



NAC Meeting

October 4, 2023



Opening of Meeting

Chip Childs, NAC Chair
President & CEO (SkyWest Airlines)



Public Meeting Announcement

NextGen Advisory Committee (NAC)

October 4, 2023



Public Statements

Members of the Public



NAC Chair Report

Chip Childs, NAC Chair
President & CEO (SkyWest Airlines)

Motion for NAC Approval

- June 12, 2023 – NAC Meeting Summary Package Draft





NAC Chair Report

Chip Childs, NAC Chair
President & CEO (SkyWest Airlines)



FAA Report

FAA



NAC Subcommittee Chair's Overview

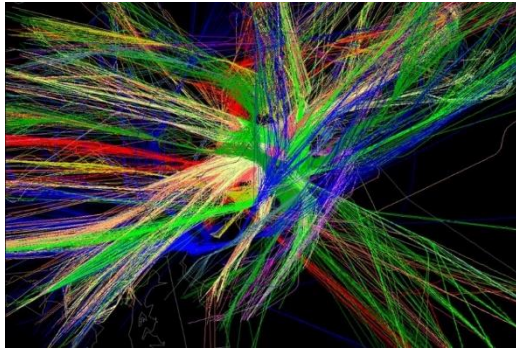
Warren Christie, NAC SC Chair (JetBlue Airways)

NAC Subcommittee Overview and Topics

- Made some changes to the update on workgroup and tasking status
 - > Focus more on engagement and discussion
- Start with a brief update on NIWG highlights, followed by policy level discussions facilitated by the NIWG Co-Chairs and FAA SMEs
 - > Data Communications – En route data communication benefits
 - > Surface & Data Sharing – Industry readiness for TFDM surface metering
- Status of the ADS-B In trials as follow-up to recommendations from Task 20-1, ADS-B In Commercial Application Technologies
- Interim findings from Task 23-1, Airspace Efficiencies

Overview of Milestones (since June 2023 NAC)

Northeast Corridor



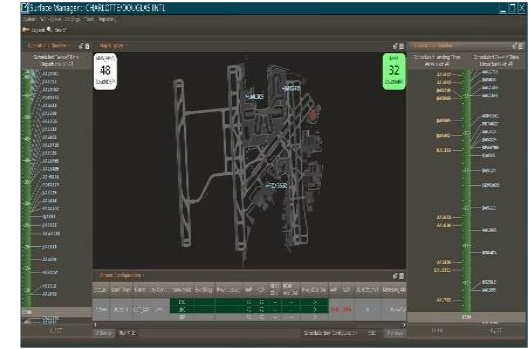
- Atlantic Coast Routes (ACR) in place since April
- PANYNJ moving forward with GBAS for JFK and LGA
- PANYNJ Fly Quiet Program draft scorecard developed

Data Communications



- Twelve en route centers operational with Full Services increment 1
- ZHU latest to go operational
- ZFW and ZJX planned for by the end of CY2023

Surface and Data Sharing



- Electronic Flight Strips operational at five sites
- Collaborative Site Implementation Team (CSIT) visits completed at six sites (where surface metering is planned)



NAC Task 23-1: NAS Airspace Efficiencies

Lee Brown (JetBlue Airways) & Ron Renk (United Airlines)

Shawn Kozica (FAA), Wendy O'Connor (FAA), & Greg Schwab (FAA)

NAC Task 23-1: NAS Airspace Efficiencies

The FAA requests NAC advice on ways to achieve greater airspace efficiencies as we collaboratively attempt to reduce reliance on and divest from legacy systems and procedures and move to a reliance on a more modernized NAS.

The FAA offers the following suggestions as a way to begin the efficiency discussions:

1. Within the scope of current FAA automation capabilities, **explore opportunities for increased utilization of existing** Performance Based Navigation (PBN) **procedures**.
2. Identify opportunities for industry to leverage efficiencies gained from their avionics and dispatch systems investments while simultaneously allowing the FAA to divest from legacy NAS elements that do not contribute to those efficiencies.
3. Identify opportunities for the FAA to **remove existing and infrequently used Instrument Flight Procedures (IFPs)**.
4. Identify opportunities to potentially **modify existing IFPs/Standard Instrument Departure Procedures (SIDs)/Standard Terminal Arrival Procedures (STARs)** to gain overall airspace efficiencies.
5. Identify a recommended baseline PBN and non-PBN IFP infrastructure to provide the **minimum service level and airport access** for both non-Global Positioning System/Area Navigation equipped aircraft and aircraft with advanced avionics for each Navigation Services Group Airport Category (1-5).
6. Identify any trends in **IFP/SID/STAR inventory suggestions that might be used as a national standard**.
7. Explore opportunities for even greater efficiencies with the use of Advanced Required Navigation Performance (A-RNP) as is being pursued by the Performance Based Operations Aviation Rulemaking Committee.
8. Work with the NAC Subcommittee Minimum Capabilities List (MCL) Team to capitalize on any cross-cutting issues that might support both taskings and industry achieving MCL-level of equipage.



Work Completed since June

- Process Completion
- Defining “Minimum Service Levels”
- FLL Case Study
- Better Use of NextGen Procedures



Process Completion

- As briefed in June, the group worked on a way to take *objective* FAA procedure use data and add a *subjective* review.
- This requires a review of things such as: types of operations at the airport, contingency procedures, weather patterns, airspace constraints, runway configuration, etc.
- Since June, the FAA met with regional and local Air Traffic personnel and no additional changes were requested for this process.
- The process was used for the initial case study (FLL) with success.
 - Will review later in this presentation when we talk about FLL

Defining Minimum Service Levels

- To assist the FAA's review of an airport, we defined Minimum Service Levels based on airport Navigation Service Group (NSG) as defined in the FAA PBN Roadmap.

NSG 1 - Low visibility (<200' HAT), redundancy (spaced-based/ground-based, DEP/ARR runway), arrivals, departures

NSG 2 - Low visibility (<=200' HAT), redundancy (spaced-based/ground-based, DEP/ARR runway), arrivals, departures

NSG 3 - CAT I mins, redundancy (spaced-based/ground-based, DEP/ARR runway), arrivals/departures where needed

NSG 4 - Instrument approaches to ensure runway access, procedures to meet operational needs of primary airport users.

NSG 5 - Instrument approaches (where users equipped) to ensure runway access, procedures to meet operational needs of primary airport users. Consideration for equipage should given to ensure any approaches available are useable by airport users.

Defining Minimum Service Levels

- The group was also able to make some blanket statements about retiring certain approach types.
 - ILS, keep when: it's the only vertically guided approach, ceiling and visibility (minima) reduced compared to PBN, resiliency for GPS failure, pilot training required.
 - RNP AR, keep when: curved approach required, NextGen program in use (example: Established on RNP), ceiling and visibility (minima) reduced compared to GPS, allows for airport access.
 - PRM Approaches: Thanks to 7110.308, PRM approach use greatly reduced. FAA should look at the need for separately titled approach if cost savings can be achieved.

FLL Case Study

- Approaches:
 - Did not find wastefulness with approaches. Due to runway use and need for resiliency (runway closures), right balance of ILS and PBN.
 - Industry willing to do without LOC approaches with the idea that when the full ILS is out, RNAV should be used in its place.
- Departures/Arrivals:
 - Some low use departures/arrivals needed for satellite airports, contingency and to mix prop/turbojet traffic.
 - Willingness however to look at combining up some procedures to reduce overall inventory.

Better Use of NextGen Procedures

- The group started discussion on how to get better use of NextGen procedures where it occurred organically in other discussions. Some concepts included:
 - Making use more attractive by providing better benefits for ATC and operators.
 - Better name and education of existing controller tools that support PBN operations, like Converging Runway Display Aid (CRDA). Calling it something like Converging Aircraft Display Aid (CADA) would draw attention to it being used for other than converging runways. During FLL discussions, ATC didn't realize that tool could be used to assist sequencing curved approaches with straight-in approaches.
 - Procedure design that helps support use: In FLL example, controllers said connecting RNP to arrivals would assist in making them more usable.
- More robust discussions will occur around this topic later this fall.



What's Next

- Additional Case Studies (Different NSG groups, NY)
- Explore opportunities for increased utilization of existing Performance Based Navigation (PBN) procedures.
- Opportunities to modify existing IFPs/Standard Instrument Departure Procedures (SIDs)/Standard Terminal Arrival Procedures (STARs) to gain overall airspace efficiencies
- Opportunities for efficiencies with the use of Advanced Required Navigation Performance
- Work with the NAC Subcommittee Minimum Capabilities List (MCL) Team to capitalize on any cross-cutting issues that might support both tasks and industry achieving MCL-level of equipage



En Route Data Comm

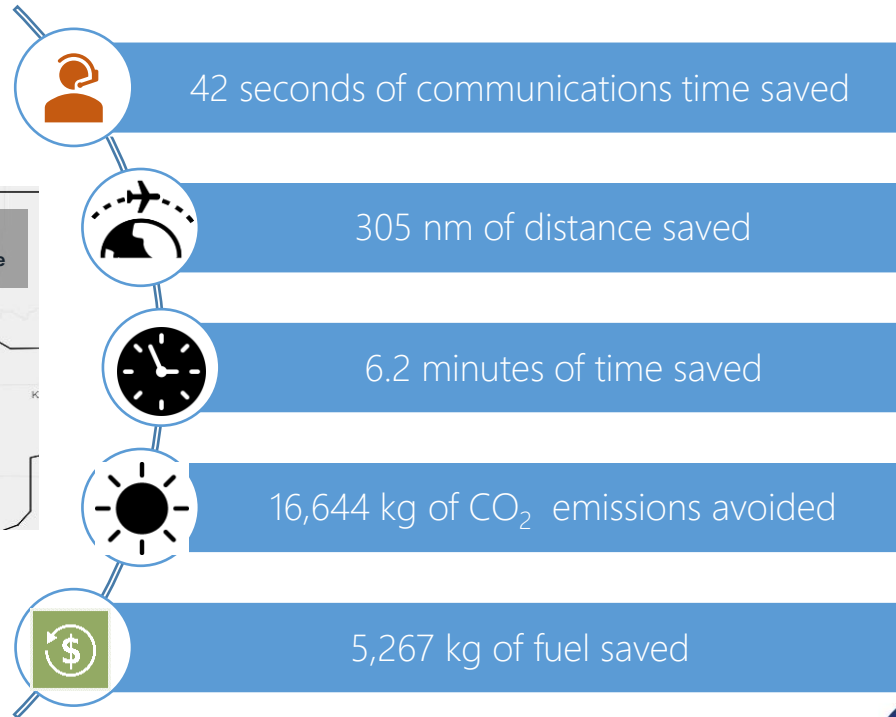
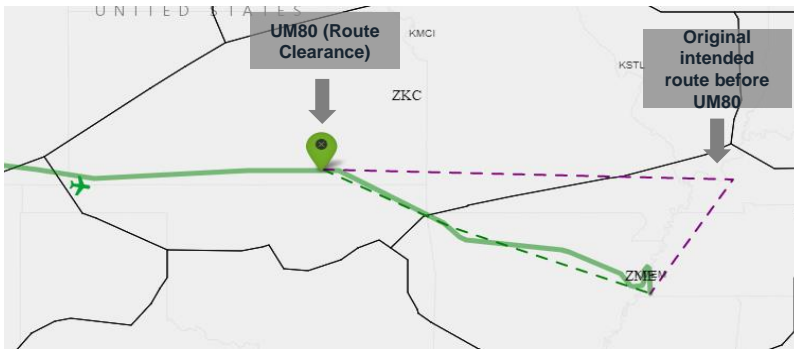
Chris Collings (L3Harris) & Ed Evans (Southwest Airlines)

Kathy Torrence (FAA)

Benefits of CPDLC vs Voice Reroutes – Kansas City Center (ZKC)

Kansas City Center was extremely busy supporting several traffic management initiatives. Memphis inbound traffic was returning to normal routing, which led to multiple re-routes.

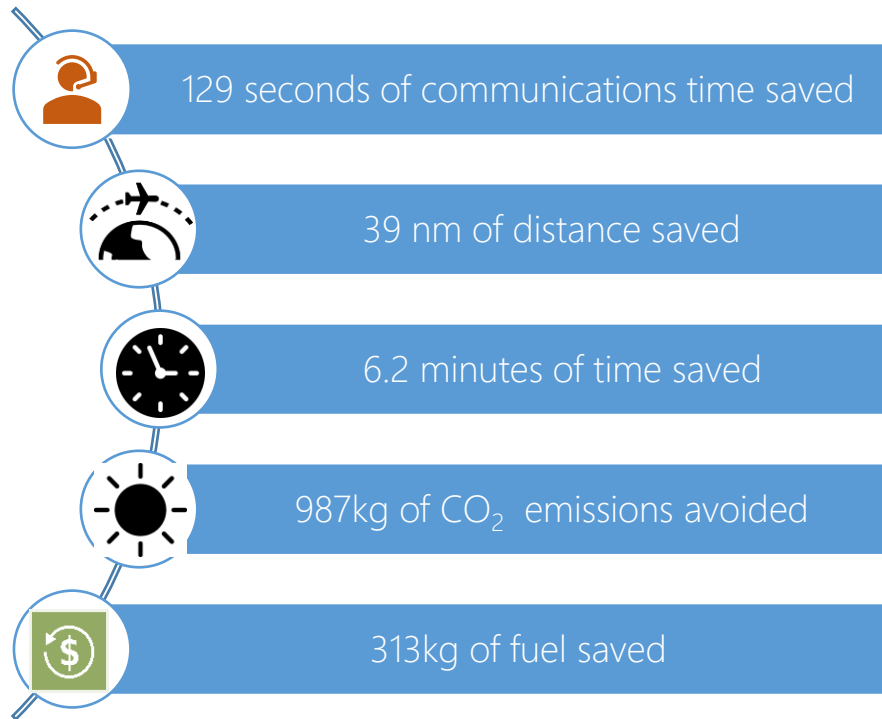
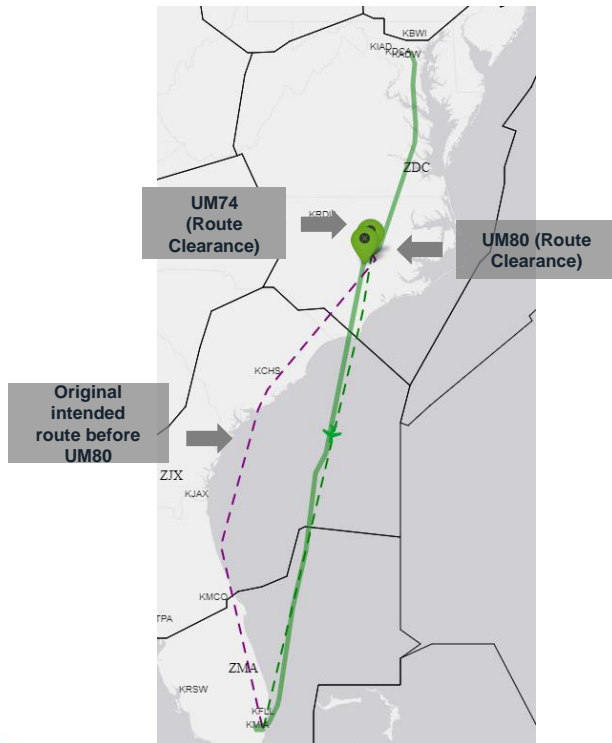
- Five aircraft en route in ZKC required re-routes, only 2 were CPDLC capable
- The three non-CPDLC flights received their reroute over voice and each taking ~30 seconds to communicate
- The two CPDLC flights had their re-route instantly uplinked to them at nearly the same moment without any voice communication required



Benefits of CPDLC vs Voice Reroutes – Washington Center (ZDC)

ZDC was extremely busy supporting several Traffic Management Initiatives:

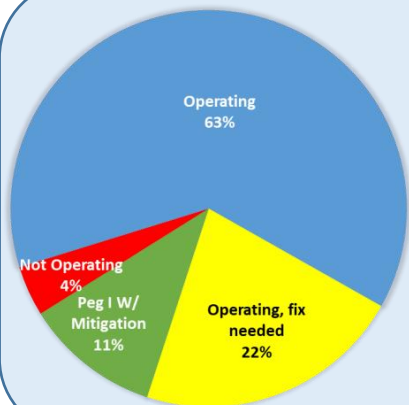
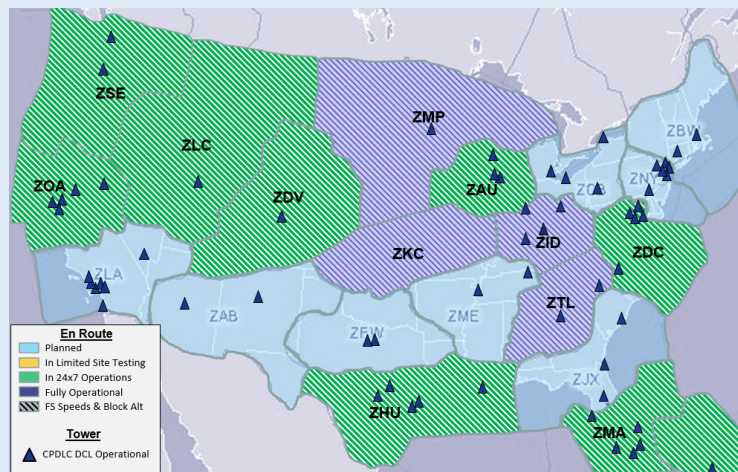
- 3 AFPs (Air Flow Programs) for ZJX and ZMA for thunderstorms on the inland routes
- PHL VIP TFR (Temporary Flight Restrictions)
- Miles in Trail Restrictions to NY Metro Airports and FL KMIA/KFLL/KPBI and KMCO
- Three southbound flights all received a similar re-route in ZDC to avoid weather



Data Comm NIWG Update (October 2023)

En Route Data Comm Deployment

- + 12 centers operational 24/7
- + En Route Full Services Increment 1 active at all active centers
- + Planning next En Route deployments to ZFW (Q4 2023), ZJX (Q4 2023), ZOB (Q1 2024), ZNY (Q2 2024)



Industry & Avionics Performance Updates

- + Business aviation users resumed en route participation – closely monitoring performance
- + Continue to receive positive user feedback as usage grows
- + Confirmed plan for A220 avionics updates – Q4 2024
- NIWG members expressed concern about the “Enhanced Services” baseline slipping to end of 2029

Data Comm En Route by the numbers

March 2019 – July 2023



32,563,378
transactions



4,917,283
sessions



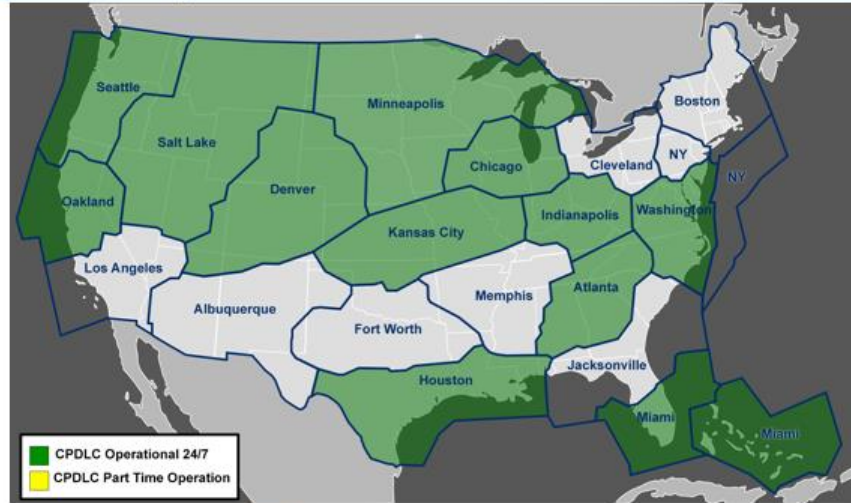
26 commercial
aircraft types



34 commercial
operators



Over 4,400
equipped aircraft



704,970 readback
errors mitigated



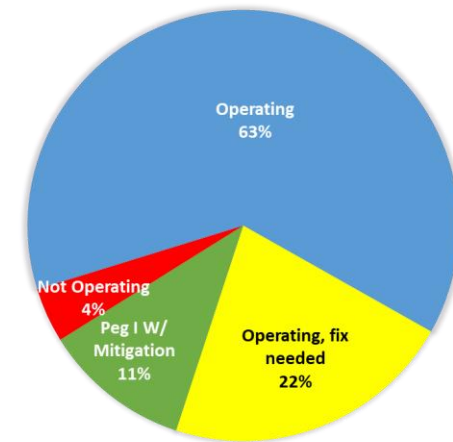
2,664,371 minutes of
comm time saved



Data Comm

Read-Ahead Only Slides

Data Comm Avionics Updates Fleet Status



Aircraft operating in Data Comm En Route – No Pending Actions (63%)

Alaska Airlines: B737	JetBlue: A321LR
American Airlines: B737, B777, B787	Southwest Airlines: B737
Delta: A330neo, A350	United: B777, B787
FedEx: B777, MD11	UPS: B744, MD11, B748

Avionics Action	Operator/Fleet	Status
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Aircraft operating in Data Comm En Route with Crew Procedure Mitigation (11%)

Boeing 757/767 Pegasus 1	FedEx, UPS	Aircraft operating under procedure mitigation; Avionics Update: Peg 1 BP11 (Q3 2023)
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Aircraft operating in Data Comm En Route with Open Avionics Actions (22%)

Collins CMU 900 Core 16	Delta, United	Delta & United ongoing installs
Boeing 767 ATN 523 (Core 16)	FedEx	Newly delivered B767s starting in mid-2022 do not have “Core 16” equivalent avionics. Update planned Q1 2024.
Airbus A320 ATSU CSB 7.5	Alaska (100%), American (100%), Delta (55%), JetBlue (100%)	CSB 7.5 released in late 2020, technical issues increased, root caused; Fix planned for CSB 7.6 Q4 2024 (or CSB 9 available now)
Airbus A320 ATSU CSB 7.6	Alaska, American, Delta, JetBlue	CSB 7.6 planned for Q4 2024 (or CSB 9 available now)

Aircraft removed from Data Comm En Route due to Open Avionics Actions (4%)

Collins VDR Update	United	Install delayed
Boeing 757/767 Pegasus 1	United	Pending Peg 1 BP11: Q3 2023
Airbus A220	Delta, JetBlue	Pending avionics fixes, FMS update Q2 2024; RIU update Q4 2024

Operating, no action required

Operating fix needed

Peg 1 operating with mitigation

Not operating



Data Comm En Route by the numbers

March 2019 – July 2023



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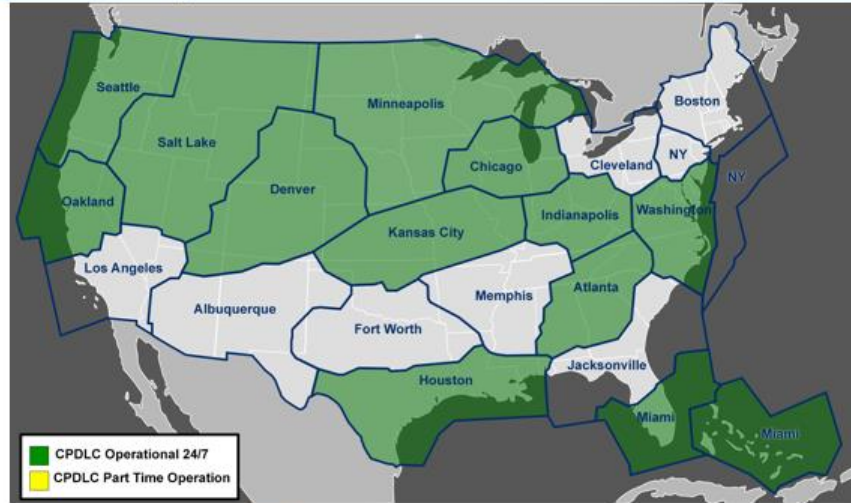
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Over 4,400
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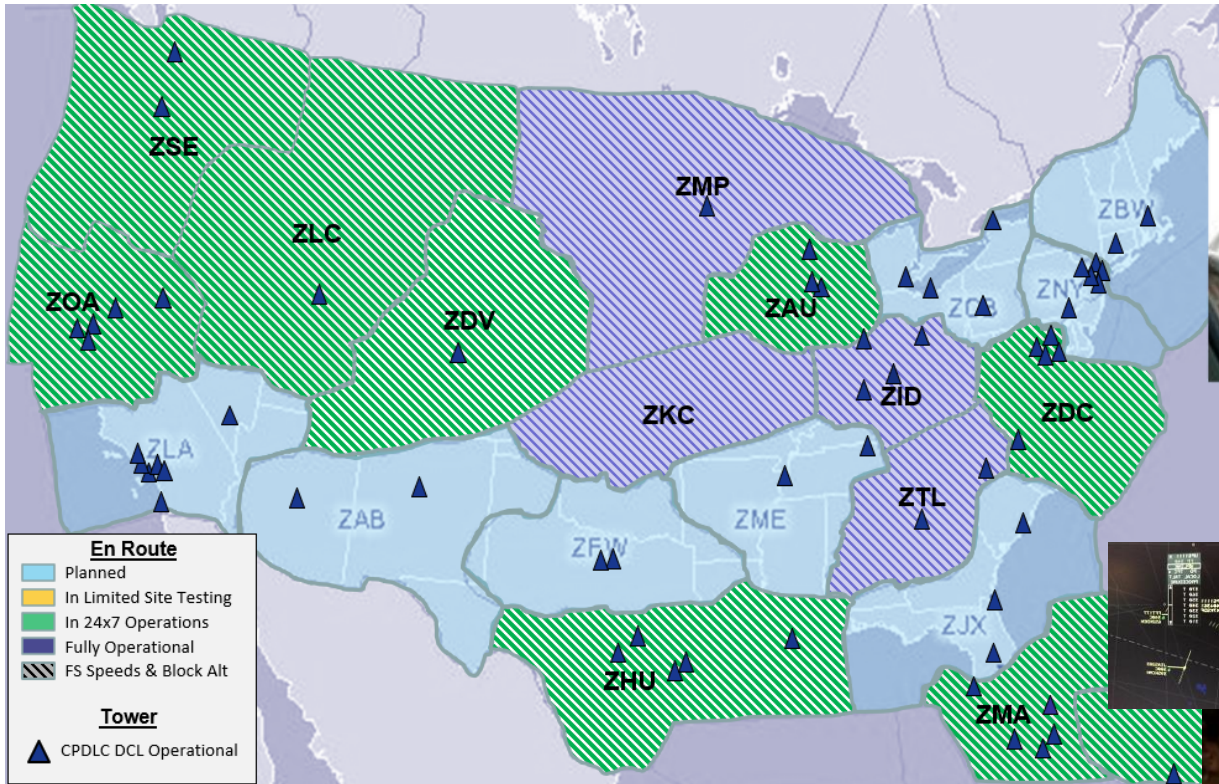
2,664,371 minutes of
comm time saved

Data Comm Accomplishments

- Data Comm services are operational at 65 airports and 12 En Route Centers
- Data Comm user participation continues to grow – tower and en route operations reaching new highs each month
- Localized air-to-ground interop issues are being fault isolated and analyzed for needed corrective actions in the avionics and air-to-ground networks
- En Route Full services increment 1 operational at all active centers



Data Comm Operational Status



Data Comm operational at 65 Towers

Data Comm operational 24x7 at 12 En Route Centers

Full Services Increment 1 (Speeds / Block Altitudes) enabled at all sites



Air-to-Ground Network



En Route









Tower



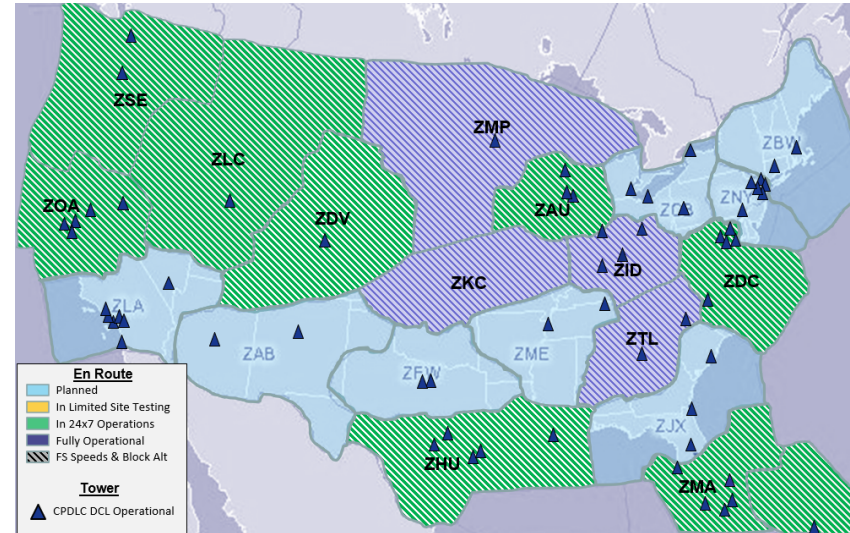
Data Comm Benefits

Since 2016, CPDLC DCL...

-  Served 20 US Air Carriers and 91 Non-US commercial and cargo operators
-  Cleared 16M+ flights
-  Saved 3.16M+ minutes of air space user time
-  Saved 4.32M+ minutes of radio time
-  Prevented 43.59M Kgs of CO₂ Emissions
-  Prevented 185,960+ readback errors

Since 2019, En Route Data Comm...

-  Served 32 operators
-  Cleared 4,646,275 flights
-  Saved 2.4M+ minutes of radio time
-  Prevented 646,617+ readback errors



2023 Data Comm NIWG/Avionics Ad Hoc Focus Items

1. Complete nationwide en route center Data Comm deployment – Initial and Full Services
 - Provide national waterfall plan for Initial and Full Services
2. Complete installation of Data Comm avionics updates for retrofit and newly delivered aircraft
3. Continue to track progress against NextGen Joint Implementation Plan (NJIP) milestones
 - NIWG members expressed concern about the “Enhanced Services” baseline slipping to end of 2029

Data Comm NAC Open Avionics Actions

1. **Airbus fix for A320 ATSU HX reject: Q4 2024**
 - ✓ CSB 7.5 (and CSB 7.4) technical issue fault isolated
 - CSB 7.6 to correct issue, planned Q4 2024
 - ✓ Alternatively, CSB 9 available today also corrects the issue
2. **Airbus A220 FMC and RIU Updates: Q4 2024**
 - FMC: IMA Build 8.0A3 expected Q2 2024
 - Radio Interface Unit (RIU) "Core 16" update: Q4 2024
3. **Boeing 767 ATN 523 "Core 16" Update: Q1 2024**
 - Newly delivered B767s with ATN starting in mid-2022 do not have "Core 16" equivalent avionics. Update expected Q1 2024
4. **Awaiting Boeing milestones for Nav Database revisions to mitigate en route STAR in free text for Pegasus II, B787, and B747 NG FMC**
 - B787 and B747 NG FMC will require an FMC update in addition to NDB changes
 - Boeing does not have firm milestones for completion

Data Comm – NJIP CY19-21 Open Milestones

Milestone	FAA /Industry	Milestone Date Q/CY	Status	Notes from July 28, 2022 NIWG Meeting
IOC for Initial En Route Services at all CONUS ARTCCs	FAA	4Q2019 4Q2021 4Q2022 4Q2023 1Q2024 2Q2025	Milestone impacted by COVID-19 and latent avionics and air-ground interop issues; deployment restarted in March 2022	Complete nationwide en route center Data Comm deployment – Initial and Full Services Provide national waterfall plan for Initial and Full Services
Baseline additional Data Comm capabilities for En Route utilizing the existing FANS message set	FAA Industry	3Q2021 3Q2024 3Q2026 4Q2029	Due to budget impacts from COVID-19, baselining of follow-on Data Comm capabilities delayed	Data Comm initial and full services provide the foundational CPDLC features. Planning for capabilities beyond en route initial and full services continue to slip to the right. In order to realize all potential benefits of Data Comm a continued evolution of capability is required to realize benefits of TBO.
Loadability Solution for Runway SID	FAA	3Q2019	Agreed on solution using future TFDM implementation in 2019. TFDM deployment milestones and Loadable SID solution release are TBD.	Current TDLS system limitations prevent ATC from sending loadable Runway/SID. Today's implementation requires manual Runway/SID entry – creating opportunity for errors. Loadable SIDs continues to be a high priority request from Data Comm users – improving efficiency and resolving human factors issues on flight deck with current implementation.

Data Comm NIWG Milestone Discussion

During our March 2023 meeting, Data Comm NIWG members expressed concern about the “Enhanced Services” baseline slipping to end of 2029.

With this new plan, there will a multi-year gap for additional Data Comm functionality which many operators included in their equipage business case.

Milestone	FAA /Industry	Milestone Date Q/CY	Status	Notes from July 28, 2022 NIWG Meeting
Baseline additional Data Comm capabilities for En Route utilizing the existing FANS message set	FAA Industry	3Q2021 3Q2024 3Q2026 4Q2029	Due to budget impacts from COVID-19, baselining of follow-on Data Comm capabilities delayed	Data Comm initial and full services provide the foundational CPDLC features. Planning for capabilities beyond en route initial and full services continue to slip to the right. In order to realize all potential benefits of Data Comm a continued evolution of capability is required to realize benefits of TBO.

10-Minute Break





Terminal Flight Data Manager Industry Readiness

Rob Goldman (Delta Air Lines) & Chris Oswald (ACI-NA)

Doug Swol (FAA)

To realize benefits of TFDM...what is needed of industry?

- **Engage Collaborative Site Implementation Team (CSIT)**
 - > Surface data management differs at key hub airports
 - > Procedures, policies, plans with local surface working group
 - > **FAA feedback:** Strong engagement from industry at all CSIT events
- **On ramp to TFDM/TFMS System Wide Information Management (SWIM) services**
 - > Provide key surface data elements to FAA via SWIM like Earliest Off Block Time and Departure Gates
 - **FAA feedback:** FAA receives data for five major carriers
 - > Use TFDM and SWIM testbeds
 - **FAA feedback:** FAA working with one carrier/partner to onramp
 - > Develop infrastructure/surface management tools to utilize TFDM data
 - COTS or local IT solutions

Does industry have IT investment plans to become TFDM ready?



FAA Industry Readiness Assessment

TFDM is coming to a Hub Near You!

Airport	IOC Date	Readiness Level
CLT	3/2024	Medium
PHX	12/2024	Very Low
LAS	2/2025	Very Low
SEA	3/2025	Low
LAX	4/2025	Low
SFO	5/2025	Low
IAH	6/2025	Low
MDW	7/2025	Very Low
MIA	10/2025	Low
BOS	3/2026	Very Low
ATL	4/2026	Low
SLC	7/2026	Low
SAN	8/2026	Very Low
DEN	9/2026	Low
DFW	10/2026	Low

Complete waterfall in Read-Ahead

Readiness Level Legend

High	Sufficient Surface Data, Accurate Surface Data, SWIM Onramping Complete Surface Tools Ready
Medium	Sufficient Surface Data > 80%, Accurate Surface Data, SWIM Onramping In Progress Surface Tools In Progress
Low	Limited Surface Data >60%, Inaccurate Surface Data, SWIM Onramping Not Started Surface Tools Not Ready / In Progress
Very Low	Insufficient Surface Data SWIM Onramping Not Started Surface Tools Not Ready

Assessments based on FAA SWIM data analysis, CSIT discussions and surveys



Industry Supports TFDM Capabilities

- **TFDM is an integral part of a suite of tools that optimizes traffic flow management (TFM) and enables trajectory based operations (TBO)**
 - > TFDM reconciles data from other systems such as Traffic Flow Management System (TFMS) and Time based flow management (TBFM) and establishes release times that aid in surface management
 - > Data exchange with TFDM enables continuity between the airport environment and en route airspace
 - > Reduced taxi time equates to reduced fuel consumption and CO2 emissions
 - > Reduced surface complexity increases situational awareness and safety

Airport Operators will Also Benefit, But Clarity on Supporting Investments and Investment Timing is Needed

- **TFDM will Benefit Airport Operators**
 - > Improved utilization of airfield and terminal infrastructure
 - > Improved operational efficiency
 - > Increased collaboration with ATO and flight operators
 - > Reduced carbon emissions and possibly taxi-out noise exposure
 - > Enhanced situational awareness and airside safety
- **Clarity Needed Regarding Airport Investments Needed to Obtain Benefits**
 - > Collection of key operational data for non-CDM carriers (earliest off block times, gate assignments, airside constraints)
 - > Surface management capabilities that can interact through FAA's Systemwide Information Management System (SWIM) to feed TFDM in real time
 - > Particularly critical for Configuration A sites, where departure metering will occur

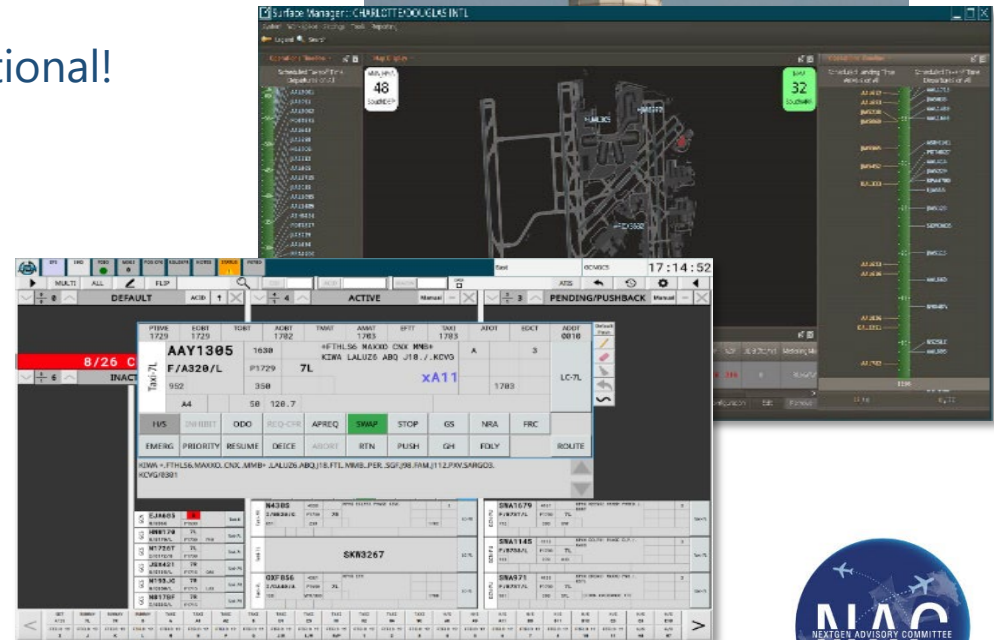


Surface & Data Sharing

Read-Ahead Only Slides

Overview: Terminal Flight Data Manager

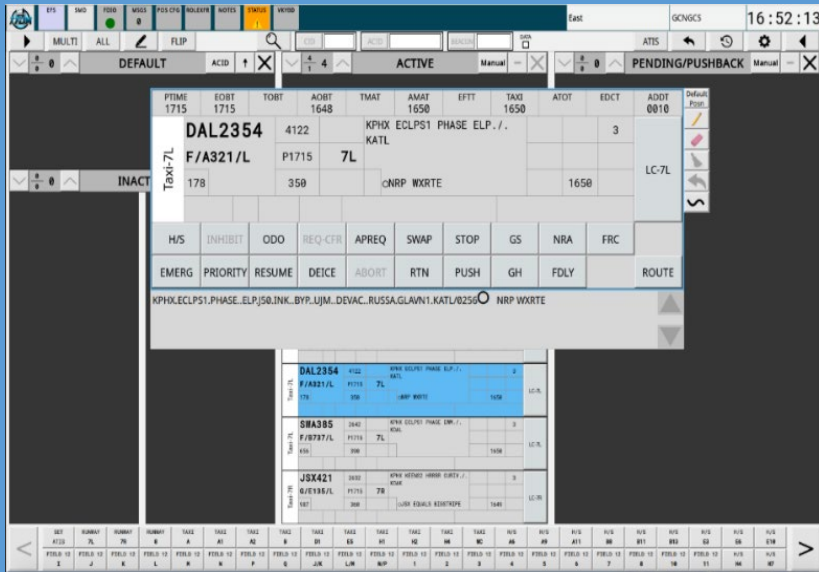
- A ~\$1 Billion investment by the FAA to modernize air traffic control towers enhancing surface efficiency and situational awareness
- Utilizes surface metering to create a virtual queue at the runway instead of first-come, first served physical queue
- Deploying now.....**4 Sites** already operational!
- Will deploy to 49 sites (all major hubs)
- Benefits:
 - > Reduced fuel burn/emissions
 - > Improved schedule predictability
 - > Improved situational awareness
 - > Reductions in delay



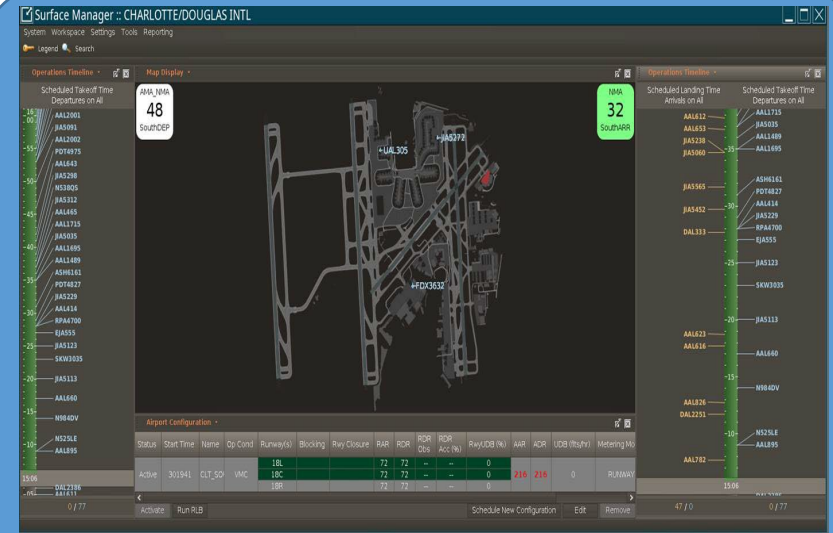
TFDM Displays in ATCT



Key TFDM Capabilities



Electronic Flight Data and Electronic Flight Strips



Surface Management and Metering Decision Support Tools for ATC (Config A sites starting in 2024)

Traffic Management Initiative (TMI) Integration

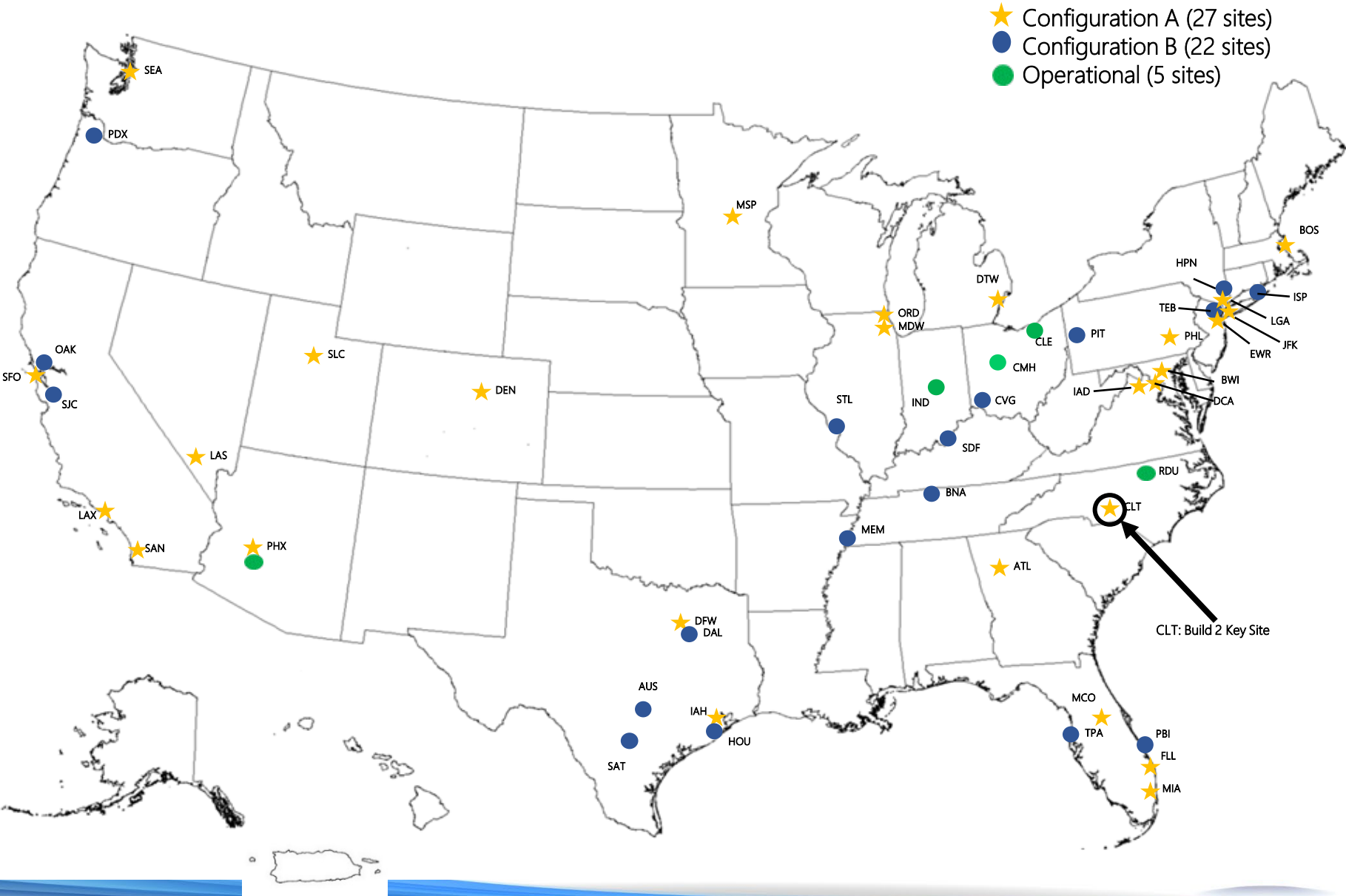


Airport Configuration Management

Data Sharing with Flight and Airport Operators



Where is TFDM Deploying?



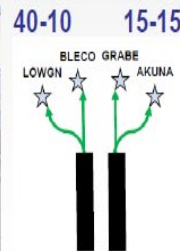
Benefits: Managing Surface Demand More Efficiently

Industry will be able to receive real-time updates, including:

- Surface schedule
- Events impacting the airport
- Traffic Flow Management Restriction information

Before

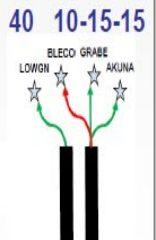
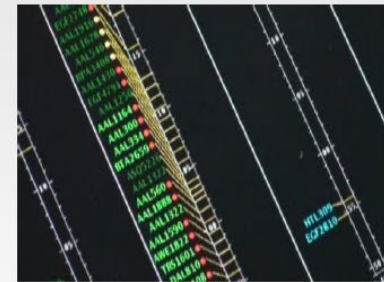
*From **unpredicted demand**, long queues, and excessive fuel burn...*



*...and **unbalanced runways***

After

*To **predicted demand** with the TFDM scheduler, reduced queue lengths, taxi times, and fuel burn...*



*...known demand driving **balanced runways***

Benefit: Improving Traffic Flow Management

Minimizing taxi delay, maximizing operator benefits:

- Reduces fuel usage: **313 million gallons** over the life of the program
- Reduces emissions: **Three million metric tons** over the life of the program
- Reductions in TMI delays from Call-For-Release or Control Times

Before

From the **flying public** waiting on the plane on the taxiway...



...and **operators** burning excess fuel, creating unneeded noise and CO2 emissions

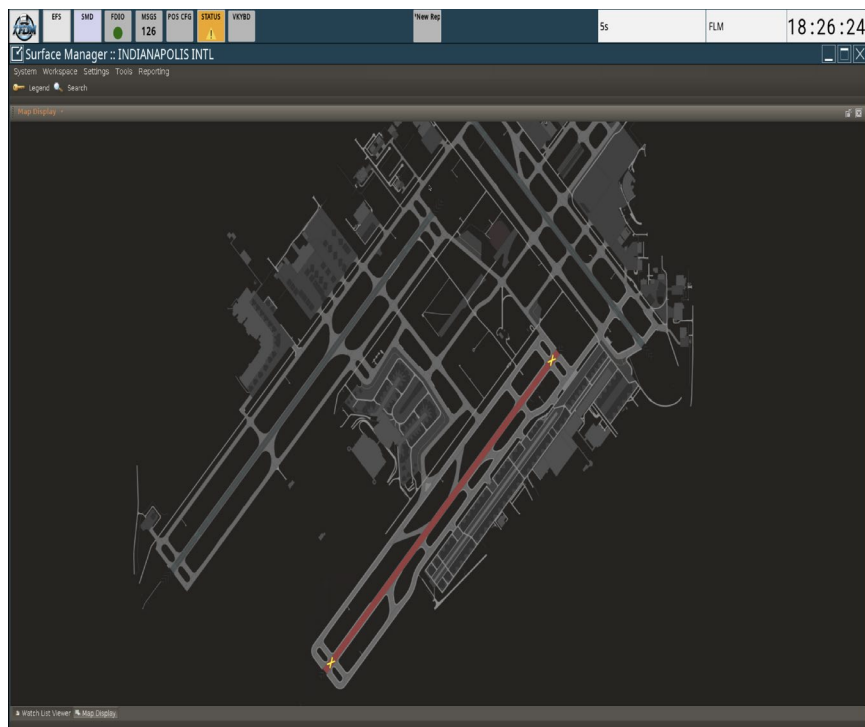
After

To the **flying public** waiting comfortably in the airport...



...and **operators** absorbing delay in the gate area, reducing taxi time and fuel costs, and improving airline and customer satisfaction with increased predictability

Benefit: Improved ATC Situational Awareness*



5 1 5		LCE Departure 23L		Manual	-	X				
LC-23R	FDX3212	IIU	KIND DANN1 IIU J89 ATL	1041	SpotE					
	K/B752/L	P1841	23R	YUESS OTK PIGLT6 KMCO						
	030	300	KMCO		1820	LUAW-23R				
	FX4									
LC-23R	FDX2711	OKK		1040	SpotE					
	H/B763/L	P1840	23R							
	021	230	KDTW		1820	LUAW-23R				
	FX42									
LC-23L	SKW5245	MEARZ	KIND MEARZ6 MEARZ BRATH	1034	SpotE					
	M/E75L/L	P1834	23L	BONNT VEECK5 KORD						
	028	200	KORD		1820	LUAW-23L				
	A23									
LC-23L	AAY9204	BVT	KIND MEARZ6 BVT KATW	1034	SpotE					
	K/A320/L	P1834	23L							
	033	200	KATL		1820	LUAW-23L				
	B4									
LC-23L	SWA277	BDOCK	KIND MARE05 BDOCK APE	1840	SpotE					
	K/B737/L	P1832	23L	NUSMM ANTHM3 KBWI						
	032	090	KBWI		1820	LUAW-23L				
	B22									
	H/S	INHIBIT	ODO	REQ-CFR	APREQ	SWAP	STOP	GS	NRA	FRC
	EMERG	PRIORITY	RESUME	DEICE	ABORT	RTN	PUSH	GH	FDLY	
5R/23L CLOSED										

Next Logical Action (NLA) is inhibited for closed Runway

TFDM Runway Closure automatically generated when closure activated

Runway Block background of closed Runway is highlighted red

*TFDM is not certified for use in separating aircraft



ATD-2 Prototype Proves the Benefits of TFDM

- Benefits through 2022-09-30 at Charlotte-Douglas International Airport:

- 9,022,044 lbs. of fuel saved
- CO₂ savings equivalent to 206,629* urban trees
- 1,298.2 hours of surface delay saved
 - \$6,231,521 passenger value of time
 - \$1,912,218** flight crew costs
- 7,042 hours of reduced runtime on engines

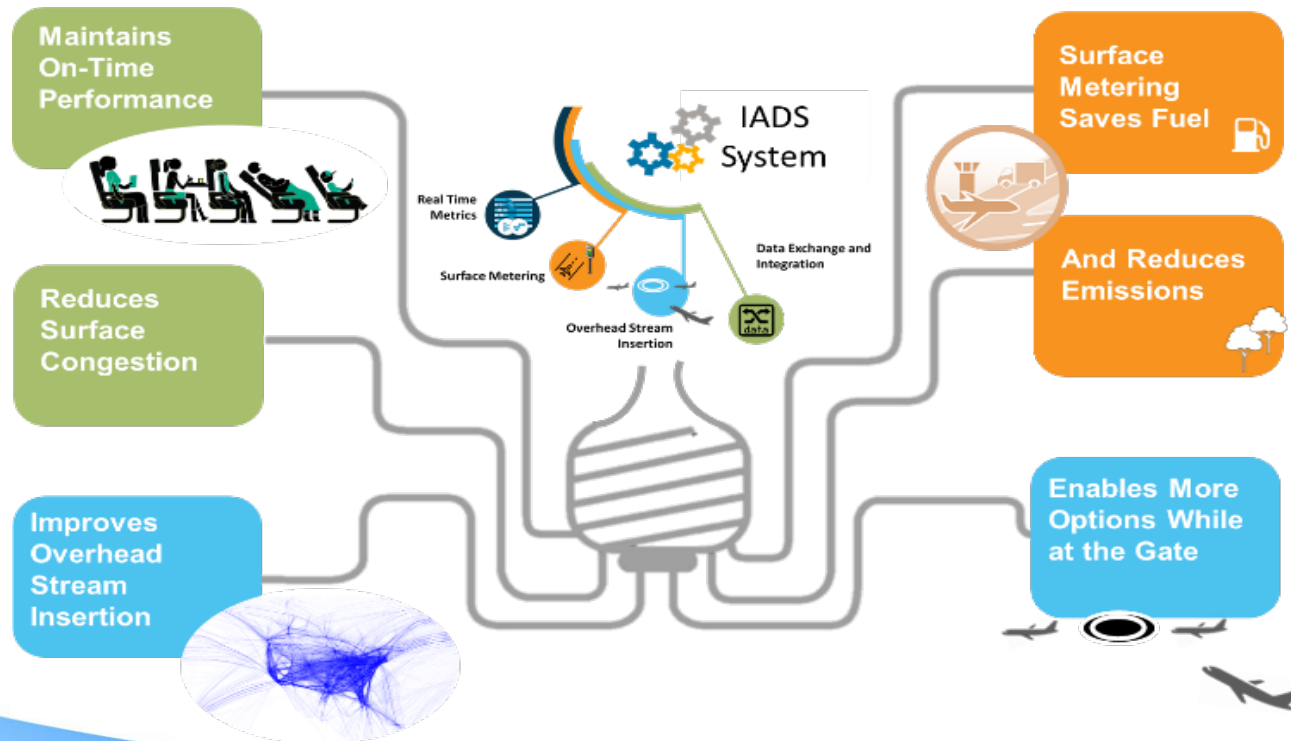
* Based on the updated equivalency factor (0.061 metric tons CO₂ per urban tree planted)

** Based on the updated flight crew cost in 2019 (\$24.55 per block minute)

ATD²
Integrated Arrival/Departure/Surface



Source: NASA



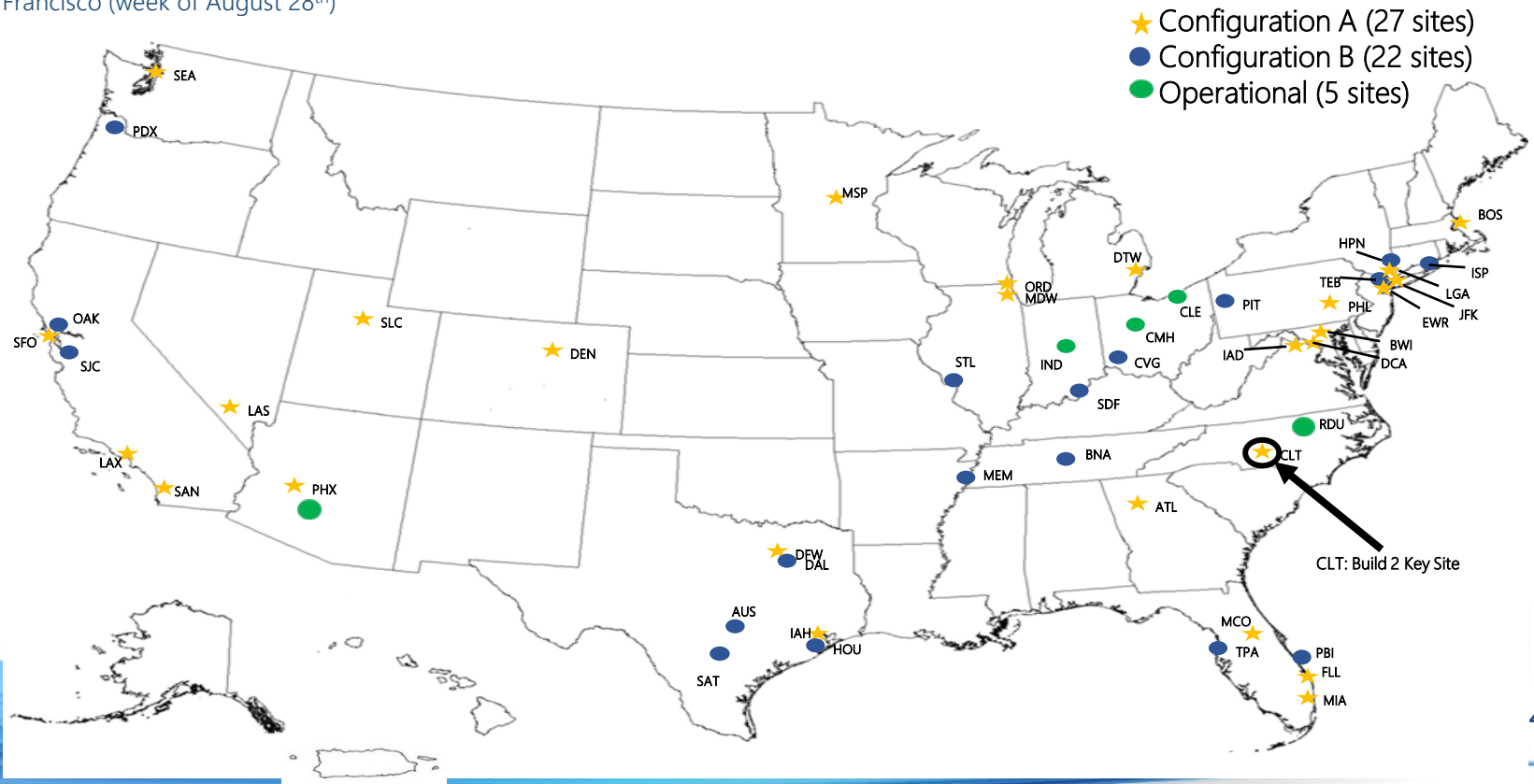
Surface & Data Sharing – NAC Update

Key TFDM Achievements

- Achieved IOC at Raleigh-Durham on July 24th
- Achieved IOC at Columbus (OH) on Sept 11th
- New TFDM Waterfall
- Conducted Collaborative Site Implementation Meetings with stakeholders at:
 - > Las Vegas (week of June 12th)
 - > Los Angeles (week of July 24th)
 - > San Francisco (week of August 28th)

Near Term Activities

- 6th IOC at Las Vegas (LAS) planned for Oct 24, 2023
- Build 2 Testing in preparation for CLT IOC (2024)



Surface NAC Milestone Status

PRE-IMPLEMENTATION COMMITMENTS	New Date
TFDM program will complete the operational testing for Build 1	Complete (9/26/2022)
NASA ATD-2 interim technology transfer from Phase 2: Fused IADS at CLT	Complete
NASA ATD-2 final technology transfer from Phase 3: Terminal departure IADS at DFW/DAL	Complete
Industry Alignment with TFDM Waterfall	Complete (12/16/2022)

IMPLEMENTATION COMMITMENTS	New Date
TFDM program will achieve key site IOC for Build 1 at CLE	Complete (10/24/2022)
TFDM program will achieve the in-service decision (ISD) for Build 1 to allow additional TFDM system deployments into the NAS	Complete (3/1/2023)
✓ TFDM program will achieve IOC at 3 additional sites	Q4 CY2023 Complete (7/24/2023)
TFDM program will achieve the key site IOC for Build 2 at CLT	Q2 CY2024 On Track
TFDM program will achieve ISD for Build 2 to allow additional deployments of the full TFDM capabilities into the NAS	Q4 CY2024 On Track
TFDM program will achieve IOC at 5 additional sites	Q4 CY2025 At Risk – Budget

TFDM Waterfall (2022-2024)

ATCT - Configuration - Functionality Deployed	ATCT	TRACON	SERV AREA	IOC
ATCT 5 (CLE) Key Site - Config B - Build 1	CLE	CLE	NC	10/24/2022
2023				
Build 1.5 ISD				
ATCT 4 (IND) - Config B - Build 1	IND	IND	NC	4/24/2023
ATCT 1 (PHX) - Config A - Build 1	PHX	P50	SW	6/5/2023
ATCT 3 (RDU) - Config B - Build 1	RDU	RDU	SE	7/24/2023
ATCT 20 (CMH) - Config B - Build 1	CMH	CMH	NC	9/11/2023
ATCT 26 (LAS) - Config A - Build 1	LAS	L30	SW	10/23/2023
2024				
ATCT 19 (SJC) - Config B - Build 1	SJC	NCT	NW	2/27/2024
ATCT 8 (CLT) - Build 2 Key Site - Config A - Build 2 SW (incl Build 1 functions)	CLT	CLT	SE	3/25/2024
ATCT 6 (LAX) - Config A - Build 1	LAX	SCT	SW	4/30/2024
ATCT 30 (TPA) - Config B - Build 1	TPA	TPA	SE	7/23/2024
Build 2.2 ISD				
<i>ATCT 5 (CLE) Key Site - Config B - Full TFDM SW, Adapt Build 2 func.</i>	<i>CLE</i>	<i>CLE</i>	<i>NC</i>	<i>10/22/2024</i>
<i>ATCT 4 (IND) - Config B - Full TFDM SW, Adapt Build 2 func.</i>	<i>IND</i>	<i>IND</i>	<i>NC</i>	<i>11/18/2024</i>
<i>ATCT 1 (PHX) - Config A - Full TFDM SW, Adapt Build 2 func.</i>	<i>PHX</i>	<i>P50</i>	<i>SW</i>	<i>12/9/2024</i>

Completed Site
<i>Site Step Up from B1 to B2</i>

TFDM Waterfall (2025-2026)

ATCT - Configuration - Functionality Deployed	ATCT	TRACON	SERV AREA	IOC
2025				
ATCT 26 (LAS) - Config A - Full TFDM SW, Adapt Build 2 func.	LAS	L30	SW	2/17/2025
ATCT 29 (SEA) - Config A - Full TFDM SW	SEA	S46	NW	3/18/2025
ATCT 6 (LAX) - Config A - Full TFDM SW, Adapt Build 2 func.	LAX	SCT	SW	4/12/2025
ATCT 15 (SFO) - Config A - Full TFDM SW	SFO	NCT	NW	4/29/2025
ATCT 3 (RDU) - Config B - Full TFDM SW, Adapt Build 2 func.	RDU	RDU	SE	5/12/2025
ATCT 16 (IAH) - Config A - Full TFDM SW	IAH	I90	SC	6/3/2025
ATCT 20 (CMH) - Config B - Full TFDM SW, Adapt Build 2 func.	CMH	CMH	NC	6/23/2025
ATCT 34 (MDW) - Config A - Full TFDM SW	MDW	C90	NC	7/15/2025
ATCT 19 (SJC) - Config B - Full TFDM SW, Adapt Build 2 func.	SJC	NCT	NW	8/4/2025
ATCT 28 (OAK) - Config B - Full TFDM SW	OAK	NCT	NW	8/26/2025
ATCT 30 (TPA) - Config B - Full TFDM SW, Adapt Build 2 func.	TPA	TPA	SE	9/15/2025
ATCT 35 (MIA) - Config A - Full TFDM SW	MIA	MIA	SE	10/28/2025
2026				
ATCT 38 (BOS) - Config A - Full TFDM SW	BOS	A90	NE	3/3/2026
ATCT XX (AUS) - Config B - Full TFDM SW	AUS	AUS	SC	3/31/2026
ATCT 17 (ATL) - Config A - Full TFDM SW	ATL	A80	SE	4/28/2026
ATCT 21 (HOU) - Config B - Full TFDM SW	HOU	I90	SC	6/2/2026
ATCT 42 (SLC) - Config A - Full TFDM SW	SLC	S56	NW	7/7/2026
ATCT 31 (SAN) - Config A - Full TFDM SW	SAN	SCT	SW	8/4/2026
ATCT 40 (CVG) - Config B - Full TFDM SW	CVG	CVG	SE	9/1/2026
ATCT 33 (DEN) - Config A - Full TFDM SW	DEN	D01	NW	9/29/2026
ATCT 37 (DFW - 3 ATCTs) - Config A - Full TFDM SW	DFW	D10	SC	10/27/2026

Completed Site
Site Step Up from B1 to B2



TFDM Waterfall (2027-2028)

ATCT - Configuration - Functionality Deployed	ATCT	TRACON	SERV AREA	IOC
2027				
ATCT 47 (DAL) - Config B - Full TFDM SW	DAL	D10	SC	3/2/2027
ATCT 39 (MSP) - Config A - Full TFDM SW	MSP	M98	NC	3/30/2027
ATCT 49 (SDF) - Config B - Full TFDM SW	SDF	SDF	SE	4/27/2027
ATCT 27 (ORD - 3 ATCTs) - Config A - Full TFDM SW	ORD	C90	NC	6/8/2027
ATCT 48 (BNA) - Config B - Full TFDM SW	BNA	BNA	SE	7/6/2027
ATCT 41 (IAD) - Config A - Full TFDM SW	IAD	PCT	NE	8/3/2027
ATCT 54 (MEM) - Config B - Full TFDM SW	MEM	M03	SE	8/31/2027
ATCT 43 (FLL) - Config A - Full TFDM SW	FLL	MIA	SE	9/28/2027
ATCT 32 (MCO) - Config A - Full TFDM SW	MCO	F11	SE	10/26/2027
2028				
ATCT 56 (SAT) - Config B - Full TFDM SW	SAT	SAT	SC	2/29/2028
ATCT 45 (DTW) - Config A - Full TFDM SW	DTW	D21	NC	3/28/2028
ATCT 24 (ISP) - Config B+ - Full TFDM SW (+ TFDM/DSP Interface)	ISP	N90	NE	4/25/2028
ATCT 46 (BWI) - Config A - Full TFDM SW	BWI	PCT	NE	5/23/2028
ATCT 62 (PBI) - Config B - Full TFDM SW	PBI	PBI	SE	6/20/2028
ATCT 50 (DCA) - Config A - Full TFDM SW	DCA	PCT	NE	7/18/2028
ATCT 65 (PDX) - Config B - Full TFDM SW	PDX	P80	NW	8/22/2028
ATCT 7 (PHL) - Config A - Full TFDM SW (+ TFDM/DSP Interface)	PHL	PHL	NE	9/26/2028
ATCT 11 (EWR) - Config A - Full TFDM SW (+ TFDM/DSP Interface)	EWR	N90	NE	10/24/2028

TFDM Waterfall (2029)

ATCT - Configuration - Functionality Deployed	ATCT	TRACON	SERV AREA	IOC
2029				
ATCT 13 (LGA) - Config A - Full TFDM SW (+ TFDM/DSP Interface)	LGA	N90	NE	2/27/2029
ATCT 18 (TEB) - Config B+ - Full TFDM SW (+ TFDM/DSP Interface)	TEB	N90	NE	3/27/2029
ATCT 12 (JFK) - Config A - Full TFDM SW (+ TFDM/DSP Interface)	JFK	N90	NE	4/24/2029
ATCT 23 (HPN) - Config B+ - Full TFDM SW (+ TFDM/DSP Interface)	HPN	N90	NE	5/22/2029
ATCT 66 (PIT) - Config B - Full TFDM SW	PIT	PIT	NE	6/19/2029
ATCT 67 (STL) - Config B - Full TFDM SW	STL	T75	SC	7/17/2029





NAC Task 20-1 Recommendation Update: ADS-B In Operational Trial

David Surridge (American Airlines)

AIRS Trial Update

ADS B In Retrofit Solution

NAC Tasking 20-1

- Asked for industry interest in ADS B In applications
 - Industry overwhelming expressed interest in ADS B In technology
 - Industry willingness to invest is dependent on FAA infrastructure investments
 - Tasking included a periodic briefing on data gathered from trial

CDTI

Cockpit Display of Traffic Information

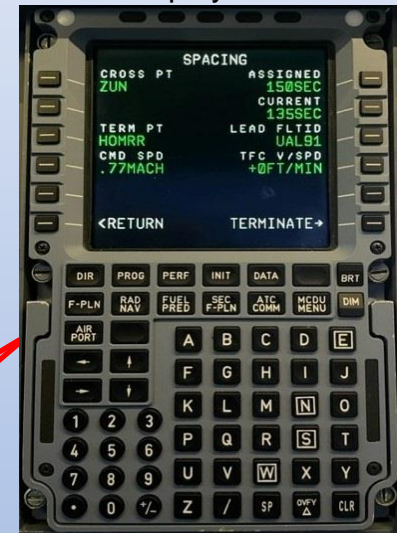
Navigation Display



ADS-B In Guidance



Multi-Purpose Control Display Unit



Current State

- Air travel continues to grow along with population
 - Air travel provides needed services
 - Safest and most efficient form of transportation
- Constraints to airspace continue to grow
 - Delay is a constant problem affecting traveling public satisfaction
 - Limit to future NAS expansion
 - Causes inefficiencies and increase in CO2 emissions
- Airports
 - New runways are hard to impossible to add
- TBO could help but might hurt
 - Will need specific accurate spacing tools to work
 - ADS B investments allow for markedly improve spacing

Purpose of the Trial

- Leverage existing investments in ADS B Out mandate
- ADS B In
 - Allows for internal algorithms to use exact environmental information to produce high fidelity spacing
 - Inter Aircraft Timing is unmatched by other spacing tools
- Evaluate 25 years of research and funding for ADS B In applications
 - Interval Management (IM)
 - CDTI Assisted Approaches (CAS)
 - In Trail Procedures (ITP)
 - And other Applications
- Collect data and then more data

Data Collection



Multiple Sources

Swim data to include

- PDARS
- ADSB

Internal Data Sources gathered through the TCAS LRU

- 100 parameters examined to verify system functionality and pilot inputs

American internal data

Feedback Forms and APA follow up conversations



Data is carefully analyzed to get the most accurate picture

Monthly meeting to analyze data with ZAB/ D-10, AA, ACSS, and FAA

Honest conversations of the operation and what works and what doesn't

CDTI Assisted Visual Separation CAVS

- Started using CAVS immediately upon equipping aircraft
- Crews reported back that the increase in situational awareness resulted in avoiding go-arounds
- Data supports more efficient spacing on final due to increased flight information from following traffic

IAT for A321s into DFW Jan 2022-Feb 2023

Metric

- Inter-arrival Time (Time between ownship threshold time and previous arrival threshold time on same runway), IAT

Analysis Details

- Limited analysis to A321 and A21Ns into DFW January 2022 – February 2023 (14 months)
- Removed arrivals with IATs > 220 sec or < 40 sec, arrivals behind a heavy, arrivals during IMC (<1000 feet ceiling OR <3 miles visibility)
- Examined distribution of IAT comparing non-AAL A321s, AAL A321s (those Designating Traffic and those not)
- Also examined impact on IAT using regression on A321s

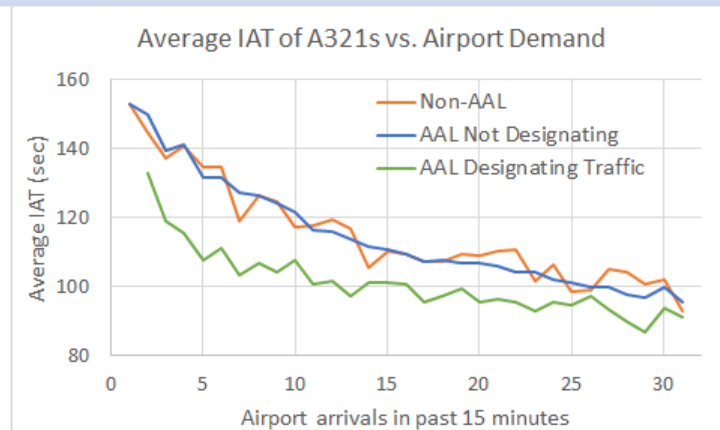
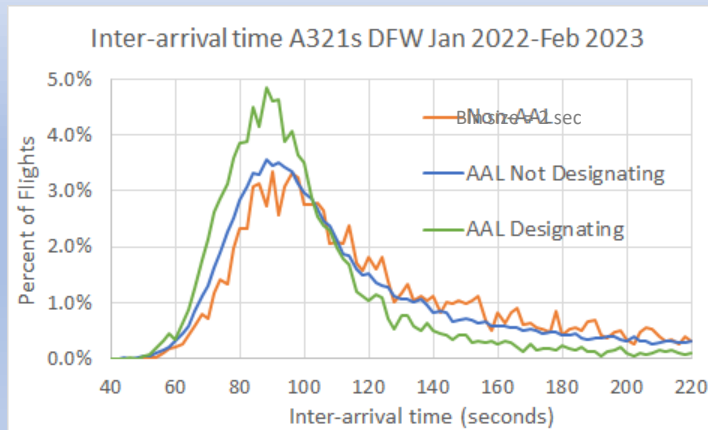
Results

- Average IAT smaller by 13-20 seconds for aircraft Designating Traffic

Regression Results

A321 and A21N	Non-AAL	AAL (not Designating)	AAL Designating Traffic
Mean IAT (sec)	118	111	98
Median IAT	107	101	92
Stdev IAT	37	36	27
Observations	4,159	46,707	5,287

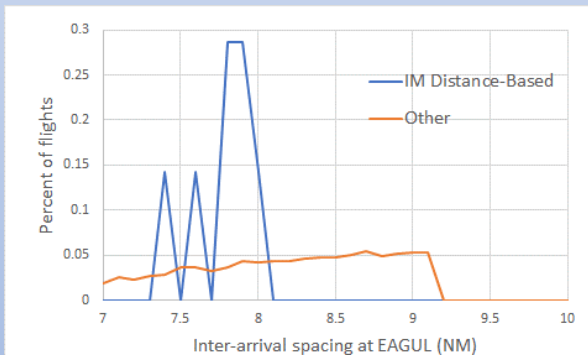
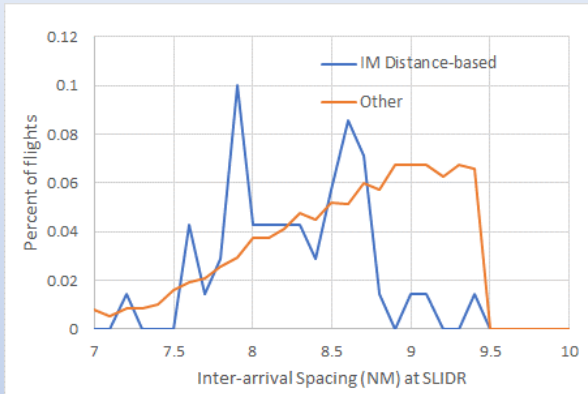
Predictors of IAT	Coefficient (seconds)	P-Value
Baseline IAT (constant)	135	<< 0.05
Arrivals in past 15 min airport	-1.4	<< 0.05
Behind a Heavy	44.0	<< 0.05
AAL	-1.6	0.003
AAL Designating Traffic	-11.1	<< 0.05



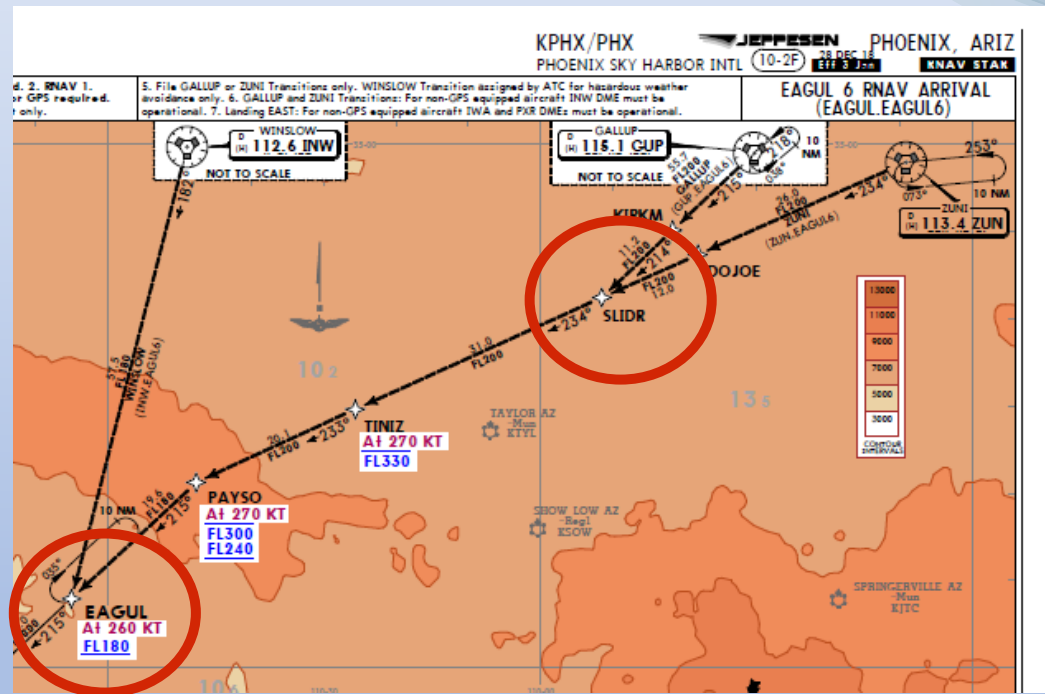
Interval Management ZAB IM

- Trial began November 2022
 - Started off well with enthusiasm from the work force
 - Start up issues occurred
 - Aircraft database was incomplete
 - Learning curve on how to use the technology
 - Algorithm understanding for controller and pilot alike
 - Human/machine improvements needed
 - Data shows IM can provide spacing enhancements
 - Operation provides predictable, repeatable performance
 - Controllers embrace the technology with ERAM automation
 - Pilots see the benefits of added situational awareness

IM DATA

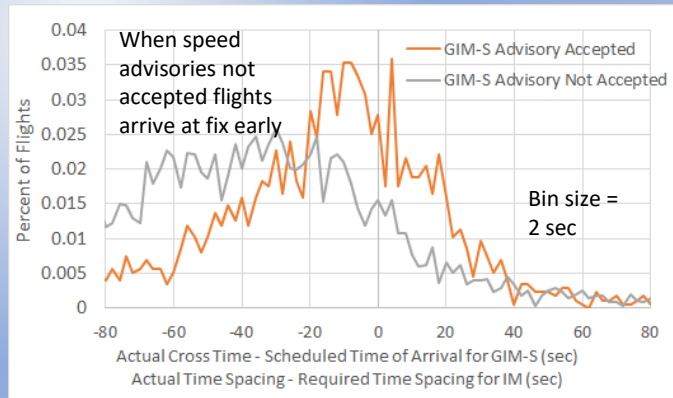
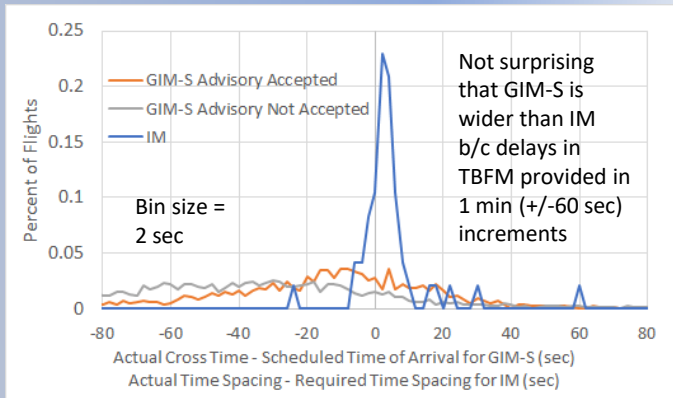


- AT SLIDR Cross and Maintain 8 NM behind.....
- AT EAGUL Cross and Maintain 8 NM behind.....



I-IM: Delivery Accuracy I-IM at ABP vs. GIM-S at XMP

- Examined Actual Time Spacing – Required Time Spacing at Achieve By Point (ABP) for flights using IM avionics and indication of controller interaction
 - See previous page
- Examined Actual Cross Time – Scheduled Cross Time at Extended Meter Point (XMP) for flights that accepted speed advisories and had non-zero TBFM delay
 - PHX arrivals that accepted speed advisories for ZABX1, ZDVPHXX, ALIBYX1
 - Jan 2022 - June 2023 data from online TBFM Tableau data set



Operation	Observations	Actual Time Spacing – Required Time Spacing (sec)		Actual Cross Time – Scheduled Time of Arrival (ATA-STA)	
		Average	StdDev	Average	StdDev
IM (Time-based)	61	4	11		
GIM-S	7017			-10	41

CDTI Assisted Separation CAS

- DFW Trial Begins March 2023
- Controllers start with issuing CAS clearances during hazy conditions
 - Pilots can no longer see the airport
 - Use of CDTI allows controllers to have pilots follow designated aircraft
 - Useful for both parallel Finals
- Pilot reactions are mixed at first but change over time
 - Startle factor plays a role early on
 - Section six negotiations didn't help
 - Training by bulletin not popular with pilots
 - Over 80% of pilots accepted the clearance
 - Today near 100%
 - Both pilots and controllers see benefit

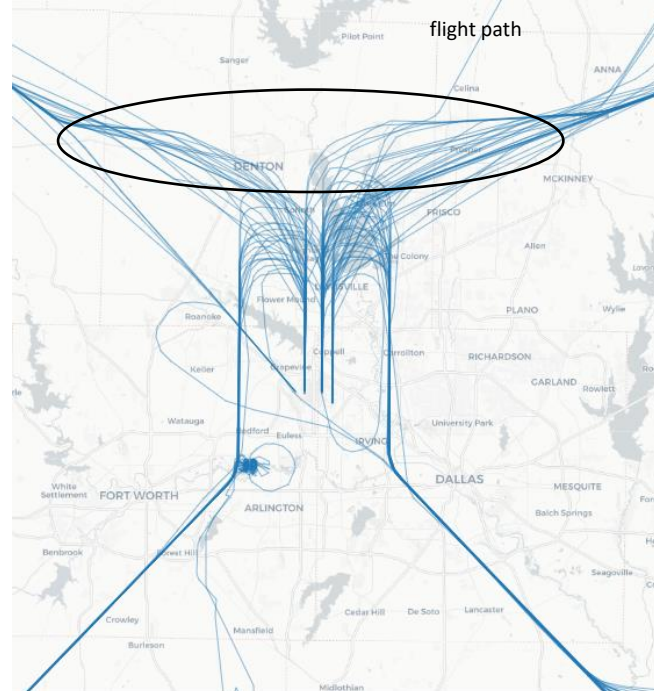
CAS-A Flight Distance and Time (Mar-Jun 2023)

- **Motivation**

- Reducing IAT and Threshold Spacing for CAS-A/CAVS aircraft is encouraging, but is there an impact on the overall system in terms of reduced flight time or flight distance?
- Controllers have reported using CAS-A to reduce during certain conditions

- **Analysis Details**

- DFW arrival trajectories from Threaded Track Mar–Jun 2023
- CAS-A determination from CountOps, Weather from ASPM
- Regression analysis with data per arrival
- Dependent Variables:
 - Flight Time 25NM to runway
 - Flight Distance 25NM to runway
 - Downwind (0= No, 1=Yes)
 - Number of arrivals at airport in past 15 minutes
 - Number of heavy arrivals at airport in past 15 minutes
 - Number of CAS-A arrivals in airport in past 15 minutes
 - IMC (ceiling <1000 feet and visibility <3 miles)
 - MMC1 (ceiling <3500 feet and visibility <5 miles)
 - MMC2 (ceiling <6000 feet and visibility <=8 miles)
 - CAS-A arrivals and IMC
 - CAS-A arrivals and MMC1
 - CAS-A arrivals and MMC2

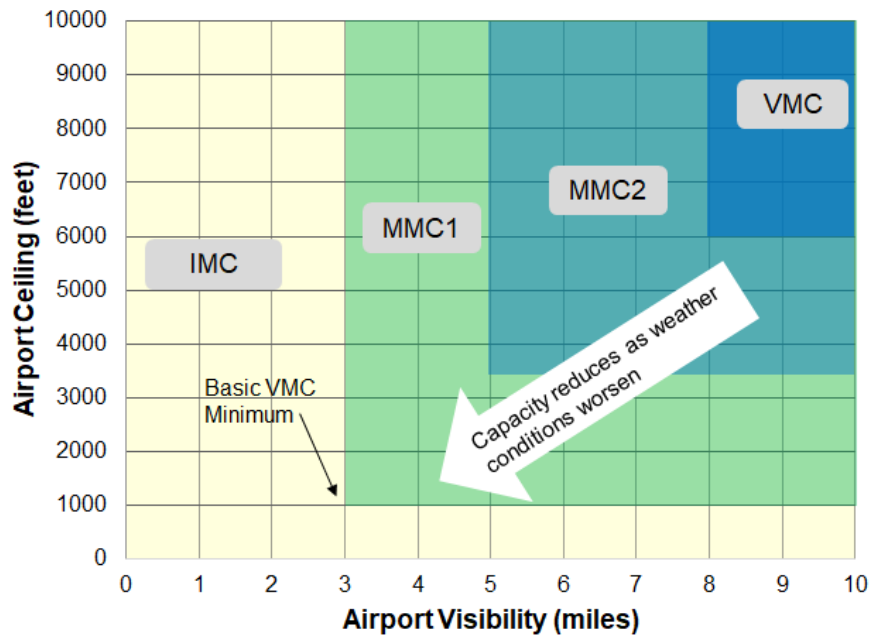


CAS-A Flight Distance and Time Weather (Mar-Jun 2023)

- **Weather conditions chosen for analysis**

- IMC uses basic minimums (<1000 ft ceiling or < 3 miles visibility)
- MMC1 based on a Visual Approach Threshold value listed in ASPM for DFW (<3500 ft ceiling or < 5 miles visibility)
- MMC2 based on information gathered from facility by J Sparrow (<6000 ft ceiling or <= 8 miles visibility)

Weather Condition	Arrivals	% of Arrivals
IMC	3,415	3%
MMC1	13,209	12%
MMC2	11,044	10%
VMC	85,627	75%
Total	113,295	



CAS-A Flight Distance and Time Benefit (Mar-Jun 2023)

- **CAS-A Arrivals March-June 2023**

- 871 CAS-A arrivals listed in CountOps data
- 113,295 total arrivals in same period
- Less than 1% of total (0.77%)

Preliminary analysis using 4 months of data; full analysis will use 1 year of test data

Benefit per CAS-A arrival in 15 min ahead:	MMC2	All other Wx
Distance (NM)	0.6	0.2
Time (seconds)	14	5

- **Measured and Hypothetical Benefit**

March through June 2023	CAS-A Arrivals in past 15 min								Total
	0	1	2	3	4	5	6	7	
Arrivals in MMC2	10,261	549	179	55					
Arrivals in other Weather	93,777	5,598	1,983	650	181	46	12	4	
Benefit in NM	0	1,454	1,012	491	145	46	14	6	3168
Benefit in minutes	0.0	595	414	201	60	19	6	2	1298

- Taking the benefit in minutes (1,298 minutes) and multiplying by an assumed airline cost of \$60/min results in a savings of \$78,000 from Mar-Jun 2023 with only 0.77% of operations receiving CAS-A
- If 25% of arrivals received a CAS-A clearance the result would be closer to 42,000 minutes and \$2,500,000 airline costs

- **Other possible CAS-A benefits**

- There are other CAS-A benefits besides direct reduction of flight time/distance in TRACON
- If equipage was higher and IAT could be shown to be smaller and more consistent, then the overall airport arrival rate/acceptance rate could eventually be increased
- Tactical metering (TBFM) and strategic metering (TFMS/GDPs) could consider equipage in arrival rate calculations
- Airlines could consider reduction in flight time to examine aircraft utilization

Advantages of IM, CAS, and CAVS

- Nothing compares to these types of operations
 - The addition of traffic information allows the controller to have confidence that the flight crew can achieve accurate spacing
 - First time the pilot can “see” the traffic around them in all environmental conditions
 - Already has proven benefit

What have we Learned

- Cockpit Display of Traffic Information (CDTI) results in better decisions from the pilots
 - Improves safety
 - Better situational awareness
 - Reduces Go-arounds
 - Improves airspace efficiencies
 - Average reduction in Final spacing
 - More consistent spacing enroute
 - Allows for better pilot/controller coordination
 - Pilot and controller communicating exactly what the controller needs
 - Pilot has more of the big picture and becomes a partner in the controllers needs

Looking Forward

- FAA along with industry developing strategies to achieve airspace efficiencies that allow for expanded use of current airspace and infrastructure
- What role does ADS B In provide to build this plan?
- How do we get there?



FAA Topics

FAA



Section 547 Update

Juan Narvid (FAA) & Kathy Torrence (FAA)

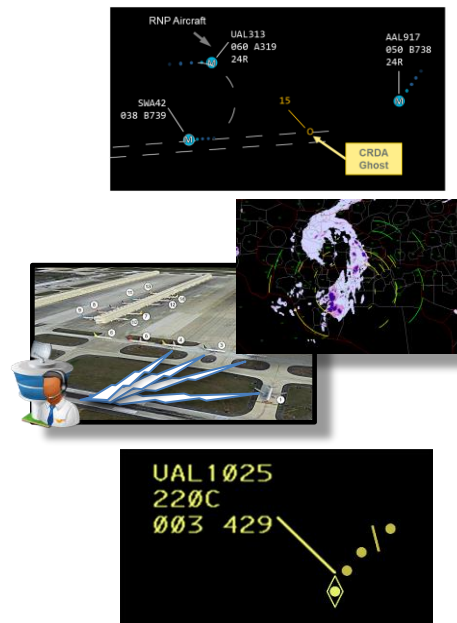
Section 547 Pilot Program: Preliminary Analysis Results Oct 2023



Overview of Selected Section 547 Initiatives

Process: Industry provided FAA a ‘short list’ of candidate recommendations based on Readiness, Return, & Relevance

Initiative
<p>Simultaneous Independent Established on RNP (EoR) at Los Angeles International Airport (LAX) <i>(start date: September 12, 2021)</i></p>
<p>CPDLC Departure Clearance (DCL) capabilities at Orlando International Airport (MCO) <i>(Focused metric tracking September 1, 2021)</i></p>
<p>Automatic Dependent Surveillance-Broadcast (ADS-B) Out enabling 3 nautical mile (NM) in en route airspace (below FL230) for Oakland Air Route Traffic Control Center (ZOA) <i>(start date: September 9, 2021)</i></p>



PBN RNP Equipage= Reduced Flight Distance and Flight Time

Data Communication Equipage= Earlier Departure During Rerouting Events, and overall system efficiency

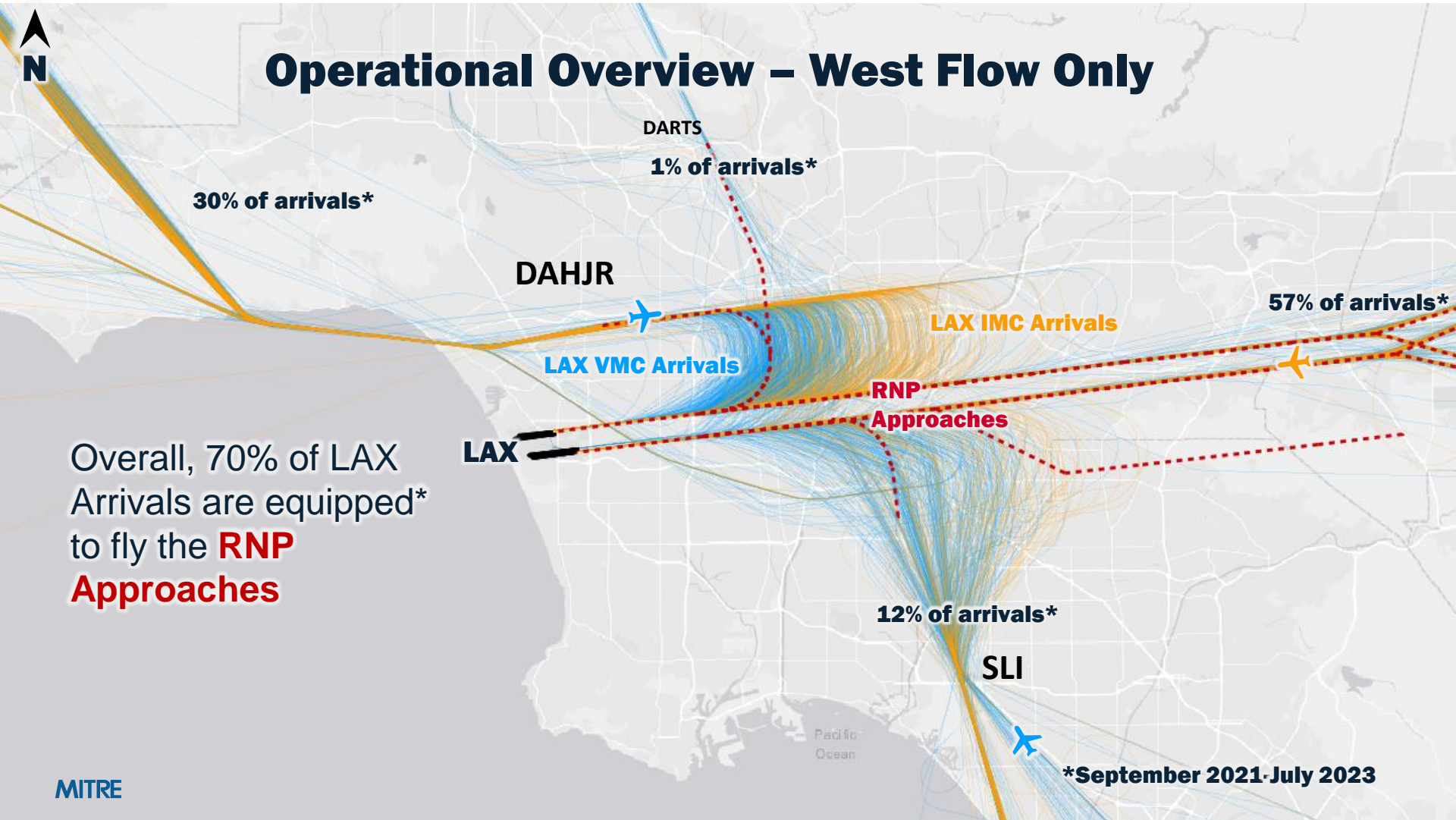
ADS-B Out Equipage= Reduced spacing/distance flown



LAX: ESTABLISHED ON RNP (EOR) INITIATIVE



Operational Overview – West Flow Only



Overall, 70% of LAX Arrivals are equipped* to fly the **RNP Approaches**

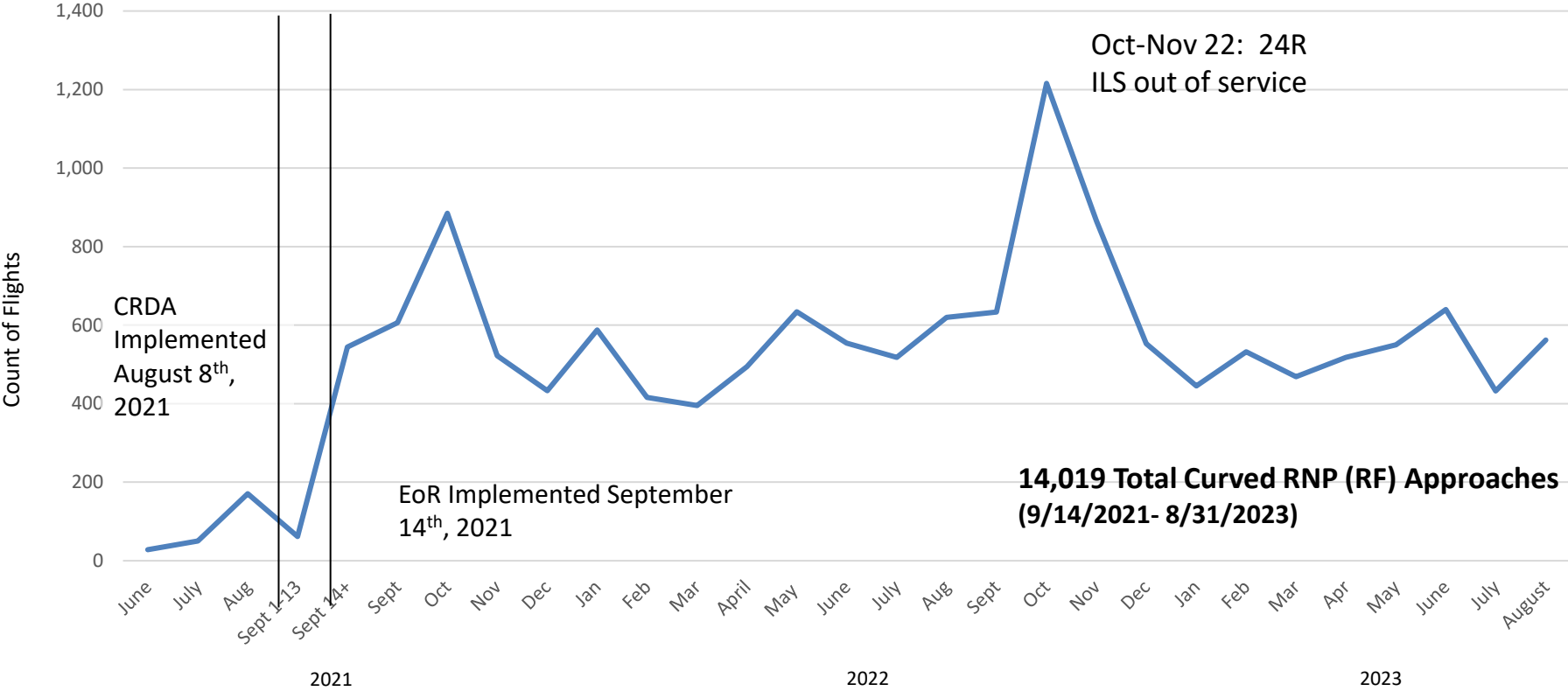
MITRE

*September 2021-July 2023



Federal Aviation Administration

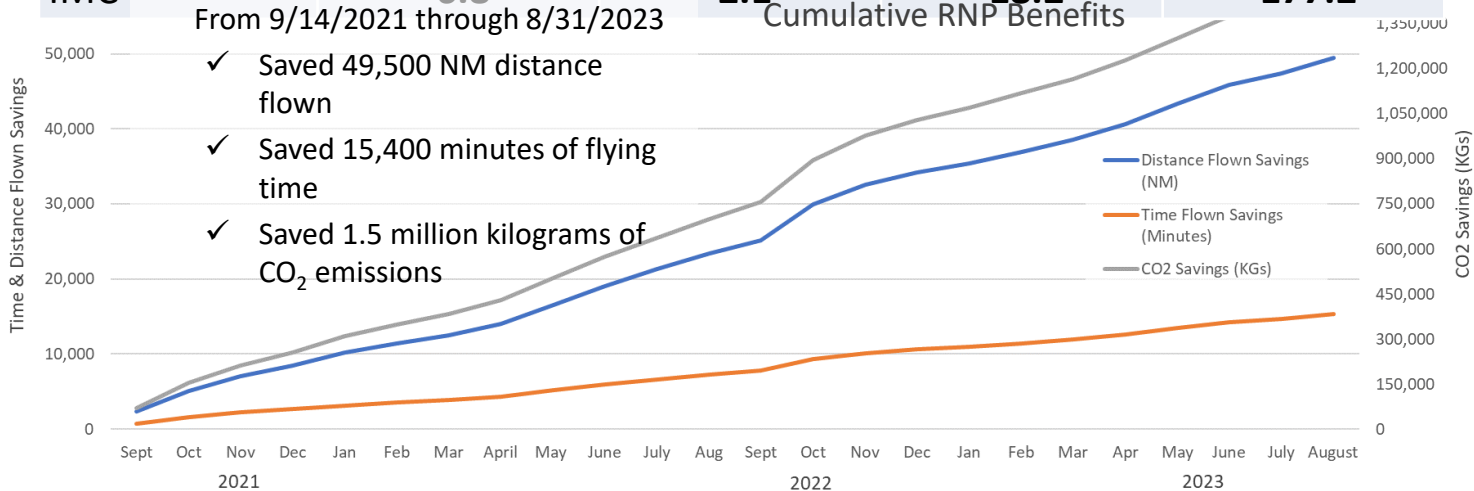
Monthly Curved RNP (RF) Usage – West Configuration Only



RNP RF Benefits – West Flow

Flight Efficiency Improvements for RNP RF vs Non-RNP Approach Operations

Savings per Flight				
VMC/IMC	Distance Flown (NM)	Time Flown (Minutes)	Fuel Burn (Gallons)	CO ₂ Emissions (kgs)*
VMC	2.7	0.8	8.9	86.8
IMC	6.8	2.1	18.2	177.2

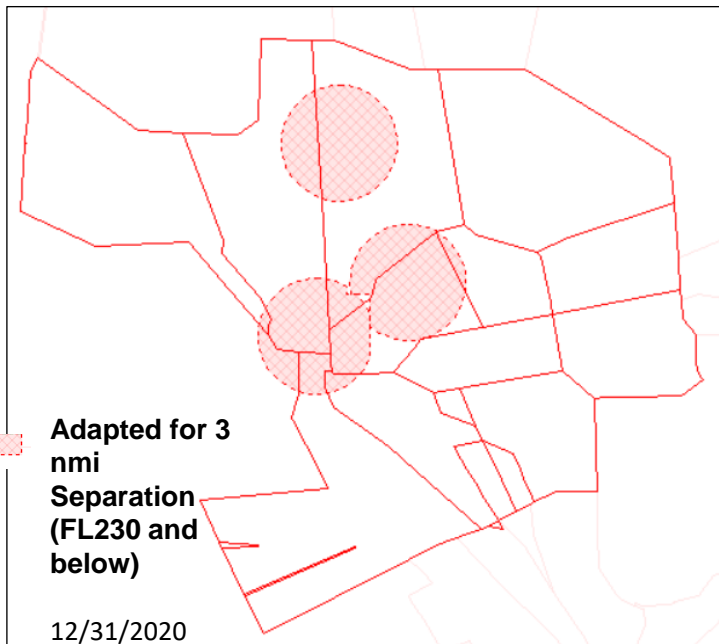


*CO₂ emissions use the latest U.S. Energy Information Administration (EIA) coefficient for jet fuel which is 9.75 kgs CO₂ per gallon of fuel.

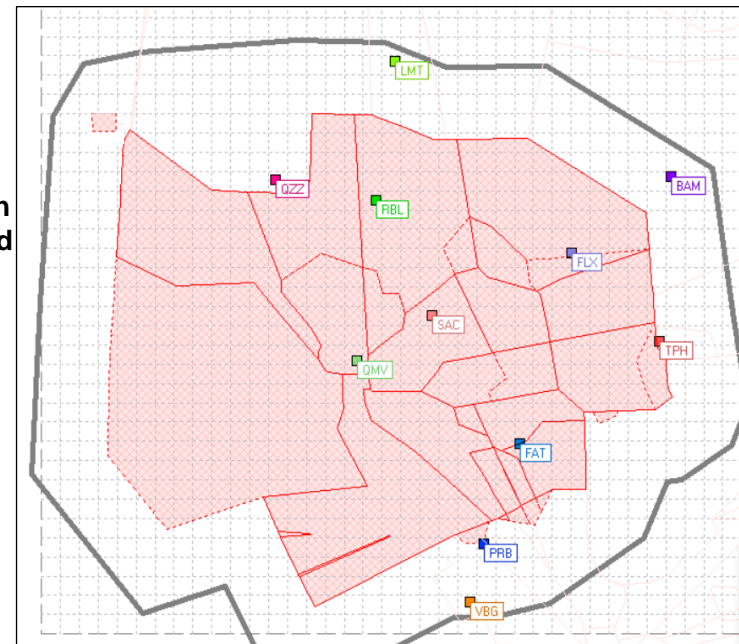
ZOA: ADS-B OUT, 5NM TO 3NM REDUCED SEPARATION INITIATIVE



Rule Change – Enabling 3NM Separation below FL230 Leveraging ADS-B Out Equipage



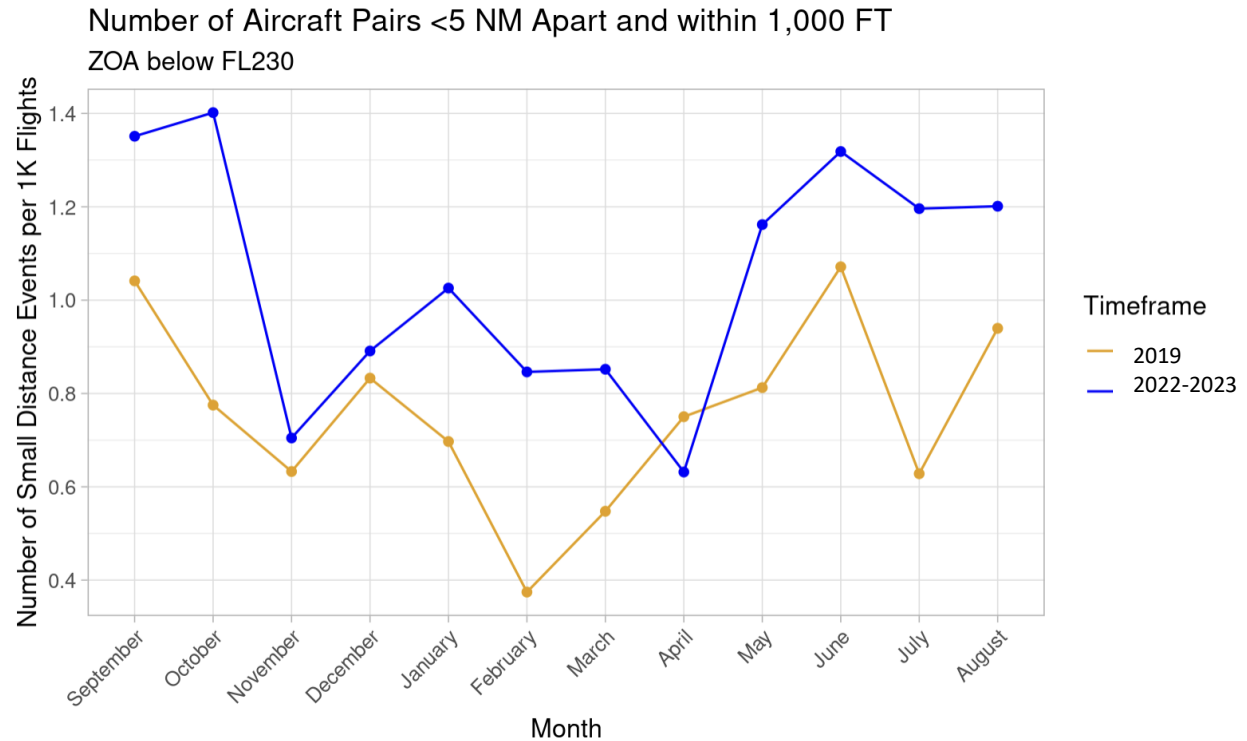
Adapted for 3 nmi Separation (FL230 and below)
10/12/2021



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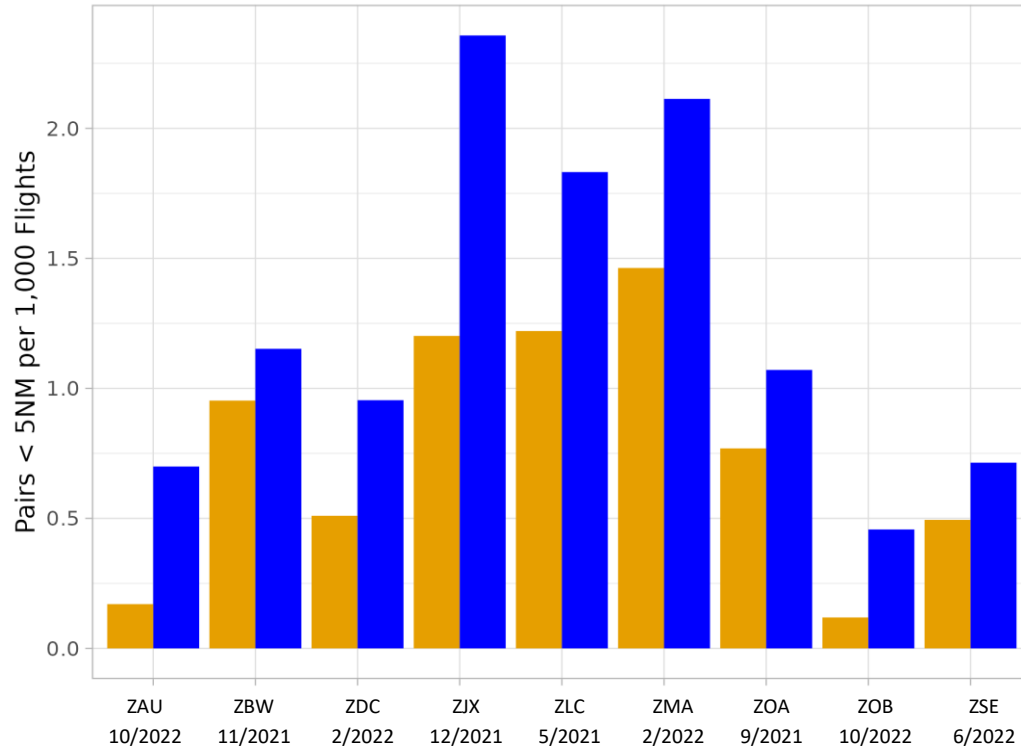


Month-to-month comparison (ZOA)



All Centers with 3NM Separation Implemented

of Pairs < 5NM per 1,000 Flights



Evaluation Timeframes

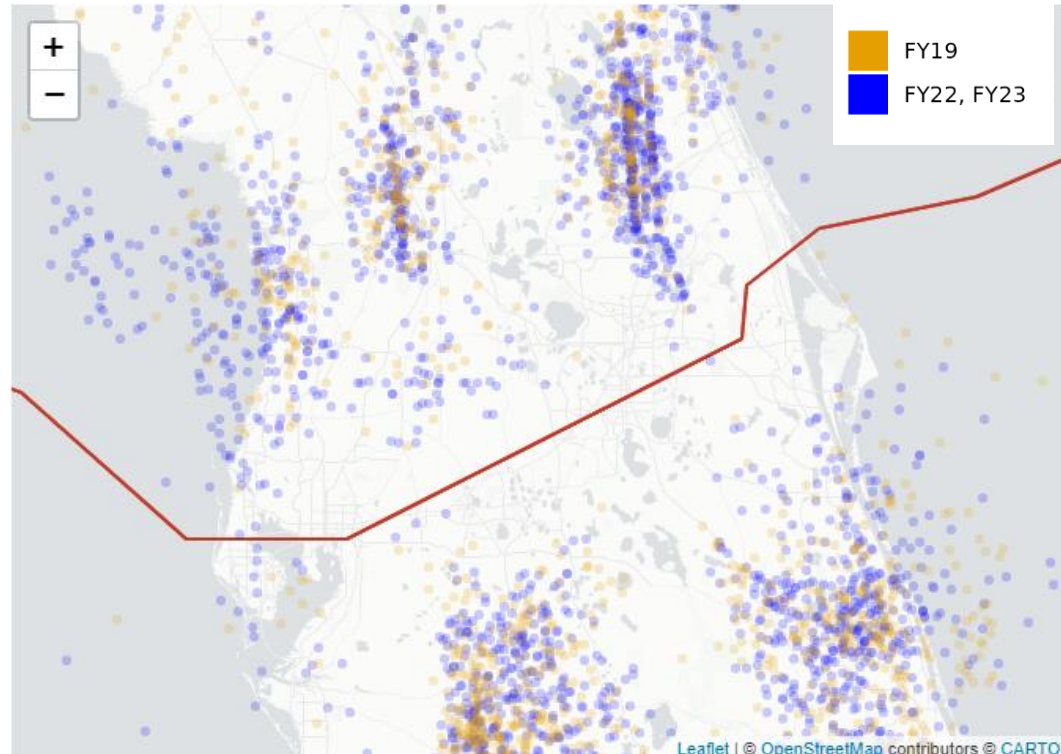
Centers	Baseline	Post
ZBW, ZDC, ZJX, ZLC, ZMA, ZOA, ZSE	01/2019 – 12/2019	09/2022 – 08/2023
ZAU, ZOB	11/2018 – 06/2019	11/2022 – 08/2023

■ FY19
■ FY22, FY23



ZMA and ZJX Zoom

Opportunities increased close to center boundary because of uniform separation standards



MCO: CPDLC DEPARTURE CLEARANCE CAPABILITIES





Section 547 Data Comm: Orlando Metrics

August 2023



L3HARRIS



**Federal Aviation
Administration**



Initiative Description

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CPDLC Departure Clearance (DCL) capabilities at Orlando International Airport (MCO)

- **Overview**

Use of DCL can provide CPDLC equipped operators revised departure clearances in a more time-efficient manner compared to unequipped operators. This is especially beneficial when reroutes are necessary due to weather or other air traffic disruptions.

- **Anticipated Benefits**

Minutes of Airspace User Time Saved and kilograms of CO₂ Emissions Prevented

- **Start Date**

Focused data collection and metric tracking beginning 9/1/2021

Orlando CPDLC DCL Departures

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 RESULTS 1616Z



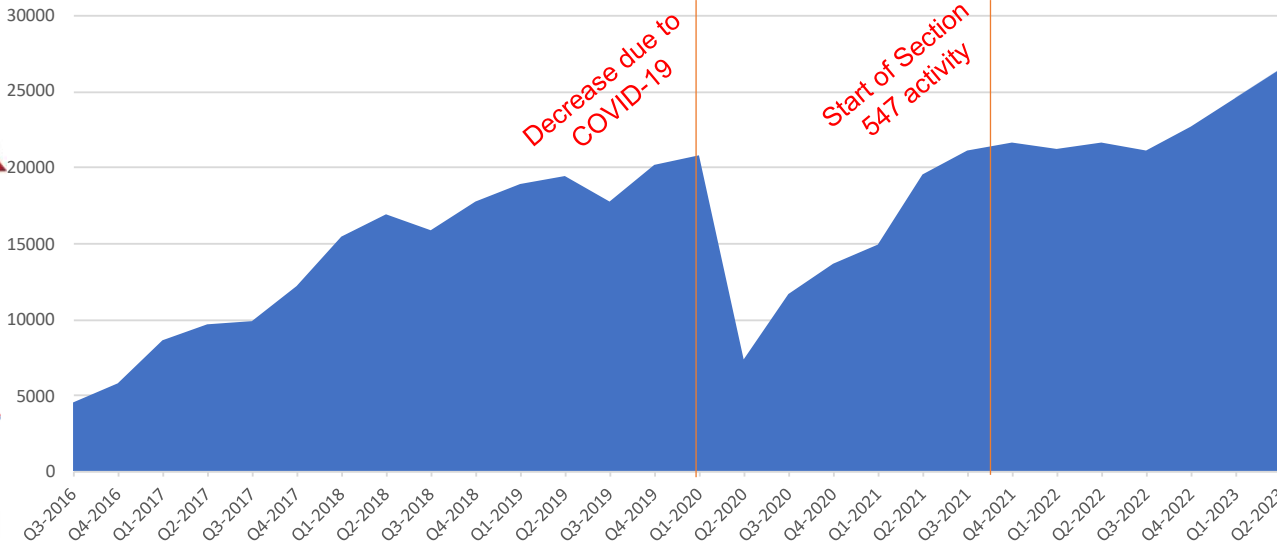
Aer Lingus

Eurowings
discover.

AIR CANADA

CPDLC DCL Clearances Received at KMCO

FedEx



jetBlue

Lufthansa

NATIONAL

Southwest

spirit

TAM

UNITED



Alaska

American Airlines

American Airlines
 INTERNATIONAL AIRLINES

Azul

BRITISH AIRWAYS

DELTA

Emirates

Orlando CPDLC DCL Clearances

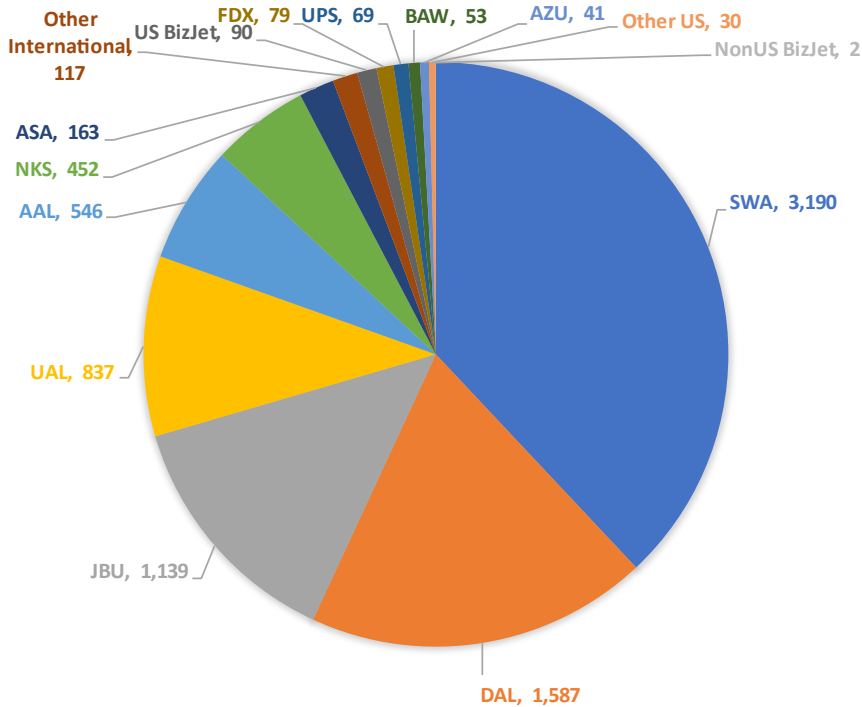
August 2023

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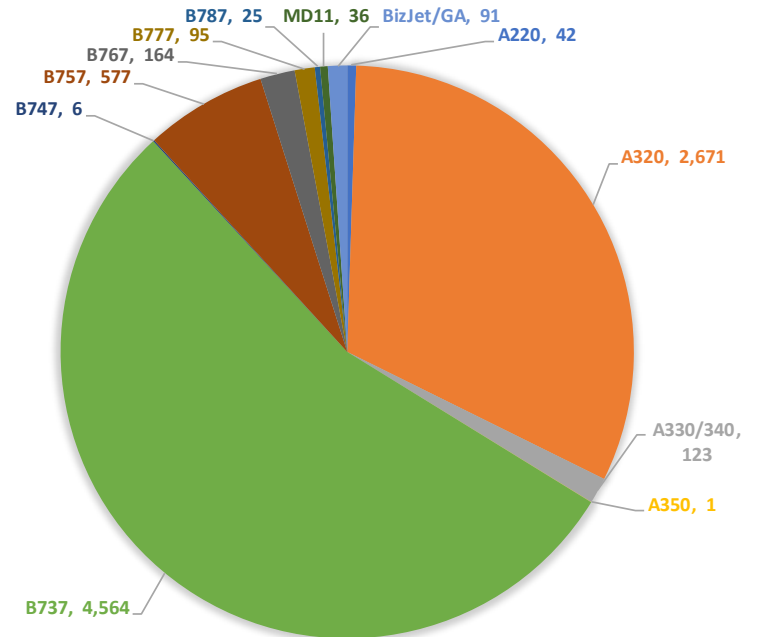
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By Operator



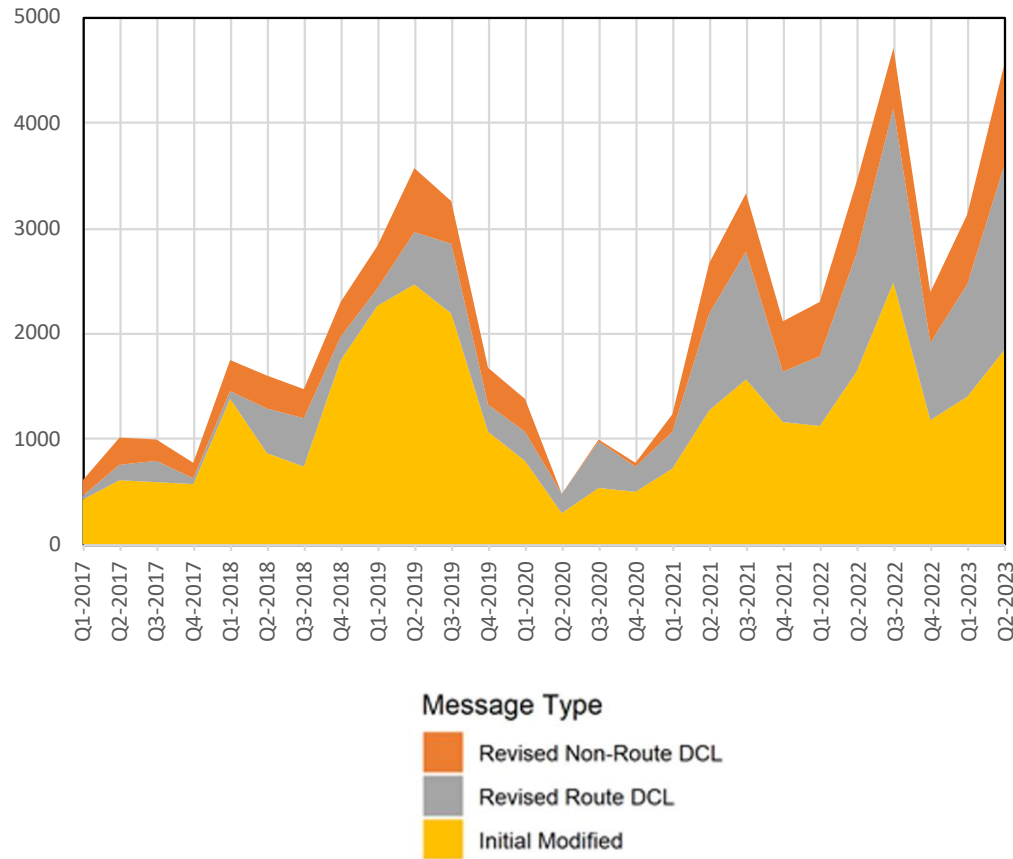
By Aircraft Type



Orlando CPDLC DCL Messages Delivered

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Quarterly KMCO CPDLC DCL Message Delivery



Cleared as Filed	The participating flight receives no changes/modifications to their original/intended route of flight filed in their flight plan.
Initial Modified	The participating flight receives a change to their original/intended route of flight on the filed flight plan, this change could be a route or non-route change.
Revised Route DCL	The participating flight receives a change/modification to their original/intended route of flight on the filed flight plan that resulted in a route change from air traffic control.
Revised Non-Route DCL	The participating flight receives a change to their original/intended route of flight on the filed flight plan. This change/modification only affected non-route information such as, but not limited to, squawk code or departure frequency.

Orlando CPDLC DCL Benefits

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Since January 2021



Cleared 205,949 flights



Saved 40,872 minutes of airspace user time (gate and taxi)



Prevented 1.06M kgs of CO₂ Emissions

In June 2023



Cleared 8,527 flights



Saved 1,211 minutes of airspace user time (gate and taxi)



Prevented 23,129 kgs of CO₂ Emissions

**Benefits are derived using ASPM data which is verified 3 months after the month closes.*

Orlando CPDLC DCL Benefits Trend

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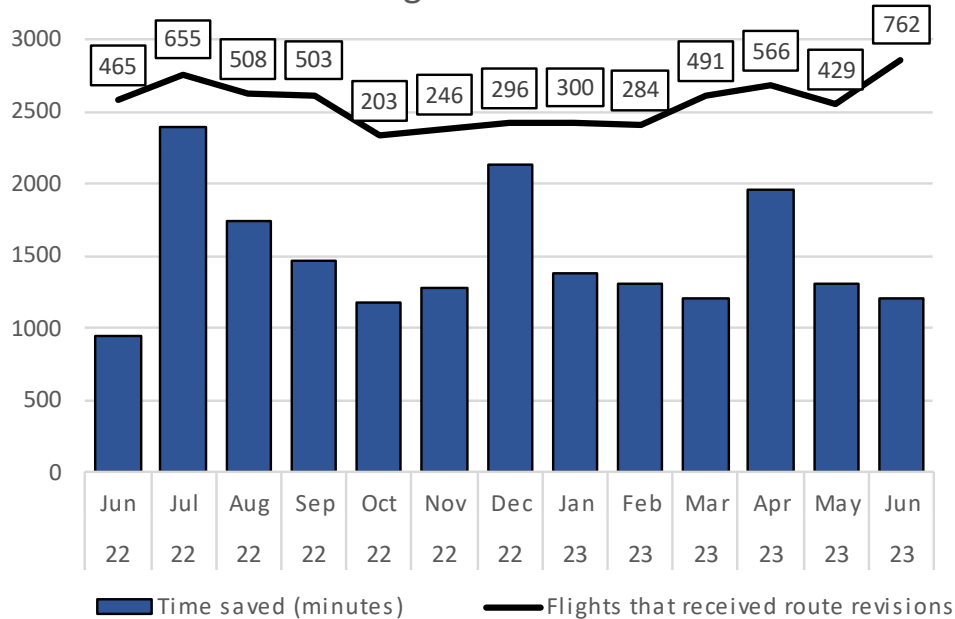
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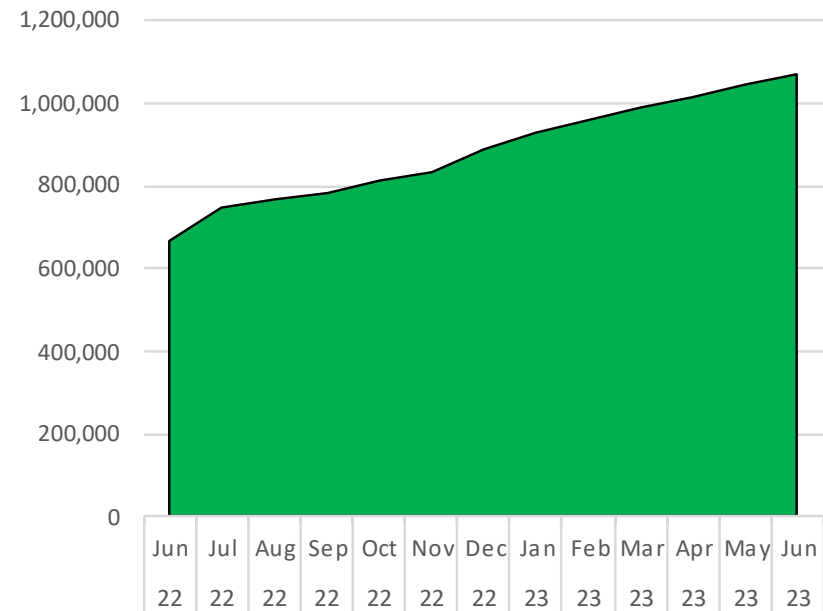
Time Savings and Emission Reductions



Time Savings and Route Revisions



Cumulative CO₂ Savings (kgs)



**Benefits are derived using ASPM data which is verified 3 months after the month closes.*



Section 547

Read-Ahead Only Slides

General Observations

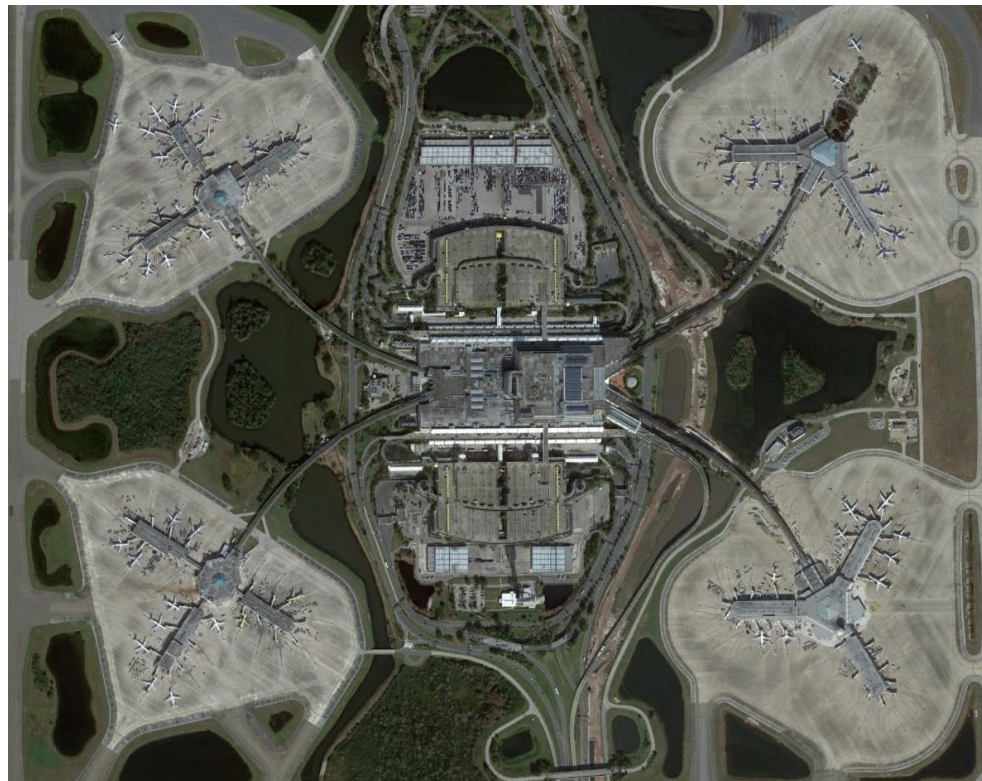
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Orlando Tower Procedures

- Gate and airport layout provides ample space for pushback and taxi, reducing delays
- Departure clearance revisions show benefits to CPDLC DCL equipped operators during the taxi phase, most notably during severe weather events



Data Comm Analysis Approach

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Expected primary benefits

- **Minutes of Airspace User Time Saved** (*gate and taxi delay savings as a result of clearances and reroutes delivered to equipped aircraft in a more efficient manner compared to unequipped aircraft using voice*)
- **Kilograms of CO₂ Emissions Prevented** (*as a result of reduced delays and fuel burn*)

Measurement of benefits

- **Airspace User Time Saved** (*gate and taxi delay savings*)
Difference between scheduled versus actual pushback times and the difference between actual pushback and actual wheels-off times comparing equipped aircraft to non-equipped aircraft
- **Kilograms of CO₂ Emissions Prevented**
Emissions prevented are directly related to taxi fuel savings, using an ICAO standard emission factor of CO₂ per unit of fuel consumed



Northeast Corridor (NEC)

Ralph Tamburro (PANYNJ) & Lee Brown (JetBlue)

Aaron Wilkins (FAA), Juan Narvid (FAA), & Raul Zamora, Jr. (FAA)

Performance Based Navigation (PBN)

Eric Morse (Delta)

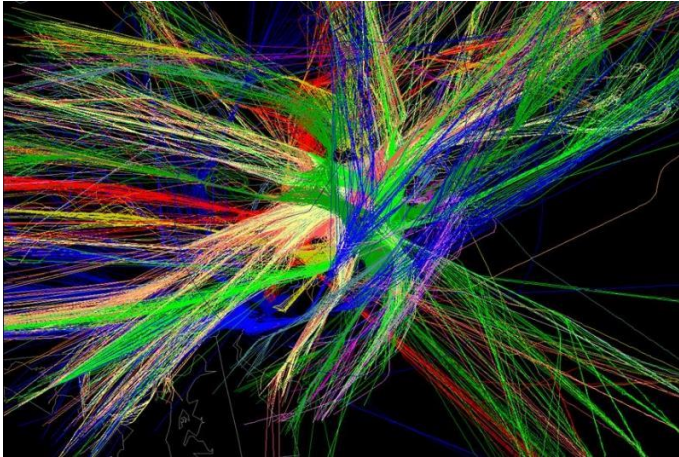
Aaron Wilkins (FAA), Juan Narvid (FAA), & Raul Zamora, Jr. (FAA)



NEC & PBN

Read-Ahead Only Slides

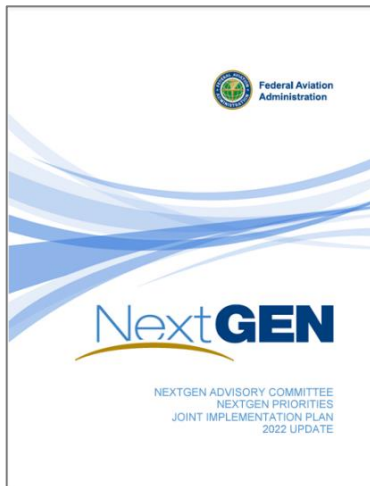
Northeast Corridor/Performance Based Navigation – Status



NEC NIWG meeting held in conjunction with the July NY Delay Initiatives Meeting (DIM)

Original ACR goals (~2016) shared

Discussed connectivity to CDM NY IROPs tasking



No changes to the remaining implementation commitments (since February NAC)

All Industry commitments are complete or on schedule



Outlook for Commitments

Type	Commitment/Milestone	Current Dates	Comments
Implementation	Complete Atlantic Coast Routes project	Q4 CY2023	No delays to the few remaining elements of ACR have been shared with NEC NEC will work with JAT to ensure context for benefits/consequences of ACR ties back to operational expectations
Implementation	Implement arrival time-based metering for PHL and EWR	Q4 CY2024	Multi-phase approach for implementation; working on detailed meeting on the project for Q3/Q4 2023
Industry	Initiate GBAS project at LGA	Q1 CY2023 Complete	Both projects have been initiated and PANYNJ holding regular procedures meetings; implementation has been delayed until 2025
Industry	Initiate GBAS project at JFK		
Industry	Conduct Fly Quiet Program for EWR, TEB, JFK and LGA	Q4 CY2024	Revised scoring plans discussed with operators in July
Industry	Identify tower space for TFDI installation at BOS	Q4 CY2024	Will pull together operators to discuss with MassPort

Implementation milestones are jointly shared by FAA and Industry for the NEC efforts





Additional Detail on Commitments for NEC and PBN NIWGs

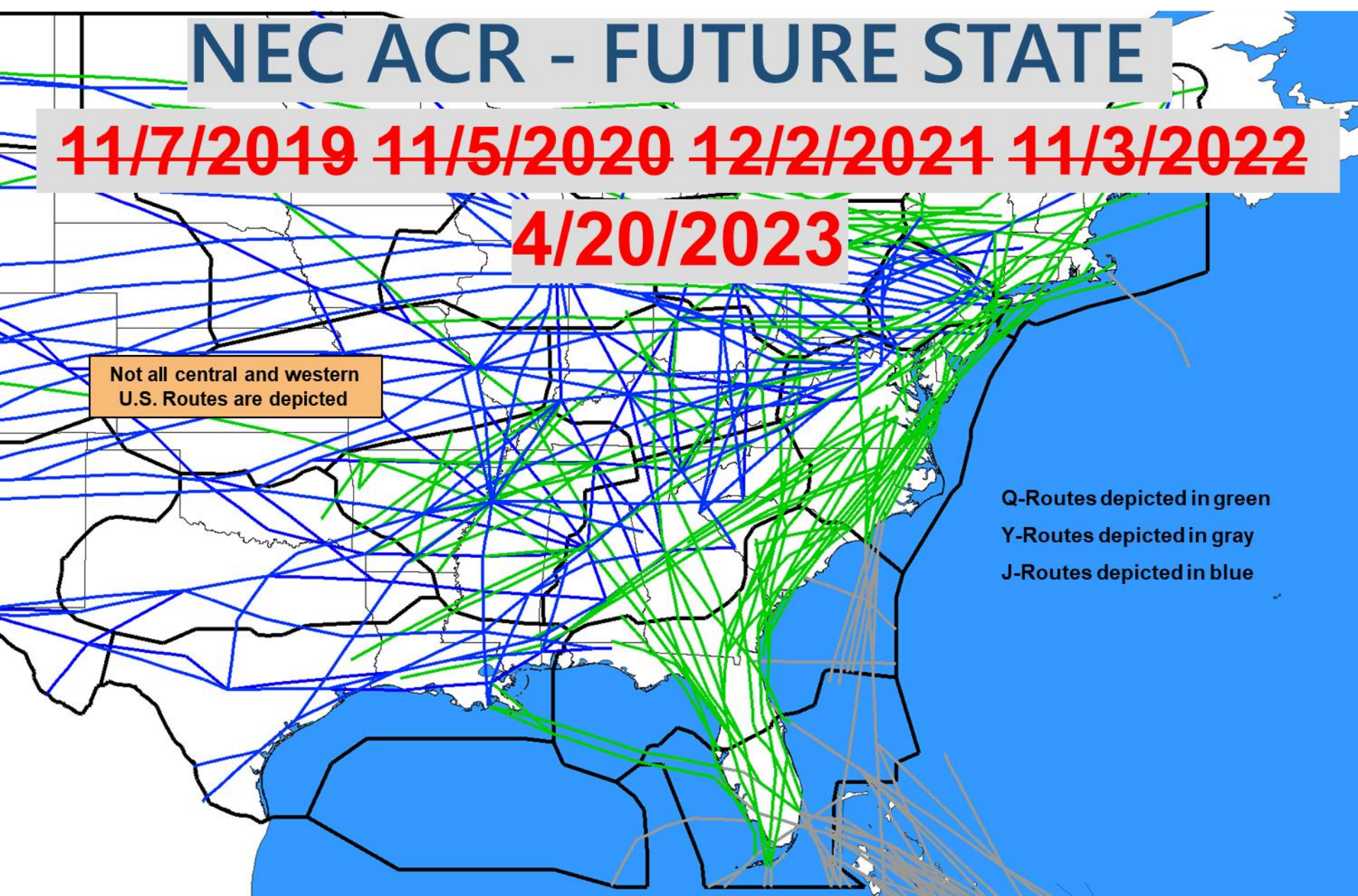
NEC ACR - FUTURE STATE

11/7/2019 11/5/2020 12/2/2021 11/3/2022

4/20/2023

Not all central and western U.S. Routes are depicted

Q-Routes depicted in green
Y-Routes depicted in gray
J-Routes depicted in blue

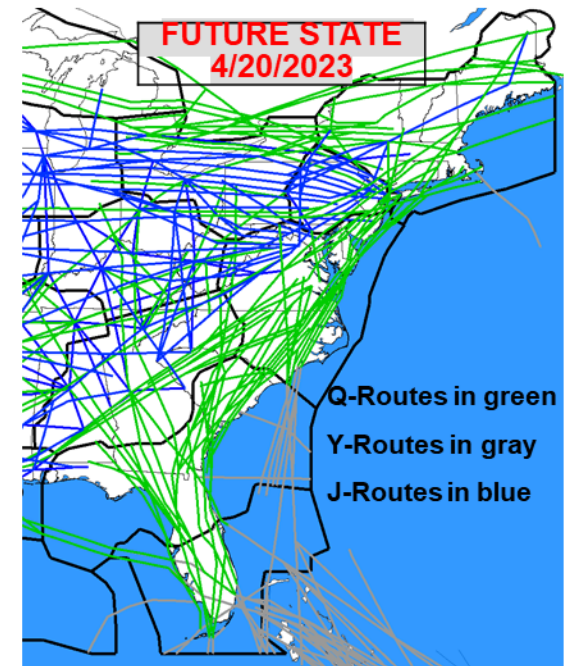


Federal Aviation Administration



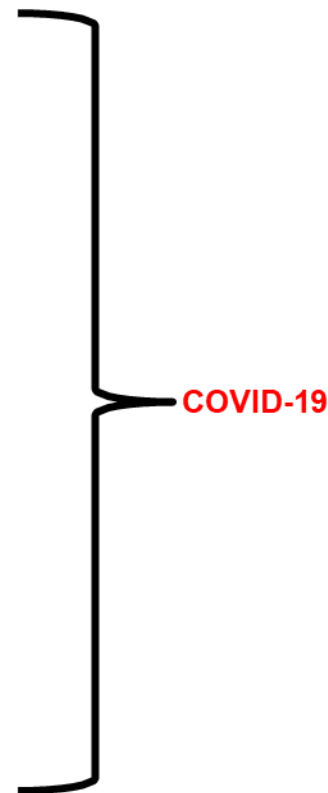
NEC ACR Summary

- Implemented 141 route changes, 2019-2022 (83% of 169 total)
 - New Y-Routes to/from Florida and the Caribbean
 - 159 (94%) or 169 route changes published
- Implemented ZDC Ultra-High Sector 30 (OBX), 5/10/2022
- Published 18 Q-Routes: NOTAM'd NA (18) until **4/20/2023**
- Remainder of project to be completed in the following phases
 - **2/23/2023**
 - Amend & implement Q437
 - Publish new Q141 (NOTAM NA until 4/20/2023)
 - **4/20/2023**
 - Amend Q101
 - Implement 18 remaining Q-Routes published on 9/8/2022 (plus Q64, Q141)
 - Delete 7 Jet Routes
 - Publish/Implement 4 STARs (PHL/EWR/TEB)
 - **6/15/2023**
 - Amend Q101
 - Delete EWR DYLIN4 STAR



Implementation Milestones 2019-2022

- ✓ 10/10/2019 Published/Implemented 1 New Y-Route and 8 Waypoints
- ✓ 11/7/2019 Implemented ZDC Low Altitude Sector Changes
- ✓ 1/30/2020 Deleted/Amended 33 J-Routes/Q-Route (FL Metroplex)
- ✓ 1/30/2020 Deleted 5 CHS STARs
- ✓ 3/26/2020 Deleted/Amended 6 SIDs (BWI/IAD/DCA/HEF/ADW)
- ✓ 5/21/2020 Amended 2 Q-Routes: Q75, Q475
- ✓ 5/21/2020 Amended 1 SID (DOV)
- ✓ 7/16/2020 Deleted/Amended 18 J-Routes
- ✓ 9/10/2020 Published/Amended 8 Q-Routes
- ✓ 11/5/2020 Published/Deleted/Amended 9 STARs (PHL/EWR/TEB/LGA/DOV/WRI)
- ✓ 11/5/2020 Published/Deleted/Amended 9 SIDs/STARs/SIAPs (CHS/JZI)
- ✓ 11/5/2020 Deleted/Amended 10 J-Routes, 1 Q-Route
- ✓ 2/25/2021 Published/Deleted/Amended 20 RDU SIDs/STARs/SIAPs
- ✓ 10/7/2021 Published/Deleted/Amended 28 Q-Routes/Y-Routes/AR-Routes
- ✓ 10/7/2021 Amended 1 SID (ATL), 1 STAR (WRI)
- ✓ 12/2/2021 Deleted/Amended 6 Jet Routes
- ✓ 5/10/2022 ZDC High Altitude Sector Changes (Sector OBX-30)
- ✓ 9/8/2022 Published/Amended 22 Q-Routes
- ✓ 9/8/2022 Amended ATL PLMMR3 SID
- ✓ 9/8/2022 Published/Amended 5 Y-Routes
- ✓ 11/3/2022 Deleted/Amended 12 Jet Routes and 2 Q-Routes



133 Routes Published, Amended, Deleted in 2020-2022



Federal Aviation Administration



NEC ACR Changes 2022-2023

✓ 5/10/2022 ZDC High Altitude Sector Changes (Sector 30)

✓ 9/8/2022 (22) Q-Route Additions/Amendments

- Publish (9) New Q101, Q107, Q111, Q117, Q131, Q133, Q167, Q445, Q481
- Amend (10) Q22, Q60, Q85, Q87, Q97, Q99, Q109, Q113, Q135, Q409
- Amend (2) Q34, Q419 (recently added, post-implementation)
- Amend Q75 (recently added, post-implementation)

✓ 9/8/2022 Amend ATL PLMMR3 SID

✓ 9/8/2022 (5) Y-Route Additions/Amendments

- Amend Y299, Y309, Y319, Y323
- Publish Y327

✓ 9/8/2022 NOTAM NA the above Q-Routes/Y-Routes (except Q22, Q34, Q75, Q419, Y327)

✓ 11/3/2022 (12) Y-Route/AR-Route Additions/Amendments/Deletions

- Amend Y291, Y307
- Publish Y313
- Amend (8) AR15, AR16, AR17, AR18, AR19, AR22, AR23, AR24
- Delete (1) AR21

✓ 11/3/2022 Cancel Y-Route NA NOTAMs and Implement Y-Routes

- Includes auto-cancellation of NA NOTAMs for Y289 and Y299 issued in 2021

✓ 11/3/2022 (14) J-Route/Q-Route Deletions/Amendments

- Amend (4) J14, J24, J52, J68
- Delete (8) J165, J207, J506, J561, J563, J573, J582, J585
- Delete Q947
- Amend Q81 (FL MP post-impl)

Completed

Completed

Publications Slipped
Due to COVID-19

- 2/23/2023 (2) Q-Routes: Amend/implement Q437, Publish new Q141 (NOTAM NA -4/20/2023)
- 4/20/2023 Cancel Q-Route NA NOTAMs and Implement 20 Q-Routes
 - Includes NA NOTAM for Q64, Q141
- 4/20/2023 (7) J-Route Deletions
 - Delete (7) J37, J55, J79, J121, J174, J191, J209
- 4/20/2023 (4) STARs Amended
 - Amend (4) STARs: PHL (JIIMS4, PAATS4), EWR (PHLBO4), TEB (JAIKE4)
- 6/15/2023 (2) Q101 Amend, Delete EWR DYLIN4 STAR

Changes Effective 4/20/2023

- **Implement 19 Q-Route (Cancel Q-Route NA NOTAMs)**
 - New routes published on 9/8/0222: Q101,Q107,Q111,Q117,Q131,Q133,Q167,Q445,Q481
 - Routes amended/extended on 9/8/2022 or before: Q60,Q64 Q85,Q87,Q97,Q99,Q109,Q113,Q135,Q409
- **7 J-Route Deletions (in their entirety)**
 - Delete J37, J55, J79, J121, J174, J191, J209
- **2 Q-Routes (2/23/2023)**
 - Publish new Q141 (NALES..BLNTN..HYTRA..TAPPA..HOUKY) for EWR/LGA DEPs via WHITE to KRDU
 - Publish 2/23/2023,NOTAM NA until 4/20/2023
 - Amend existing Q437 (VILLS..DITCH..LUIGI..HNNAH..LLUND) deleting segments north of LLUND)
- **4 STAR Amendments (valid transitions below)**
 - PHL JIIMS4: BRIGS,DASHA,ZJAAY (DELETED SWL)
 - PHL PAATS4: BBDOL,GVE,HYTRA (DELETED FAK, PXT)
 - EWR PHLBO4: QUART,GVE,SWANN,HYTRA (DELETED FAK, PXT)
 - TEB JAIKE4: GVE,SWANN,SWNGR, ATC ASSIGNED ONLY: BOOYA,HYTRA (DELETED FAK, PXT, HPW, RIC)
- **Multiple FIX Cancellations**
- **6/15/2023 1 Q-Route Amendment (6/15/2023)**
 - Amend Q101 (add segment from TUGGR..KALDA)
- **6/15/2023 Delete (1) CONV STAR, EWR DYLIN4 STAR**

iTBO Capabilities Among First 4 Operating Areas

Northwest Mountain

- ✓ DEN Metroplex
- ✓ CRDA/EoR at DEN
- ✓ XM for DEN
- ✓ IDAC for ZDV, ZLC
- ✓ Arrival metering for SLC
- Data Comm En Route Services – ZLC, ZDV (2023)
- TFDM for DEN

South West

- ✓ LAS Metroplex
- ✓ CRDA/EoR at LAX
- ✓ IDAC for ZLA, ZAB
- ✓ Arrival metering for PHX, SAN
- XM for LAS (2023), LAX
- TFDM for PHX, LAS, LAX (2023; build 1), SAN
- Data Comm En Route Services – ZLA, ZAB (2024)

Acronyms

ABRR: Airborne Re-Route
ACM: Adjacent Center Metering
EoR: Established on RNP
IDAC: Integrated Departure Arrival Capability
PDRR: Pre-Departure Reroute
TBM: Time-based Management
XM: Extended Metering



NAS-Wide

- ✓ En Route Departure Capability (EDC)
 - ✓ PDRR & ABRR (except ZNY)
 - ✓ Reroute Impact Assessment/TFMS R15
 - ✓ Data Comm Tower Data Services – 65 Towers
 - ✓ Data Comm Initial En Route Services & Full Increment 1; 11 Sites Complete;
- 9 sites remain -- ZHU (May 2023), ZJX, ZFW, ZSE (fall 2023), ZNY, ZLA (spring 2024); ZBW, ZAB, ZME (fall 2024)

Northeast Corridor

- ✓ IDAC (ZNY, ZBW, ZOB, ZID, ZDC)
- Data Comm En Route Services – ZDC, ZID, ZBW, ZNY, ZOB
- ✓ Atlantic Coast Routes (2023)
- Departure Scheduling for PHL & EWR (2024)
- XM for PHL & EWR
- TBM for JFK, LGA, DCA
- TFDM for ISP, BOS, PHL, EWR, LGA, JFK (dependent of DSP subsumption and FMDS)
- ABRR/PDRR (ZNY)

Mid Atlantic

- ✓ ACM for ATL & CLT
- ✓ IDAC for ZTL (ATL, CLT (2024))
- CRDA at BNA (2023)
- TFDM at CLT Build 2 (2024)
- TFDM at RDU, CMH, ATL (2025)
- Explore XM for ATL, CLT
- ✓ Data Comm En Route Services – ZTL

Legend

- ✓ Completed
- In progress (expected completion)
- Near term opportunity (funding needed)
- New investment required



iTBO Capabilities Among Other 4 Operating Areas

Pacific Northwest

- ✓ Arrival metering for SFO, SEA
- ✓ Data Comm En Route Services – ZOA, ZSE
- IDAC for ZOA, ZSE
- TFDM for SJC, SEA, SFO, OAK
- CRDA at BOI, PDX (2023)

South Central

- ✓ Departure Scheduling for AUS
- ✓ CRDA/EoR at IAH, AUS
- IDAC for ZME, ZHU, ZFW
- Arrival metering for IAH/HOU, AUS
- XM for DFW/DAL
- TFDM for IAH, DFW, HOU, DAL, AUS
- Data Comm En Route Services – ZHU (2023), ZFW (TBD), ZME (TBD)

Acronyms

ABRR: Airborne Re-Route
 ACM: Adjacent Center Metering
 EoR: Established on RNP
 IDAC: Integrated Departure Arrival Capability
 PDRR: Pre-Departure Reroute
 TBM: Time-based Management
 XM: Extended Metering



Other Needs

- Expand IDAC to 7 remaining centers: ZSE, ZHU, ZFW, ZKC, ZAU, ZMP, ZLC
- Synchronize with Airspace Modernization Roadmap

North Central

- ✓ Data Comm En Route Services – ZKC, ZAU, ZMP,
- TFDM Build 1 CLE, IND (2023)
- Departure Scheduling ORD Arrivals (2023)
- Arrival TBM for ORD (TBD)
- TFDM for MDW, CVG
- IDAC for ZKC, ZAU, ZMP

South East

- ✓ Data Comm En Route Services – ZMA, ZJX
- ✓ IDAC for ZJX
- ✓ CRDA for MIA, FLL
- IDAC for ZMA: MIA, FLL, PBI, FXE, RSW, TPA (2023)
- TFDM for TPA, MIA, FLL, MCO, PBI
- Northbound Departure Scheduling
- TBM for arrivals to MIA, FLL, PBI

Legend

- ✓ Completed
- In progress (expected completion)
- Near term opportunity (funding needed)



Review of Action Items & Other Business

Kimberly Noonan, NAC Committee Manager (FAA)



Closing Comments & Adjourn

Chip Childs, NAC Chair

President & CEO (SkyWest Airlines)