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

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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

Data Exchange and Integration
Shared situational awareness across the airport surface between ATC and operators

Overhead Stream Insertion
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)
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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

**Operator to ATC**

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

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**Call for release or Controlled Take off Time**

**UAL1087** A319 E
KILNS-EWR
A2100
A10 27 18L 1916

**EOBT/Ready Time Improvement Over Legacy Off Block Estimates**

- Improvement over legacy estimates, %
- Accuracy
- Predictability

- Off Block look-ahead time, minutes
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

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Overhead Stream Insertion
Collaborative Nature of Overhead Stream Insertion

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

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

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

4) Ramp utilizes the now visible controlled time on their strips and pushback advisories
85% of flights to Washington Center were electronically negotiated.
Overhead Stream Operational Integration Benefits

52.7 hours of delay saved by electronically renegotiating a better overhead stream time for over 386 flights. Trending upward.

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

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Overhead Stream Insertion
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

Operational Characteristics During Metering
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

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
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Overhead Stream Insertion
Integrated Arrival, Departure, and Surface (IADS) Operations

Improved scheduling enables efficient spacing.

More predictability means reduced delays on the ground and in the air.
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

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

Surface Components
- 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

Airspace Components
- CLT ATCT TMU position
- Tactical departure scheduling capability via STBO display
- ZDC TMU
- Tactical departure scheduling via modified TBFM/IDAC
- CLT TRACON TMU

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

Airline Ops

= 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
CLT is the seventh busiest airport in the world by total aircraft movements (545,742 takeoffs and landings in 2016)
Charlotte Douglas International Airport Characteristics

**Taxi Out Time in the AMA and Ramp**
- Taxi Out AMA
- Taxi Out Ramp

**Taxi In Time in the AMA and Ramp**
- Taxi In AMA
- Taxi In Ramp

Locations:
- North
- South Sim
- South Conv
Automation Assisted Capacity Prediction

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?

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

- 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)
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.

Blue lines are taxiway node link network (i.e. model of airport geometry)

White line is predicted surface trajectory updated every 10 sec

Flight of Interest

EOBT

Rwy

Gate
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
   - ATC TMC Runway Utilization Intent
   - TRACON controller runway intent
   - Highly accurate TBFM de-conflicted ON time estimate
   - TFM SWIM ETAs
   - TMs. Controlled Take Off Times (CTOT)
   - Flight Operator Provided ETBs
   - Tactical airline intent (ramp controller)

2. Monitor Surface Demand Capacity Imbalances
   - Predicted Departure Queue
   - “What If” available. If Surface Metering, Go to Step 3

3. Enable Metering. Set Hold Level
   - Tactical Metering Bridge

4. Honor TOBT and TMAT advisories
   - TOBT Advisory
   - TMAT Advisory

5. Evaluate Metering Effectiveness