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

SJSU SAN JOSÉ STATE UNIVERSITY

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ATD-2 IADS Traffic Management System

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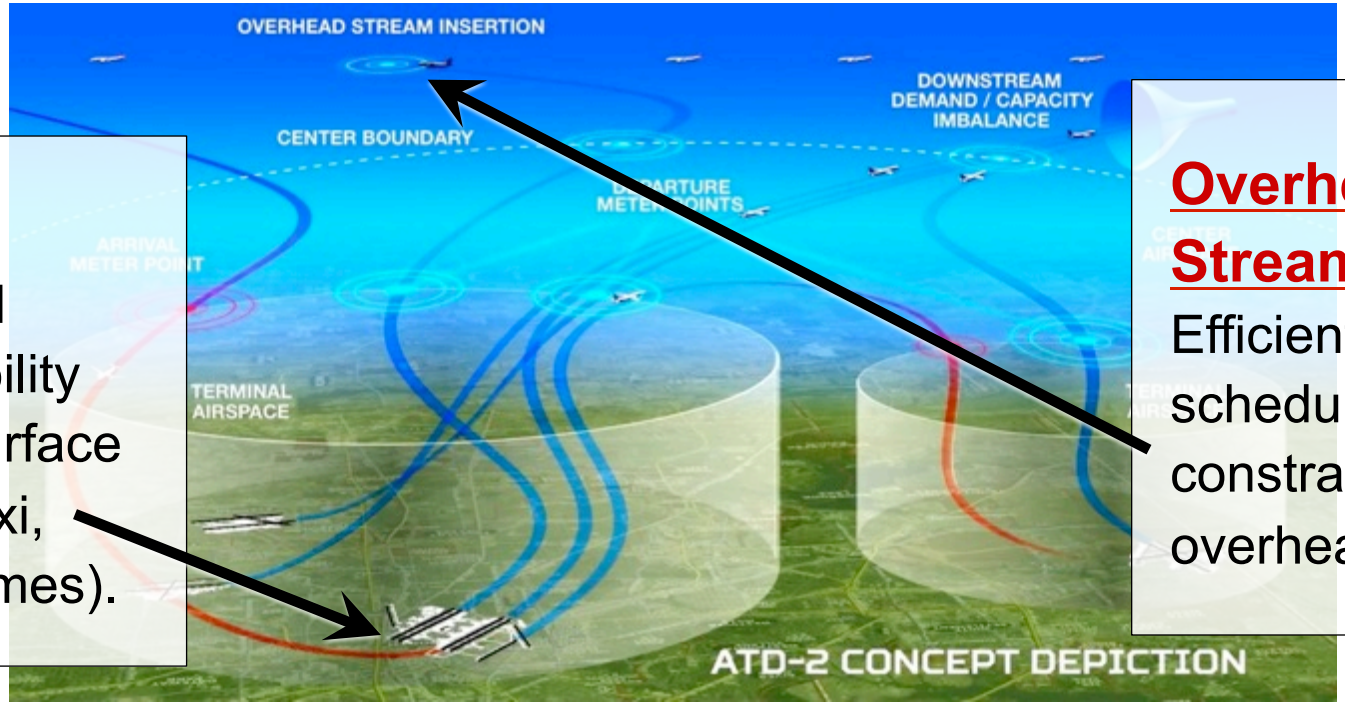
- Airspace Technology Demonstration 2 (**ATD-2**)
- Integrated Arrival, Departure, and Surface (**IADS**) traffic management system

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

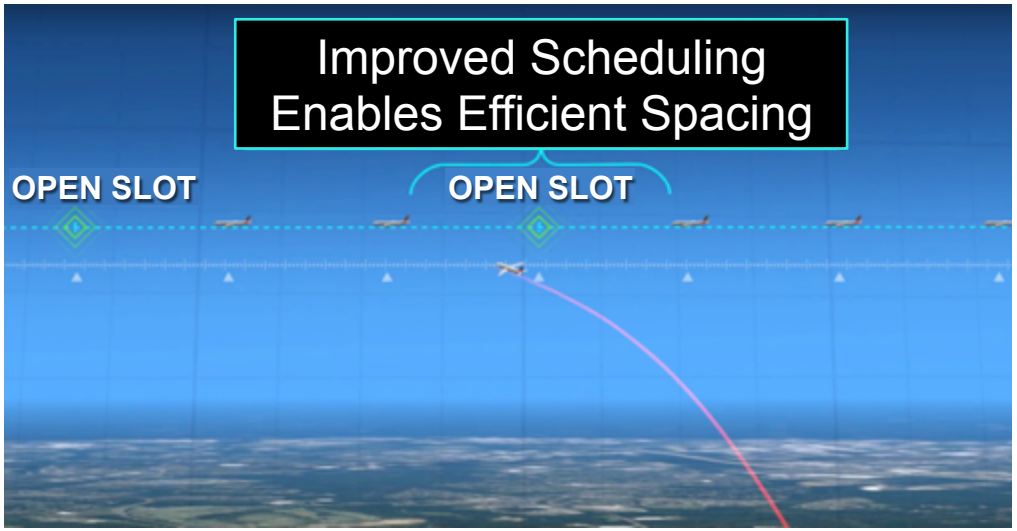


Overhead Stream
Efficient scheduling into constrained overhead flows.

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.

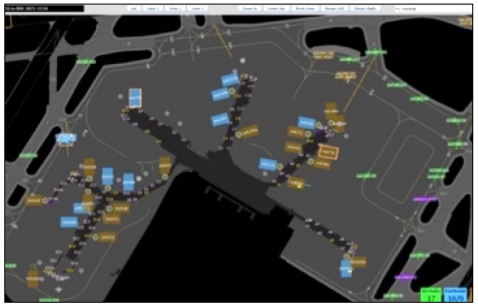
Surface Scheduler Generates target times; monitors demand and capacity imbalance estimates.

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**

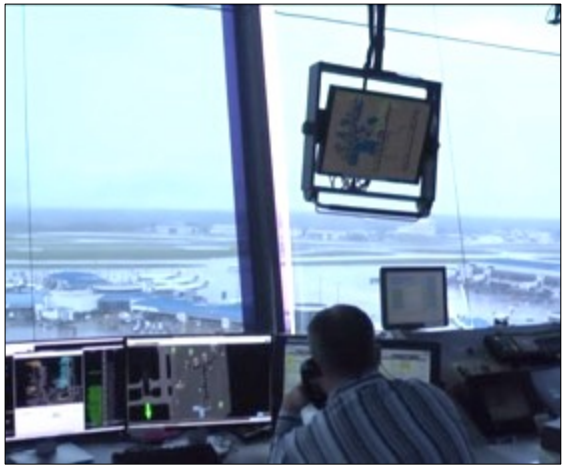
Ramp Tower

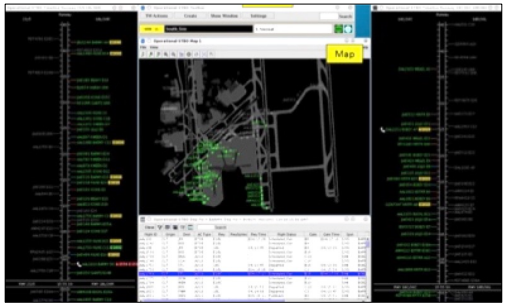


Display/Interface

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

ATC Tower

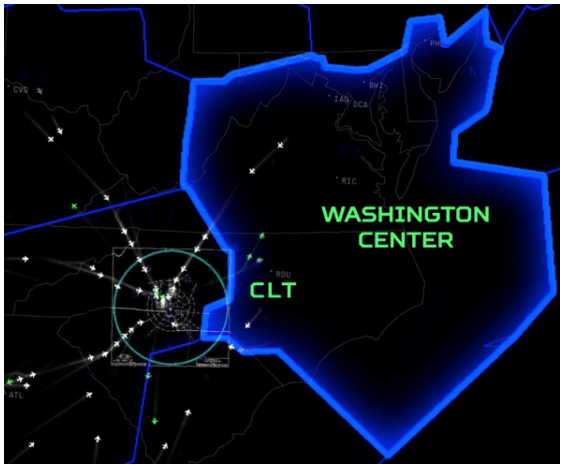


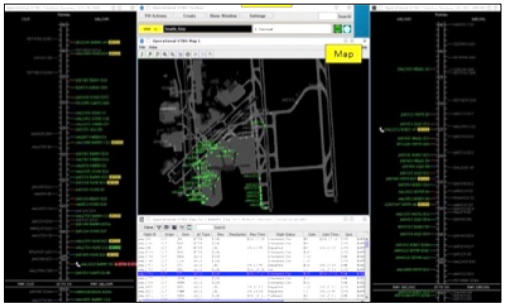


Display/Interface

Runway arrival /departure timelines, flight list, map

ARTCC (Center)





Display/Interface

Departures into overhead streams

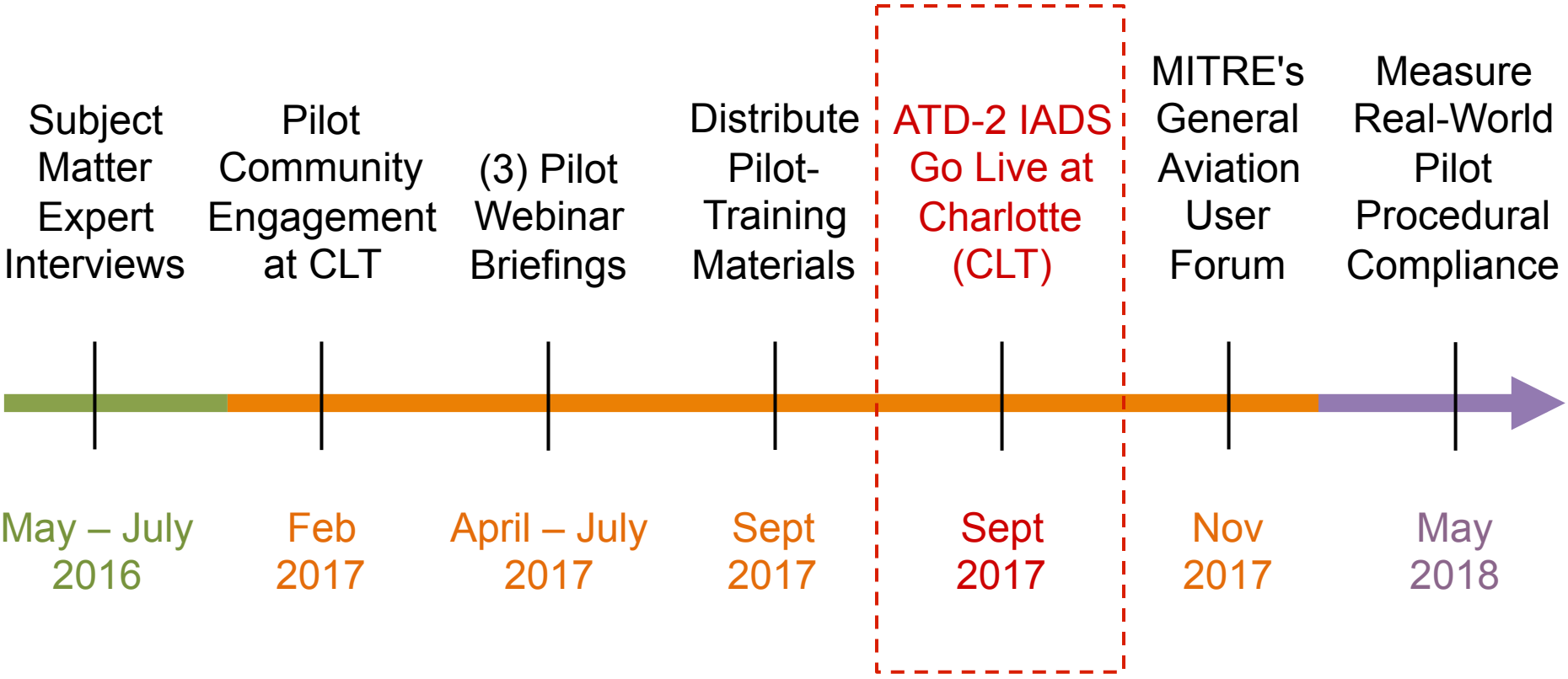
ATD-2 IADS Flight Deck Implications

- 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



Charlotte Douglas International Airport (CLT)

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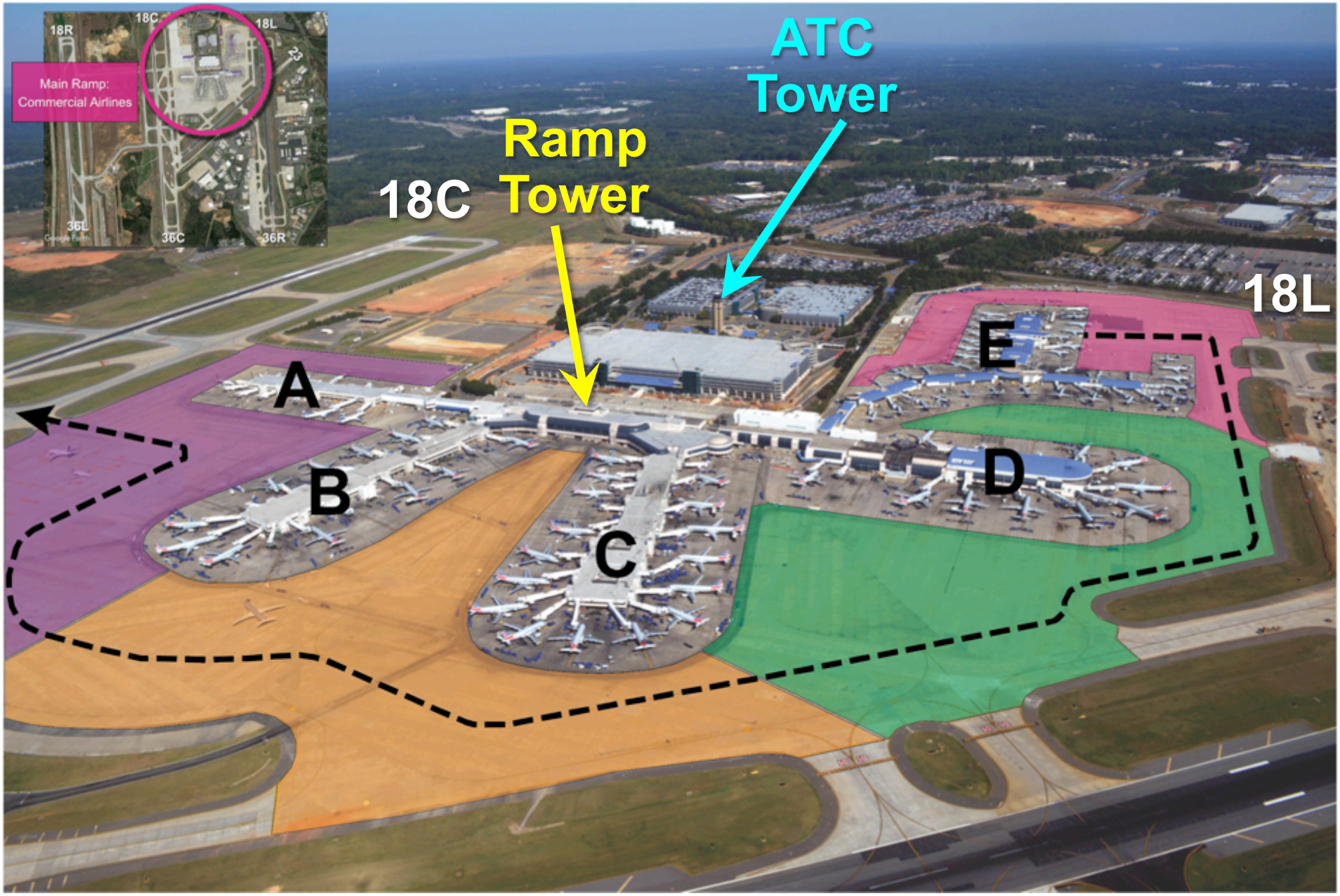
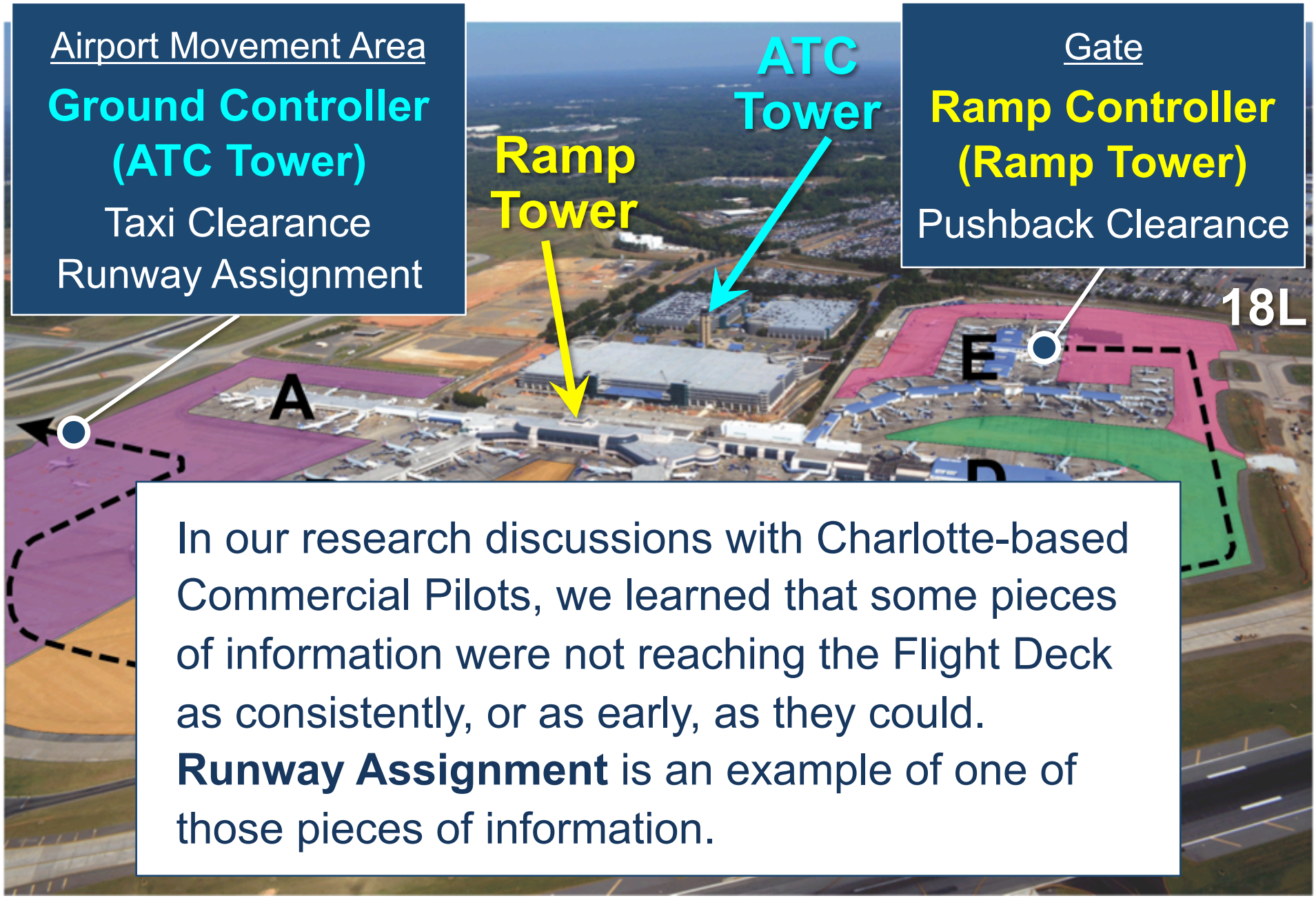
Charlotte Douglas (CLT) Main Ramp



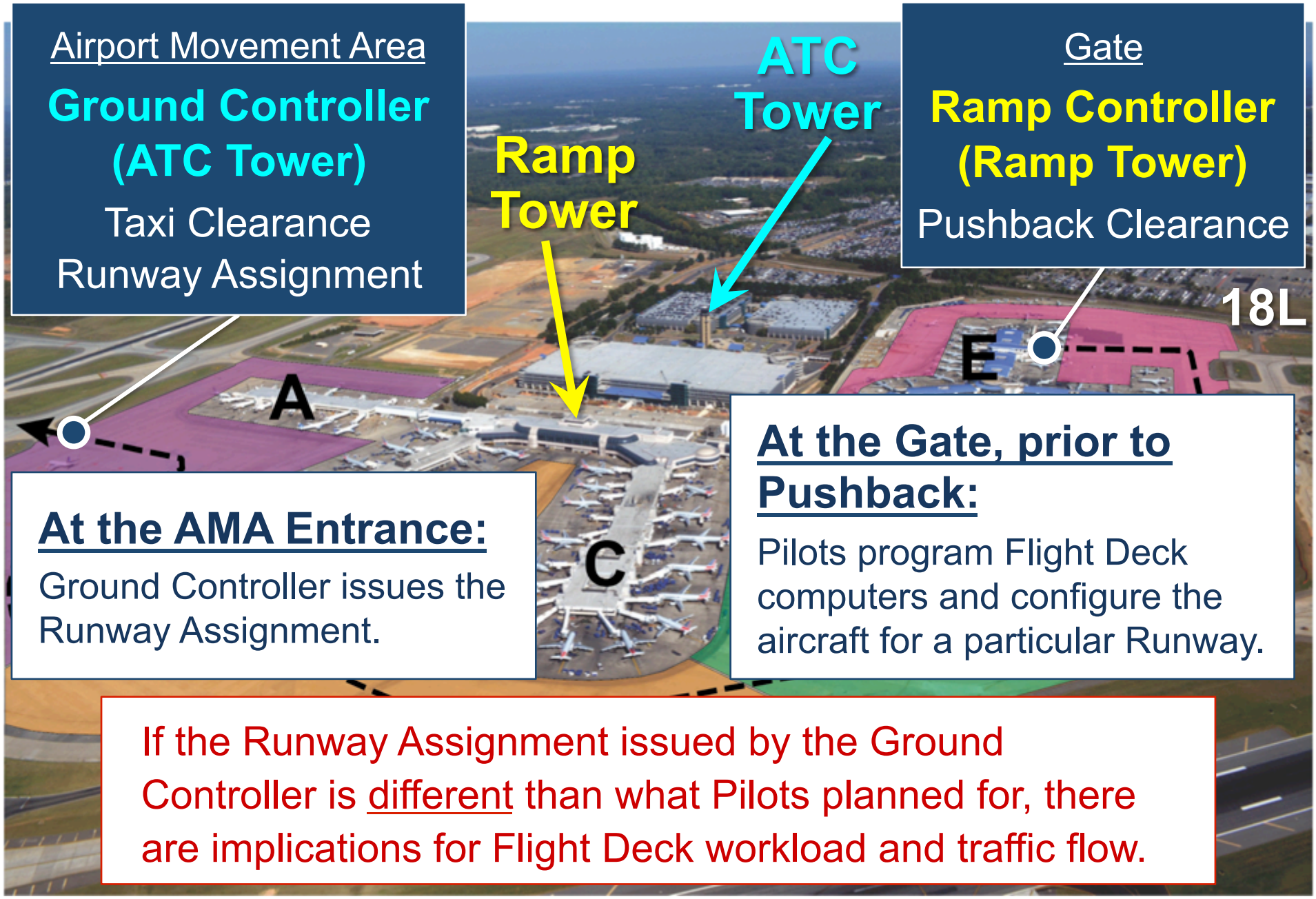
Charlotte Douglas (CLT) Main Ramp

SJSU



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.

Charlotte Douglas (CLT) Main Ramp



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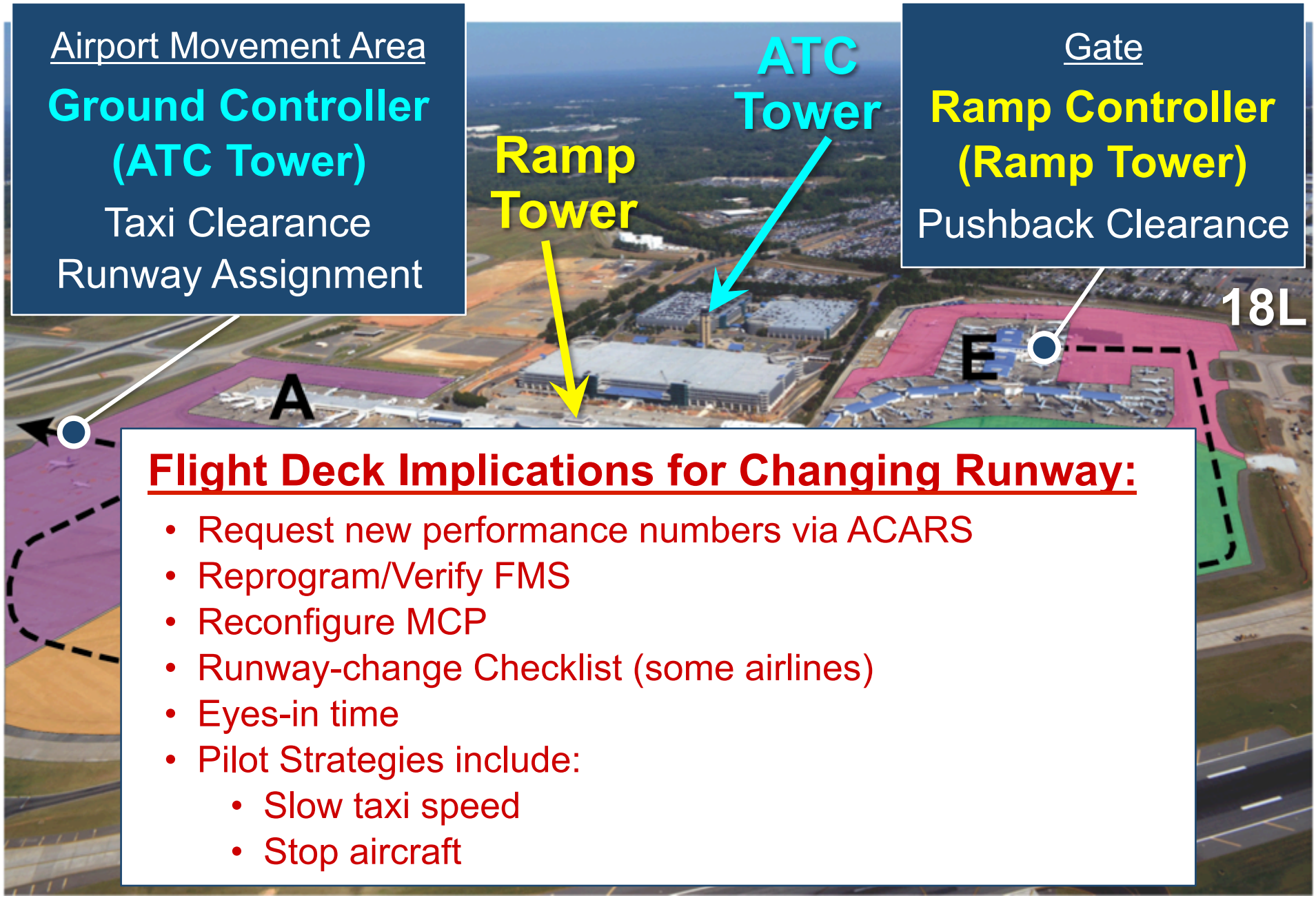


Flight Deck Implications for Changing Runway:

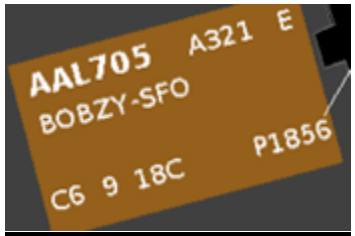
- Request new performance numbers via ACARS
- Reprogram/Verify FMS
- Reconfigure MCP
- Runway-change Checklist (some airlines)
- Eyes-in time
- Pilot Strategies include:
  - Slow taxi speed
  - Stop aircraft

ATD-2 IADS Information Sharing

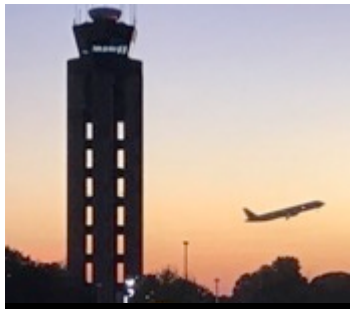
- Share information among all operators who are responsible for managing traffic to support efficient operations.

Airlines

Ramp Tower



Ramp Controller's Display



ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms

ARTCC Center Control

Flight Deck
Commercial Airlines at Main Ramp

ATD-2 IADS Information Sharing

National Airspace 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 — ATD-2 IADS
- Earliest Off-Block Time (EOBT) — ATD-2 IADS

Flight Deck Implications of ATD-2 IADS at CLT

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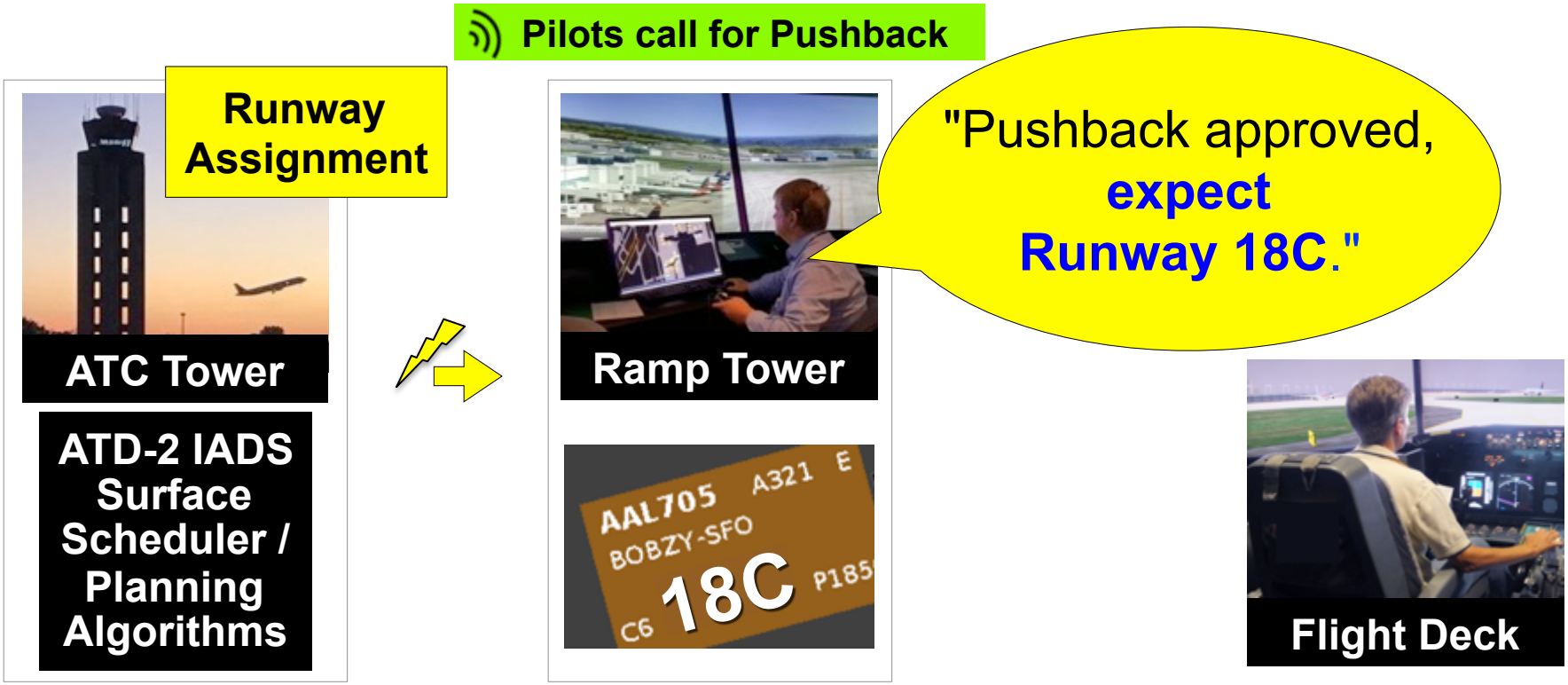
Runway Assignment

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



Flight Deck Implications of ATD-2 IADS at CLT

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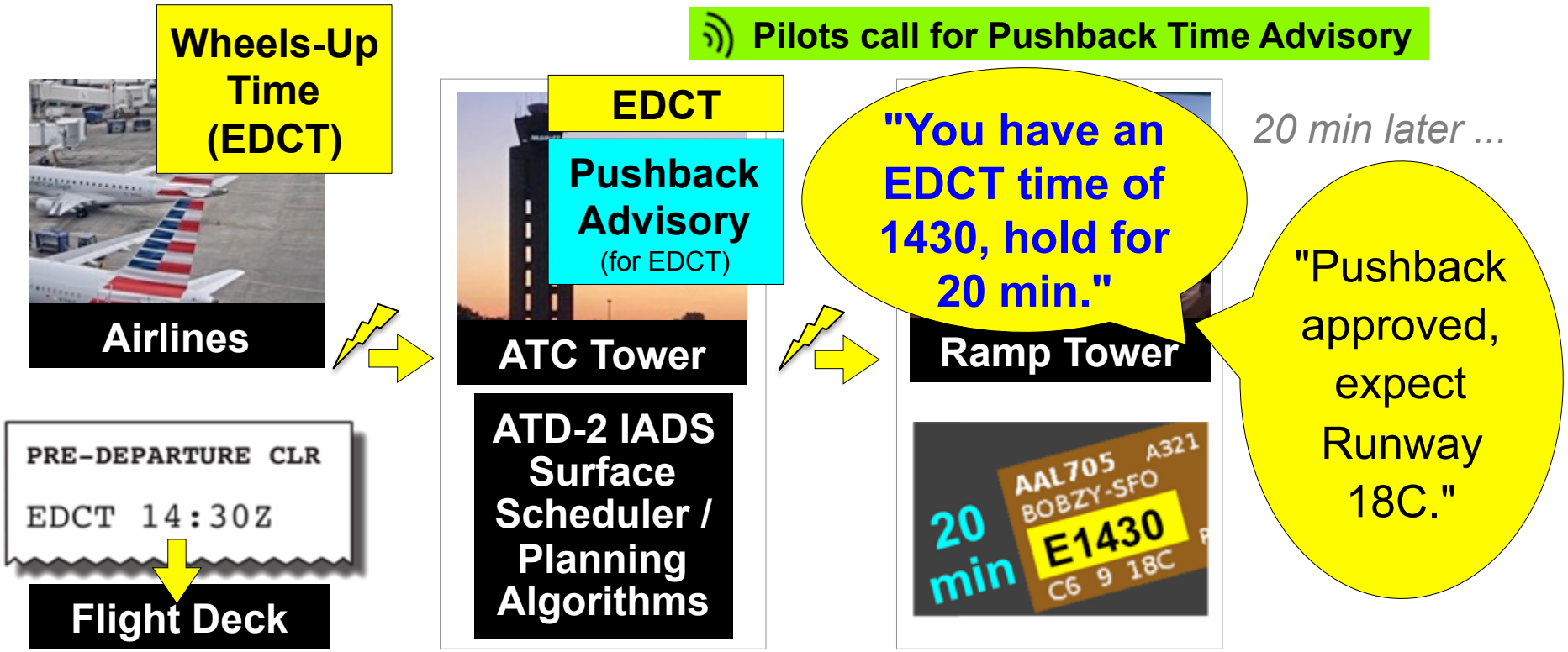
Traffic Management Initiative (TMI)

Expect Departure Clearance Time (EDCT)

Prior to 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.



Flight Deck Implications of ATD-2 IADS at CLT

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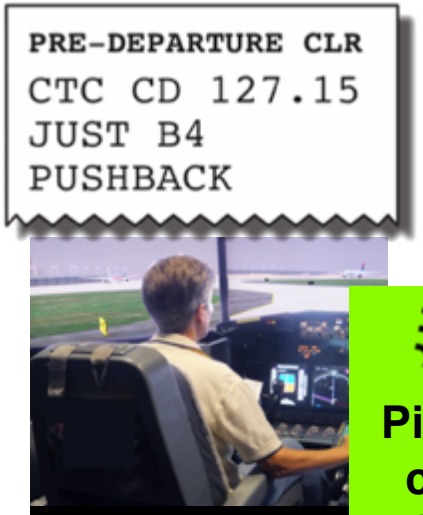
Traffic Management Initiative (TMI)

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.



Flight Deck *before Pushback*

Pilots call Clr. Delivery

Clearance Delivery

***Negotiation of APREQ (overhead slot)**

ARTCC Center Control

***Negotiation is not triggered until the Flight Deck contacts Clearance Delivery.**

Flight Deck Implications of ATD-2 IADS at CLT

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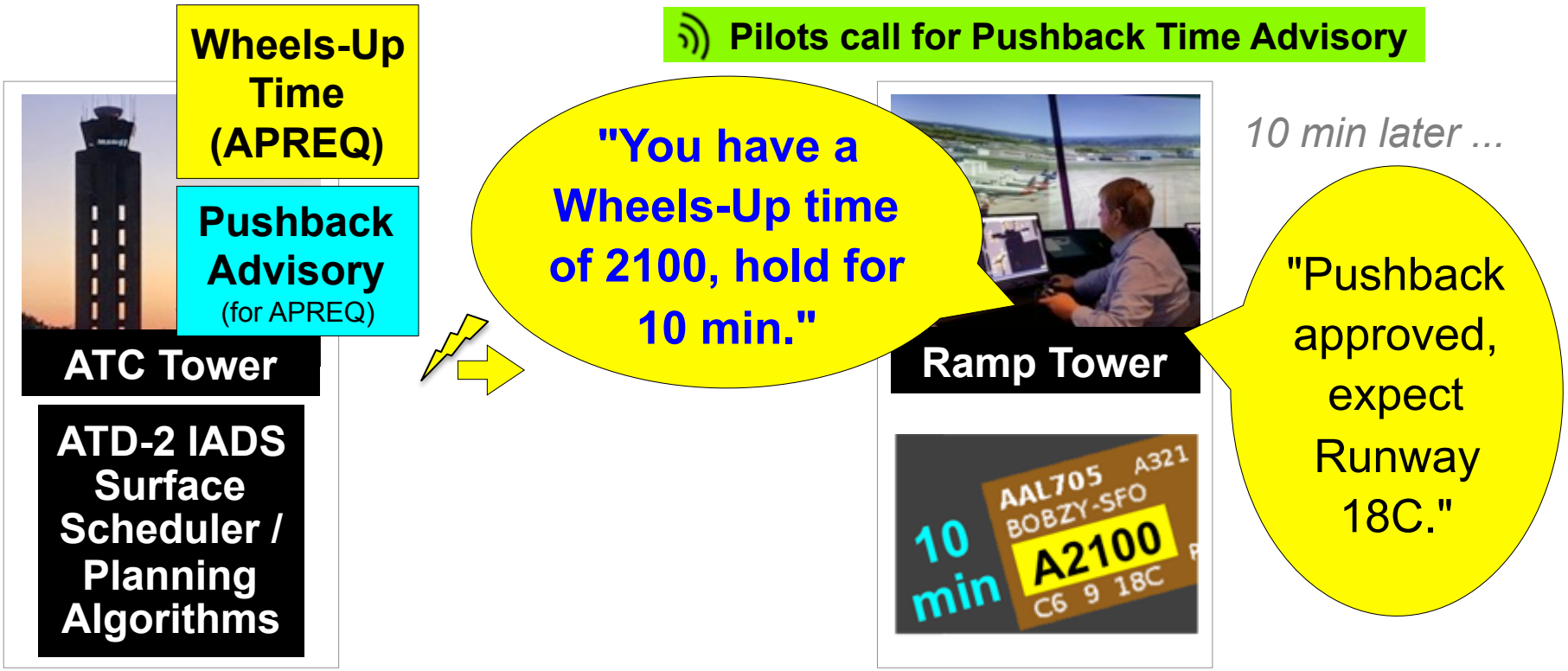

Flight Deck Implications of ATD-2 IADS at CLT

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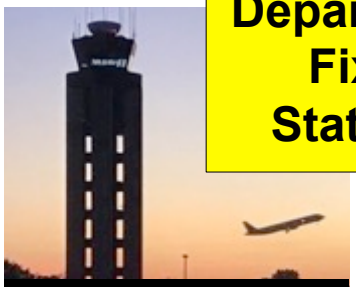
Departure Fix Change/Closure

Prior to ATD-2 IADS	• Departure Fix closures were typically communicated to pilots by Ground Control at the spot or, sometimes, by Ramp Control.
ATD-2 IADS Information Sharing	• Ramp Control is equipped with Departure Fix status. • Ramp Control communicates to pilots when Departure Fixes are closed or combined.

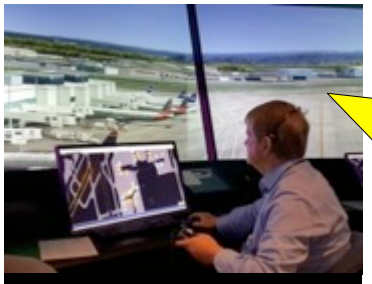
Pilots call for Pushback



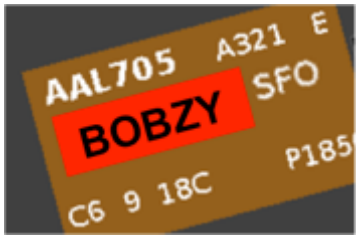
Departure Fix Status

ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms



Ramp Tower



"Contact Clearance Delivery for new route, call when ready for push."

Flight Deck Implications of ATD-2 IADS at CLT

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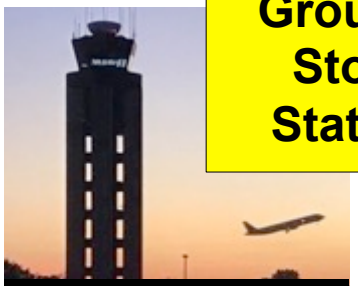
Ground Stop at Destination Airport

Prior to ATD-2 IADS	• Ground Stops were communicated to pilots by Ground Control at the spot or, sometimes, by Ramp Control.
ATD-2 IADS Information Sharing	• Ramp Control is equipped with Ground Stop information. • Ramp Control communicates to pilots when the destination airport is closed.

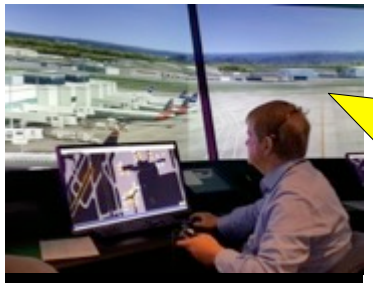
Pilots call for Pushback

Ground Stop Status



ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms



Ramp Tower

"Ground Stop in effect at destination airport."

Flight Deck Implications of ATD-2 IADS at CLT

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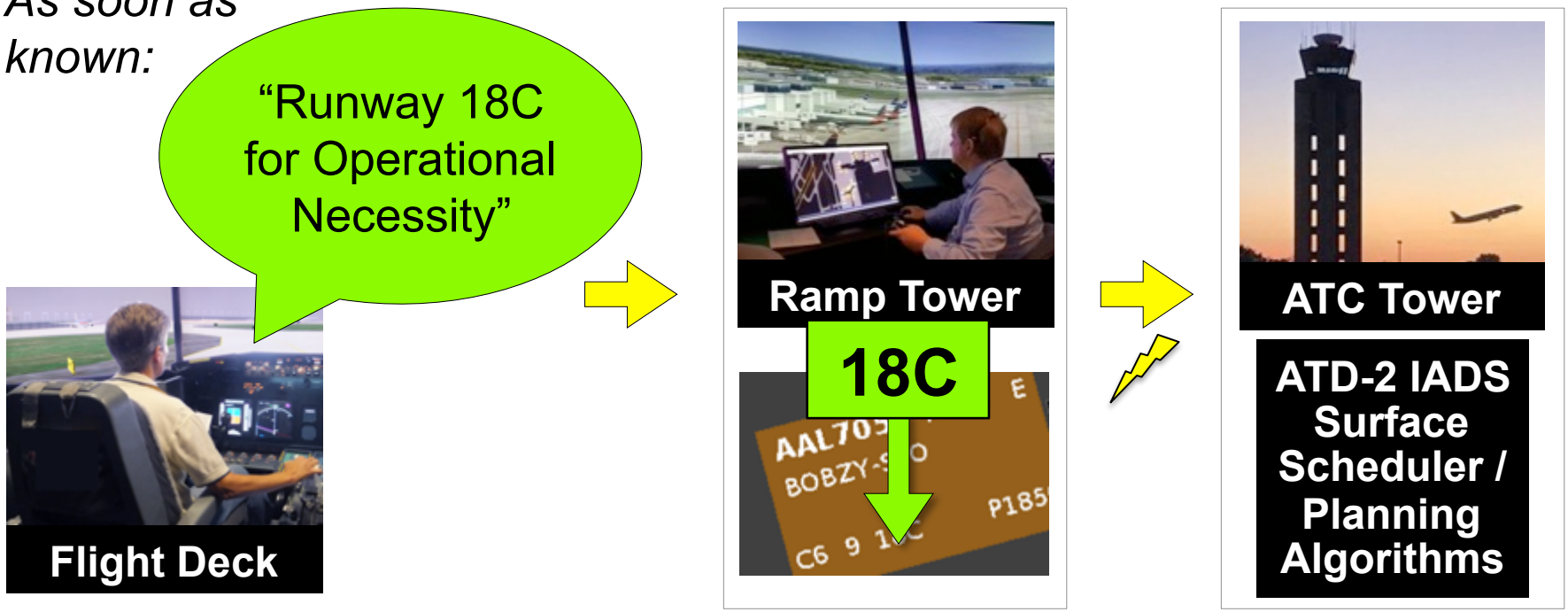
Specify Runway for Operational Necessity

Prior to ATD-2 IADS	• Pilots specified runway for operational necessity to Ramp Control or Ground Control.
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.

As soon as known:



Flight Deck Implications of ATD-2 IADS at CLT

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Anticipated Pushback Delay

Prior to ATD-2 IADS	• Pilots, sometimes, informed Ramp Control of anticipated pushback delays (e.g., maintenance issue).
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:

Flight Deck Implications of ATD-2 IADS at CLT

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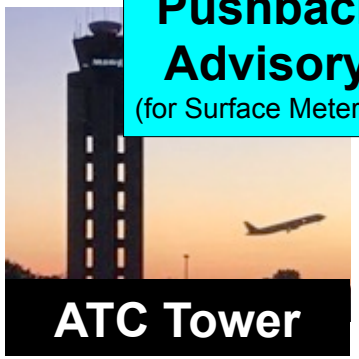
Surface Metering: Gate Hold Advisories

ATD-2 IADS

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



Pushback Advisory (for Surface Metering)

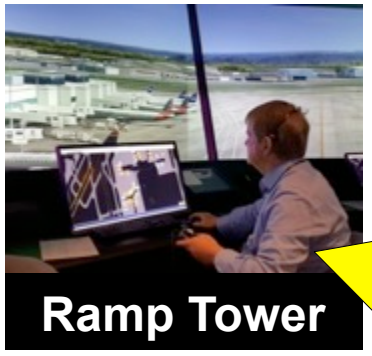
ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms

"Hold 5 min for metering."

Ramp Tower

5 min later ...



Ramp Tower

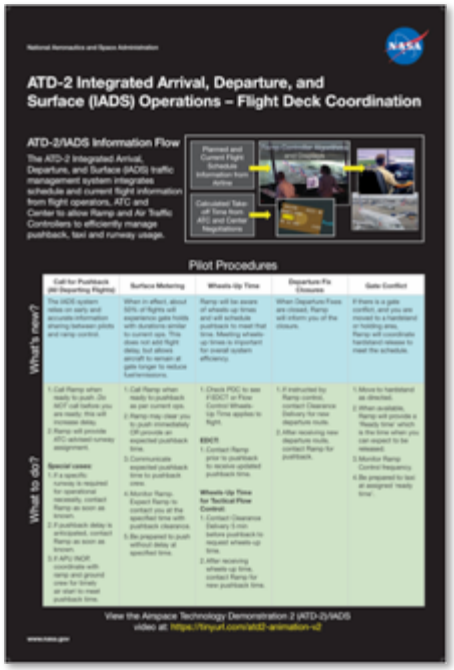
"Pushback approved, expect Runway 18C."

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)

Overview and Expected Benefits



Pilot Procedures

Wheels-Up Time Flowcharts

Real-World Procedural Compliance

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TRAFFIC MANAGEMENT INITIATIVE (TMI)

APREQ/CFR: "Wheels-Up Time for Flow Control"

- 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%

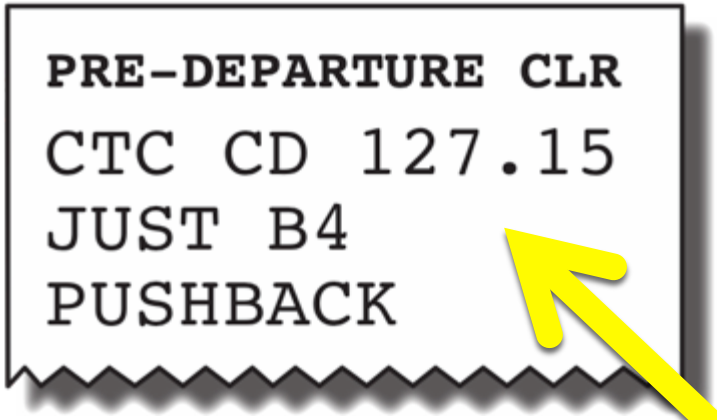
Average

February 2018

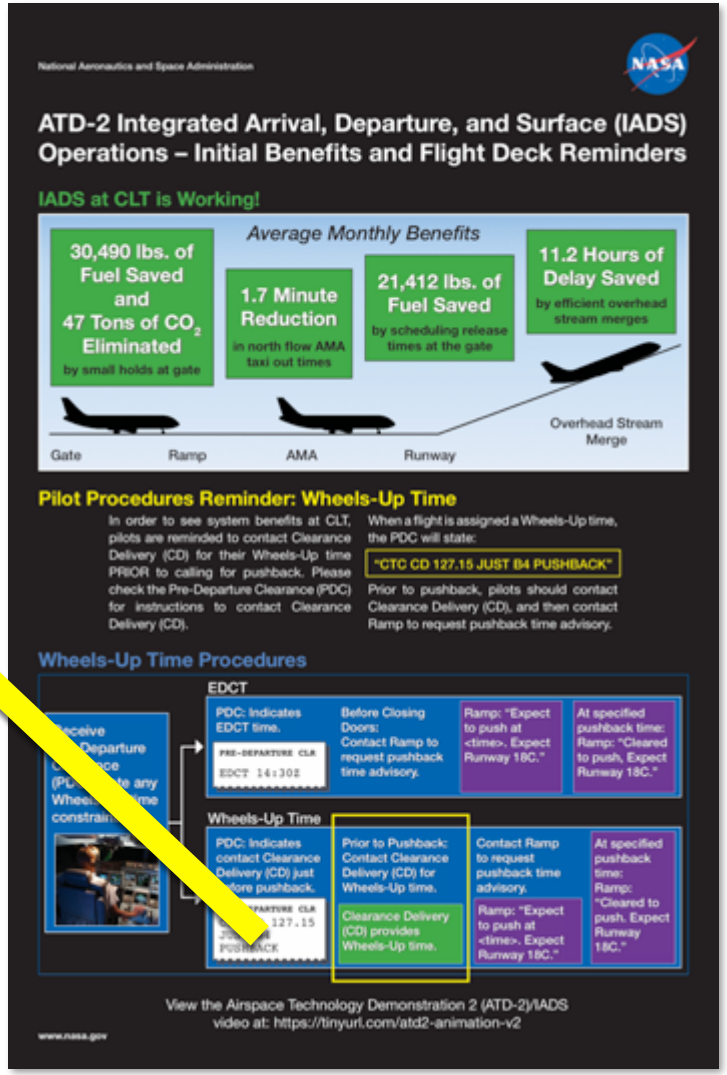
Real-World Procedural Compliance

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

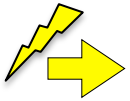


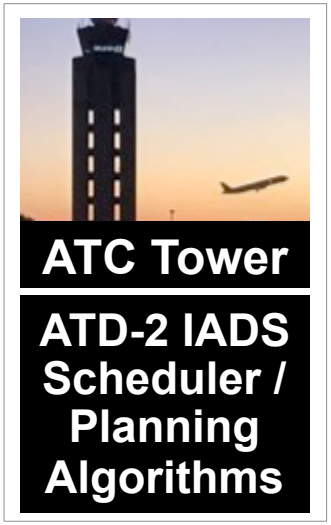
Flight Deck Implications of ATD-2 IADS

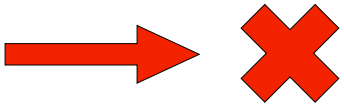
Earliest Off-Block Time (EOBT)

ATD-2 IADS

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

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ATD-2 IADS

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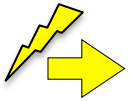

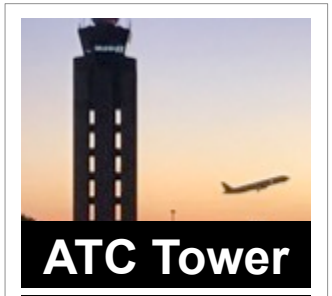

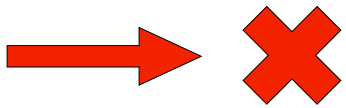

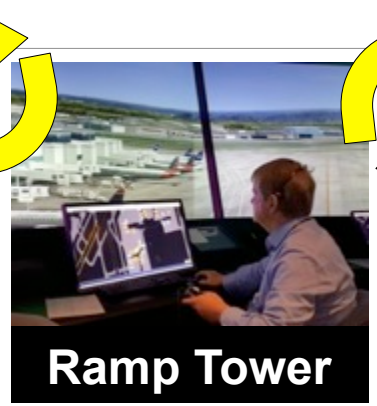

Earliest Off-Block Time (EOBT):

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Charlotte Douglas International Airport (CLT)

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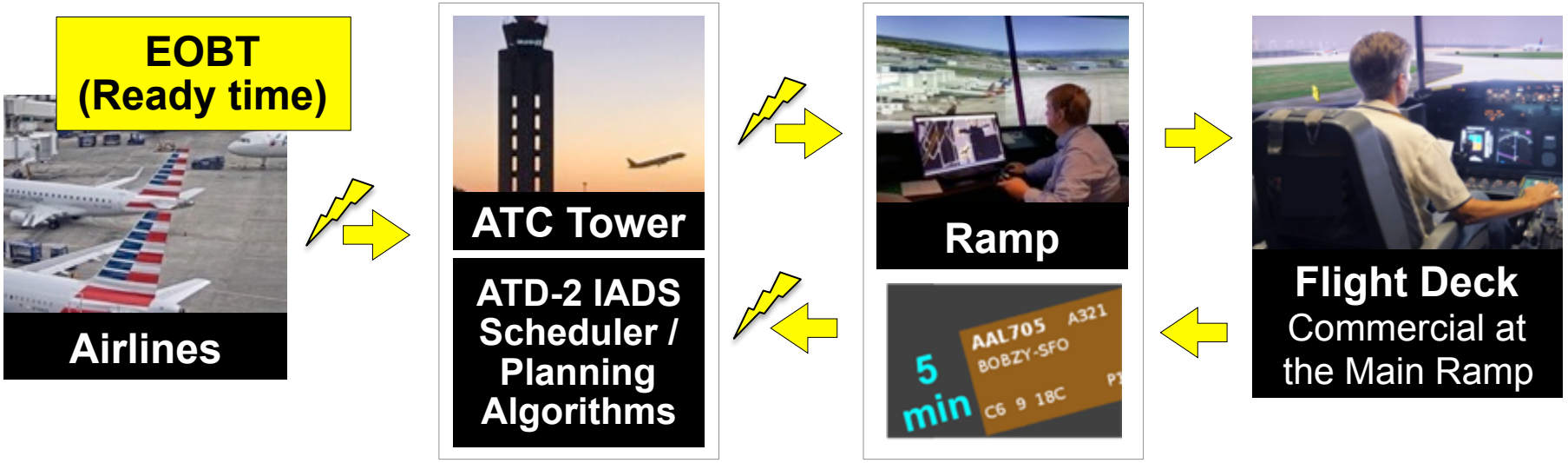
ATD-2 IADS Information Flow

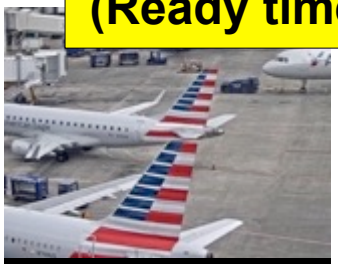
Main Ramp (Commercial Operations) at Charlotte



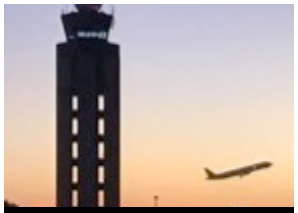
ATD-2 IADS Information Flow

Main Ramp (Commercial Operations) at Charlotte

EOBT (Ready time)



Airlines



ATC Tower

ATD-2 IADS Scheduler / Planning Algorithms

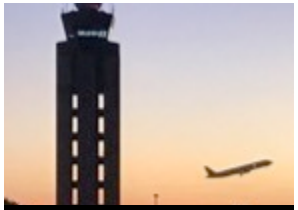
Ramp

Flight Deck
Commercial at the Main Ramp

General Aviation / Business Jet Operations at Charlotte

No Airlines to compute and share accurate EOBT (Ready times)

Filed departure time only



ATC Tower

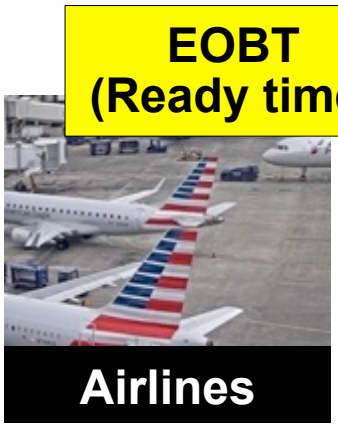
ATD-2 IADS Scheduler / Planning Algorithms

No Ramp Controller to facilitate information exchange with Pilots

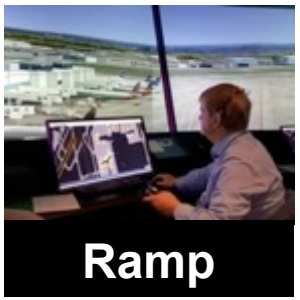
Flight Deck
General Aviation Business Jet

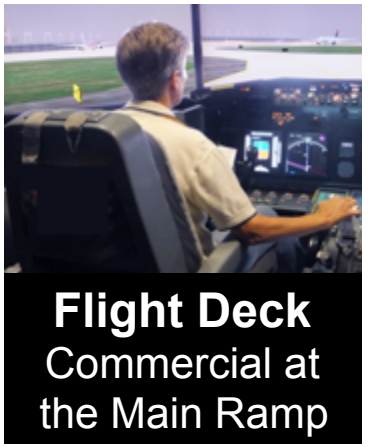
ATD-2 IADS Information Flow

Main Ramp (Commercial Operations) at Charlotte



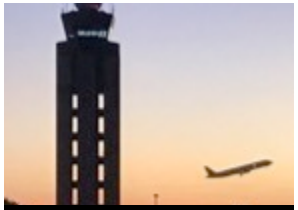
ATD-2 IADS Scheduler / Planning Algorithms





General Aviation / Business Jet Operations at Charlotte

Mobile Application for GA Pilots to facilitate information sharing



ATD-2 IADS Scheduler / Planning Algorithms

General Aviation (GA) Information Flow

Ready-to-Taxi Time (RTT)

ATD-2 IADS

ATD-2 IADS Information Sharing

- Mobile App to enable information flow for GA flights.
- Ready-to-Taxi Time (RTT) similar to EOBT at the Main Ramp.
- **The MITRE Corporation** developing prototype '*Taxi Time*' App

  Diffenderfer, P.A., Long, K.M., & Wilkins, S.A. (2018). Concepts for delivering IFR clearances and exchanging pre-departure data using mobile devices. *Proceedings of the 2018 IEEE/AIAA Integrated Communications, Navigation, and Surveillance Conference (ICNS)*.

Flight Deck
General Aviation
Business Jet

ATC Tower

ATD-2 IADS Surface Scheduler / Planning Algorithms

General Aviation (GA) Information Flow

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

  Diffenderfer, P.A., Long, K.M., & Wilkins, S.A. (2018). Concepts for delivering IFR clearances and exchanging pre-departure data using mobile devices. *Proceedings of the 2018 IEEE/AIAA Integrated Communications, Navigation, and Surveillance Conference (ICNS)*.

Flight Deck
General Aviation
Business Jet

- **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

SJSU

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

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

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