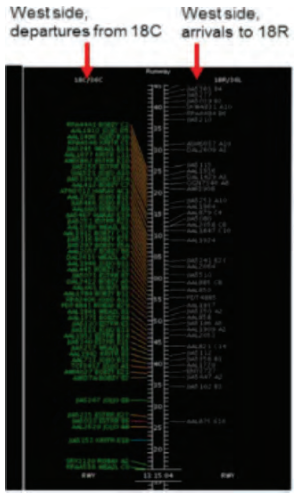
(Updates every 10 seconds)

Surface modeling logic
- Earliest IN time estimate
- Earliest OFF time estimate
- Latest OUT estimate
- Pushback duration model
- Ramp and AMA taxi time
- Trajectory hovering logic

Scheduling Logic:
- Converging runways
- Flight spacing requirements
- Dual use runways
- Runway crossing delays
- Departure fix separation
- Use of flight state

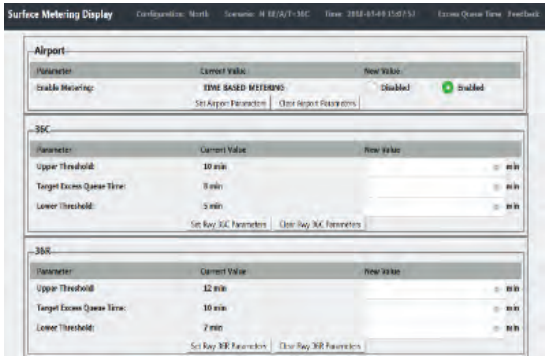
2 Monitor Surface Demand Capacity Imbalances



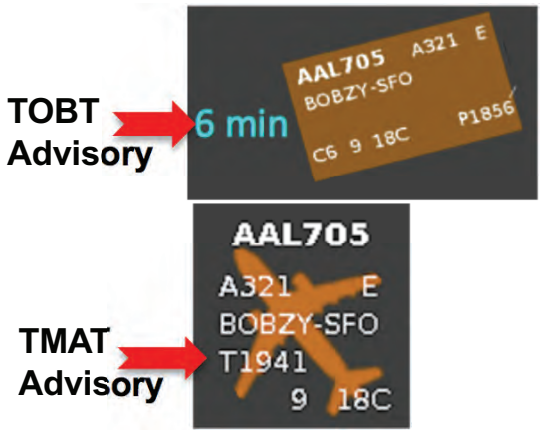


"What If" available. If Surface Metering, Go to Step 3

3 Enable Metering. Set Hold Level



4 Honor TOBT and TMAT advisories



5 Evaluate Metering Effectiveness