Flight Deck Implications for the Implementation of an Integrated Arrival, Departure, and Surface (IADS) Traffic Management System

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ATD-2 IADS Traffic Management System

- Airspace Technology Demonstration 2 (ATD-2)
- Integrated Arrival, Departure, and Surface (IADS) traffic management system

Surface
Improved predictability on the surface (push, taxi, takeoff times).

Overhead Stream
Efficient scheduling into constrained overhead flows.

Scheduling tools to efficiently manage traffic from the gate to the overhead stream merge.
ATD-2 IADS Capabilities

- ATD-2 combines existing and emerging technologies to create the IADS traffic management system

**Departure Scheduler** Produces airspace trajectory predictions to enable more precise scheduling into overhead traffic streams.

**Information Sharing** Increased sharing of data and decision information among users.

**Surface Modeler** Produces surface trajectory predictions.

**Surface Scheduler** Generates target times; monitors demand and capacity imbalance estimates.

**Surface Metering** Throttles demand to the runway.
ATD-2 IADS Displays and Interfaces

- ATD-2 IADS improves predictability through a coordinated schedule between the Ramp, Tower, Terminal, and Center

Ramp Tower

Display/Interface
Ramp Traffic Console (RTC): Flight info, pushback advisories

ATC Tower

Display/Interface
Runway arrival/departure timelines, flight list, map

ARTCC (Center)

Display/Interface
Departures into overhead streams
ATD-2 IADS Flight Deck Implications

- Airspace Technology Demonstration 2 (ATD-2)
- Integrated Arrival, Departure, and Surface (IADS) traffic management system

Flight Deck

- Which parts of the ATD-2 IADS system impact the Flight Deck?
- What pilot training and communication are needed?
- What procedures are required of pilots to support the ATD-2 IADS system?
Pilot Engagement and Outreach

- Subject Matter Expert Interviews
- Pilot Community Engagement at CLT
- (3) Pilot Webinar Briefings
- Distribute Pilot-Training Materials
- ATD-2 IADS Go Live at Charlotte (CLT)
- MITRE's General Aviation User Forum
- Measure Real-World Pilot Procedural Compliance

- May–July 2016
- Feb 2017
- April–July 2017
- Sept 2017
- Sept 2017
- Nov 2017
- May 2018
Charlotte Douglas International Airport (CLT)

Main Ramp: Commercial Airlines

General Aviation / Business Jet Operations
Charlotte Douglas (CLT) Main Ramp

ATC Tower

Ramp Tower

18C Tower

18L
In our research discussions with Charlotte-based Commercial Pilots, we learned that some pieces of information were not reaching the Flight Deck as consistently, or as early, as they could. **Runway Assignment** is an example of one of those pieces of information.
At the Gate, prior to Pushback:
Pilots program Flight Deck computers and configure the aircraft for a particular Runway.

If the Runway Assignment issued by the Ground Controller is different than what Pilots planned for, there are implications for Flight Deck workload and traffic flow.
Flight Deck Implications for Changing Runway:

- Request new performance numbers via ACARS
- Reprogram/Verify FMS
- Reconfigure MCP
- Runway-change Checklist (some airlines)
- Eyes-in time
- Pilot Strategies include:
  - Slow taxi speed
  - Stop aircraft
ATD-2 IADS Information Sharing

- Share information among all operators who are responsible for managing traffic to support efficient operations.
ATD-2 IADS Information Sharing with Flight Deck Implications:

- Runway Assignment
- TMI: Expect Departure Clearance Time (EDCT)
- TMI: Wheels-Up Time for Flow Control (APREQ)
- Departure Fix Closures
- Ground Stop at Destination Airport
- Runway for Operational Necessity
- Anticipated Pushback Delay
- Surface Metering: Gold Hold Advisories
- Earliest Off-Block Time (EOBT)
## Flight Deck Implications of ATD-2 IADS at CLT

### Runway Assignment

<table>
<thead>
<tr>
<th>Prior to ATD-2 IADS</th>
<th>ATD-2 IADS Information Sharing</th>
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| • Runway assignment was typically communicated to pilots by Ground Control at the spot or, sometimes, by Ramp Control. | • Ramp Control is equipped with runway assignment information.  
• *Expected* runway (accurate/reliable) is incorporated into the pushback clearance so pilots know their runway earlier. |

**Pilots call for Pushback**

"Pushback approved, expect Runway 18C."

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**Runway Assignment**

**ATC Tower**

**ATD-2 IADS Surface Scheduler / Planning Algorithms**

**Ramp Tower**

**Flight Deck**
### Flight Deck Implications of ATD-2 IADS at CLT

#### TRAFFIC MANAGEMENT INITIATIVE (TMI)

**Expect Departure Clearance Time (EDCT)**

| Before ATD-2 IADS | • Pilots estimated when to pushback to meet EDCT.  
|                   | • Ramp Control and ATC didn't always have the same EDCT. |
| ATD-2 IADS Information Sharing | • Ramp Control tools support pushback coordination to meet the EDCT, without excess taxi time.  
|                   | • Depending on EDCT, scheduler may assign a Gate Hold. |

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**Airlines**

- **Wheels-Up Time (EDCT)**

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**ATC Tower**

- **EDCT**
  - Pushback Advisory (for EDCT)

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**Ramp Tower**

- "You have an EDCT time of 1430, hold for 20 min."
  
- "Pushback approved, expect Runway 18C."

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**Flight Deck**

- PRE-DEPARTURE CLR
  - EDCT 14:30Z
**Flight Deck Implications of ATD-2 IADS at CLT**

**TRAFFIC MANAGEMENT INITIATIVE (TMI)**

**APREQ/CFR: “Wheels-Up Time for Flow Control”**

| Prior to ATD-2 IADS | • Pilots were often unaware until contacting Ground Control.  
|                     | • Ramp Control was unaware of Wheels-Up times (APREQs). |
| ATD-2 IADS Information Sharing | • Ramp Control tools support pushback coordination to meet the APREQ (Wheels-Up Time), without excess taxi time.  
|                     | • Depending on APREQ, scheduler may assign a Gate Hold. |

*Negotiation is not triggered until the Flight Deck contacts Clearance Delivery.*
## Flight Deck Implications of ATD-2 IADS at CLT

### TRAFFIC MANAGEMENT INITIATIVE (TMI)

**APREQ/CFR: “Wheels-Up Time for Flow Control”**

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<td>• Depending on APREQ, scheduler may assign a Gate Hold.</td>
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### ATC Tower

#### Wheels-Up Time (APREQ)

**Pushback Advisory (for APREQ)**

### Ramp Tower

- **You have a Wheels-Up time of 2100, hold for 10 min.**

- 10 min later ...

- "Pushback approved, expect Runway 18C."

- "Pilots call for Pushback Time Advisory"
Flight Deck Implications of ATD-2 IADS at CLT

Departure Fix Change/Closure

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| • Departure Fix closures were typically communicated to pilots by Ground Control at the spot or, sometimes, by Ramp Control. | • Ramp Control is equipped with Departure Fix status.  
• Ramp Control communicates to pilots when Departure Fixes are closed or combined. |

Pilots call for Pushback

"Contact Clearance Delivery for new route, call when ready for push."
**Ground Stop at Destination Airport**

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<td>• Ground Stops were communicated to pilots by Ground Control at the spot or, sometimes, by Ramp Control.</td>
<td>• Ramp Control is equipped with Ground Stop information. • Ramp Control communicates to pilots when the destination airport is closed.</td>
</tr>
</tbody>
</table>

ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms

Ramp Tower

Ground Stop Status

Pilots call for Pushback

"Ground Stop in effect at destination airport."
### Flight Deck Implications of ATD-2 IADS at CLT

**Specify Runway for Operational Necessity**

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<th>Prior to ATD-2 IADS</th>
<th>• Pilots specified runway for operational necessity to Ramp Control or Ground Control.</th>
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| ATD-2 IADS Information Sharing | • Pilots specify runway for operational necessity to Ramp Controller while at the gate (as soon as known).  
• Ramp Control electronically communicates need to ATC. |

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**As soon as known:**

"Runway 18C for Operational Necessity"

- **Flight Deck**
- **Ramp Tower**
- **ATC Tower**
  - ATD-2 IADS Surface Scheduler / Planning Algorithms
Flight Deck Implications of ATD-2 IADS at CLT

Anticipated Pushback Delay

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<th>Prior to ATD-2 IADS</th>
<th>• Pilots, sometimes, informed Ramp Control of anticipated pushback delays (e.g., maintenance issue).</th>
</tr>
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</table>
| ATD-2 IADS Information Sharing | • Pilots inform Ramp Controller of anticipated pushback delay (as soon as known).  
• Ramp Control electronically communicates delay to ATC. |

As soon as known:

“We expect a 5 minute delay.”
Flight Deck Implications of ATD-2 IADS at CLT

Surface Metering: Gate Hold Advisories

ATD-2 IADS Information Sharing

- Time-based Surface Metering throttles demand to the runway.
- Flights are held at the gate instead of in long departure queues.
- Shifts excess taxi delay from the taxiway to the gate.
- Reduced runway queue, reduced fuel burn and emissions.
- EDCTs and APREQs (Wheels-Up) exempted from Metering.

Pilots call for Pushback

"Hold 5 min for metering."

5 min later...

"Pushback approved, expect Runway 18C."

ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms

Ramp Tower

Ramp Tower

ATD-2 IADS

Surface Metering: Gate Hold Advisories
Pilot Outreach and Training

Pilot Communication Distributed Prior to ATD-2 Go Live at Charlotte on September 29th, 2017

- 15 airlines at Charlotte's main ramp (Mainline and Regional)
- 2 pilot organizations (distributed Operational Bulletins)
Of flights subject to a Wheels-Up Time for Flow Control (APREQ/CFR), percent that had their Wheels-Up Time when they pushed back. 63% Average February 2018
Real-World Procedural Compliance

TRAFFIC MANAGEMENT INITIATIVE (TMI)

APREQ/CFR: “Wheels-Up Time for Flow Control”

• Flight is subject to a Wheels-Up Time for Flow Control

• Action Required: Contact Clearance Delivery just before pushback
**Flight Deck Implications of ATD-2 IADS**

**Earliest Off-Block Time (EOBT)**

| ATD-2 IADS | • Best prediction of earliest expected pushback.  
|            | • EOBTs (ready times) are ingested by the Surface Scheduler / planning algorithms. |

**Earliest Off-Block Time (EOBT):**

- Calculated by Airlines
- Calculated in real-time
Flight Deck Implications of ATD-2 IADS

Earliest Off-Block Time (EOBT)

**ATD-2 IADS**
- Best prediction of earliest expected pushback.
- EOBTs (ready times) are ingested by the Surface Scheduler / planning algorithms.

Earliest Off-Block Time (EOBT):
- Calculated by Airlines
- Calculated in real-time

**ATC Tower**
**ATD-2 IADS Scheduler / Planning Algorithms**

**Ramp Tower**

**Flight Deck**

**EOBT**

Airlines
Charlotte Douglas International Airport (CLT)

Main Ramp: Commercial Airlines

General Aviation / Business Jet Operations
ATD-2 IADS Information Flow

Main Ramp (Commercial Operations) at Charlotte

EOBT
(Ready time)

Airlines

ATC Tower

ATD-2 IADS Scheduler / Planning Algorithms

Ramp

Flight Deck
Commercial at the Main Ramp
ATD-2 IADS Information Flow

Main Ramp (Commercial Operations) at Charlotte

- **EOBT (Ready time)**
- **ATC Tower**
- **ATD-2 IADS Scheduler / Planning Algorithms**
- **Ramp**
- **Flight Deck**
  - Commercial at the Main Ramp

General Aviation / Business Jet Operations at Charlotte

- **No Airlines** to compute and share accurate **EOBT (Ready times)**
  - *Filed departure time only*
- **ATC Tower**
- **ATD-2 IADS Scheduler / Planning Algorithms**
- **Flight Deck**
  - General Aviation / Business Jet
- **No Ramp Controller** to facilitate information exchange with Pilots
ATD-2 IADS Information Flow

Main Ramp (Commercial Operations) at Charlotte

Airlines

EOBT (Ready time)

ATC Tower

ATD-2 IADS Scheduler / Planning Algorithms

Ramp

Flight Deck Commercial at the Main Ramp

General Aviation / Business Jet Operations at Charlotte

Mobile Application for GA Pilots to facilitate information sharing

Mobile App

ATC Tower

ATD-2 IADS Scheduler / Planning Algorithms

Flight Deck General Aviation Business Jet
### General Aviation (GA) Information Flow

#### Ready-to-Taxi Time (RTT)

<table>
<thead>
<tr>
<th>ATD-2 IADS Information Sharing</th>
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</thead>
<tbody>
<tr>
<td>• Mobile App to enable information flow for GA flights.</td>
</tr>
<tr>
<td>• Ready-to-Taxi Time (RTT) similar to EOBT at the Main Ramp.</td>
</tr>
<tr>
<td>• <strong>The MITRE Corporation</strong> developing prototype 'Taxi Time' App</td>
</tr>
</tbody>
</table>


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**Flight Deck**
- General Aviation
- Business Jet

**Ready-to-Taxi Time**
- 5:00 Z

**MITRE Corporation**

**ATC Tower**
- ATD-2 IADS Surface Scheduler / Planning Algorithms
Mobile App: Two-Way Information Flow

ATD-2 IADS Information Sharing

- Two-way information flow to send information back to pilots.
- Expected beta-testing 2018
- The MITRE Corporation developing prototype 'Taxi Time' App

Flight Deck
General Aviation
Business Jet

Ready-to-Taxi Time
5:00 Z
RWY 18L
Takeoff 5:12
Wheels-Up
Arrival 7:04

MATRE Corporation

- Runway Assignment
- Target Takeoff Time
- Wheels-Up Time
- Expected Arrival

ATC Tower
ATD-2 IADS Surface Scheduler / Planning Algorithms
Expanding IADS and the Mobile App

General Aviation / Business Jet Operations

- Larger proportion of GA operations at Dallas Love Field (DAL)
- Greater impact in ATD-2 IADS Scheduler / Planning Algorithms
- Exploring 2019 / 2020 timeframe

Charlotte Douglas (CLT) 6%

Dallas Love Field (DAL) Close to 25%
ATD-2 IADS

- Airspace Technology Demonstration 2 (ATD-2)
- Integrated Arrival, Departure, and Surface (IADS) traffic management system