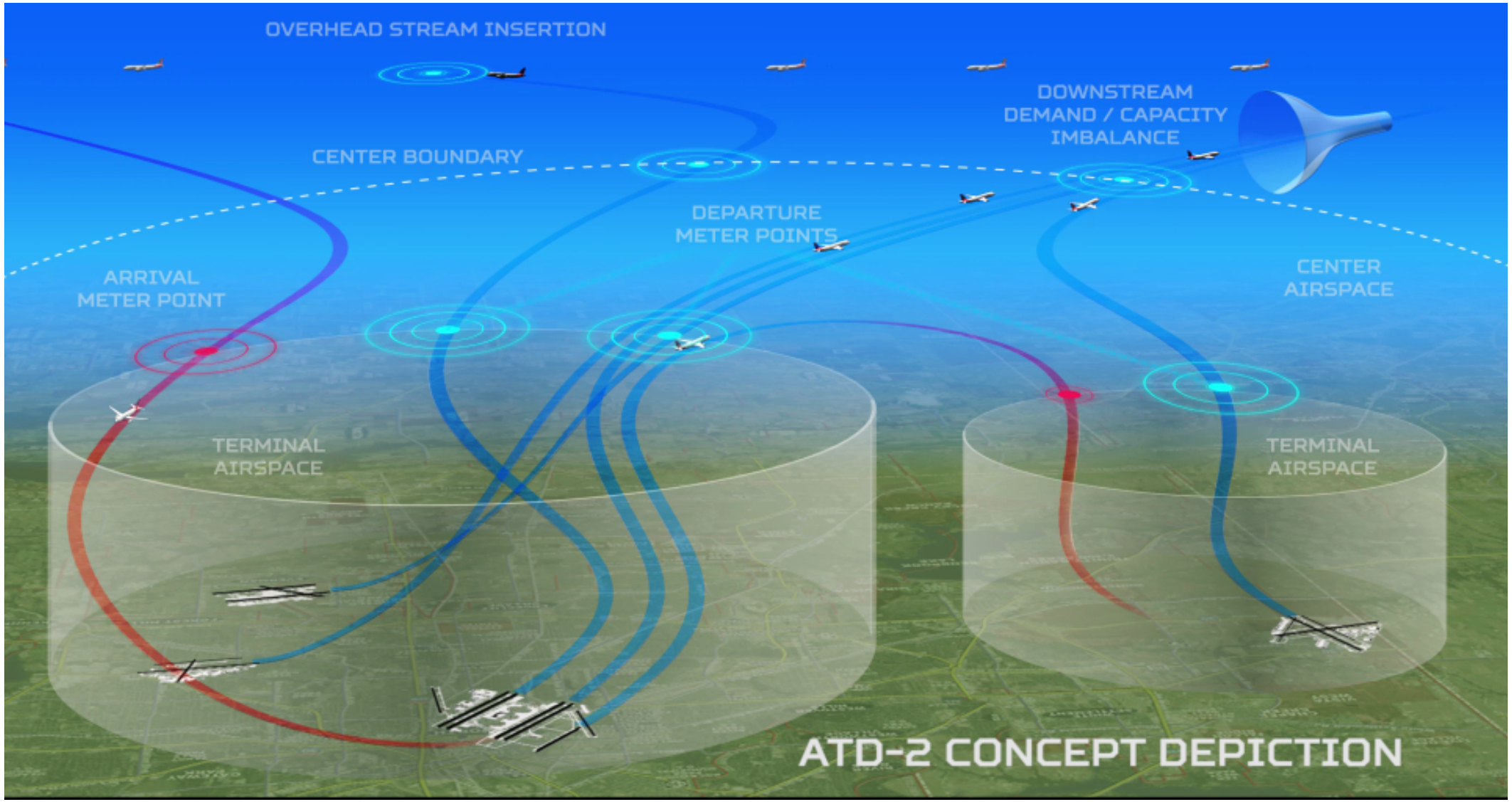
ATD-2 PHASE 3 OVERVIEW

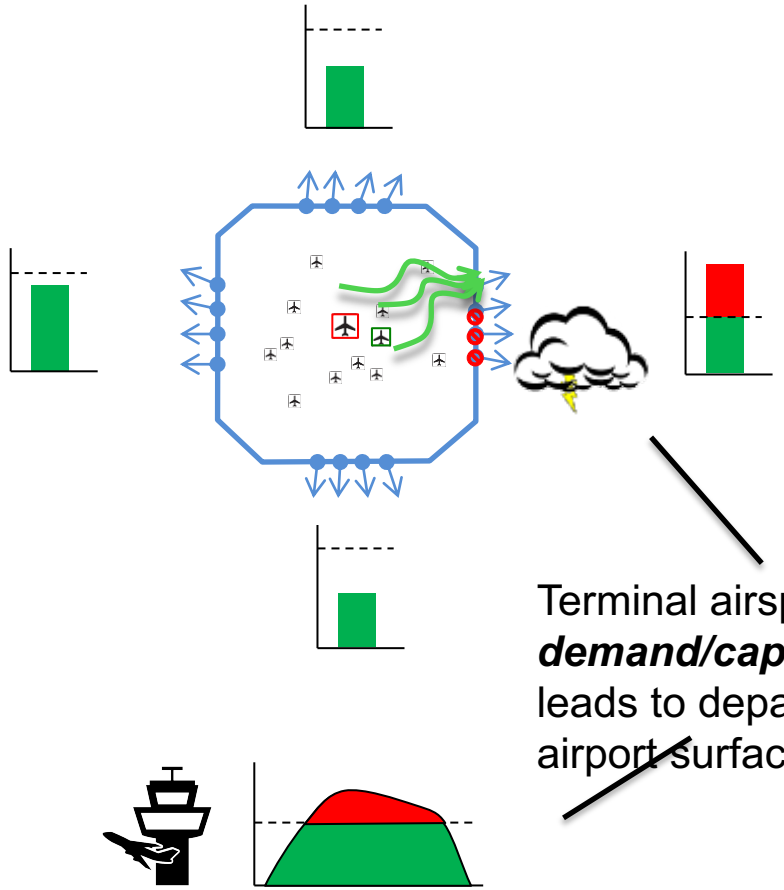


Outline of Briefing Today

- Phase 3 parameters
- What information does ATD-2 integrate in order to provide TOS opportunities
- How does ATD-2 present TOS opportunity information to the flight operator and ATC
- How are TOS opportunities processed through ATD-2 between the flight operator and ATC
- Overview of results and major lessons learned so far

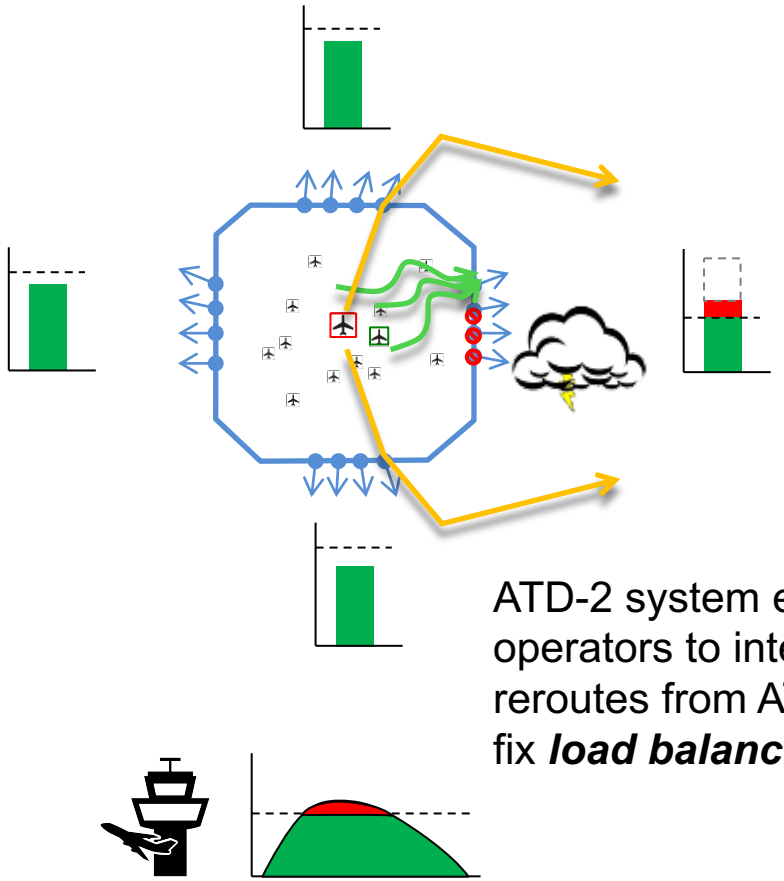
ATD-2 Phase 3: Managing Multi-Airport Departures

The Problem



Terminal airspace ***demand/capacity imbalance*** leads to departure delays on the airport surfaces

The Solution

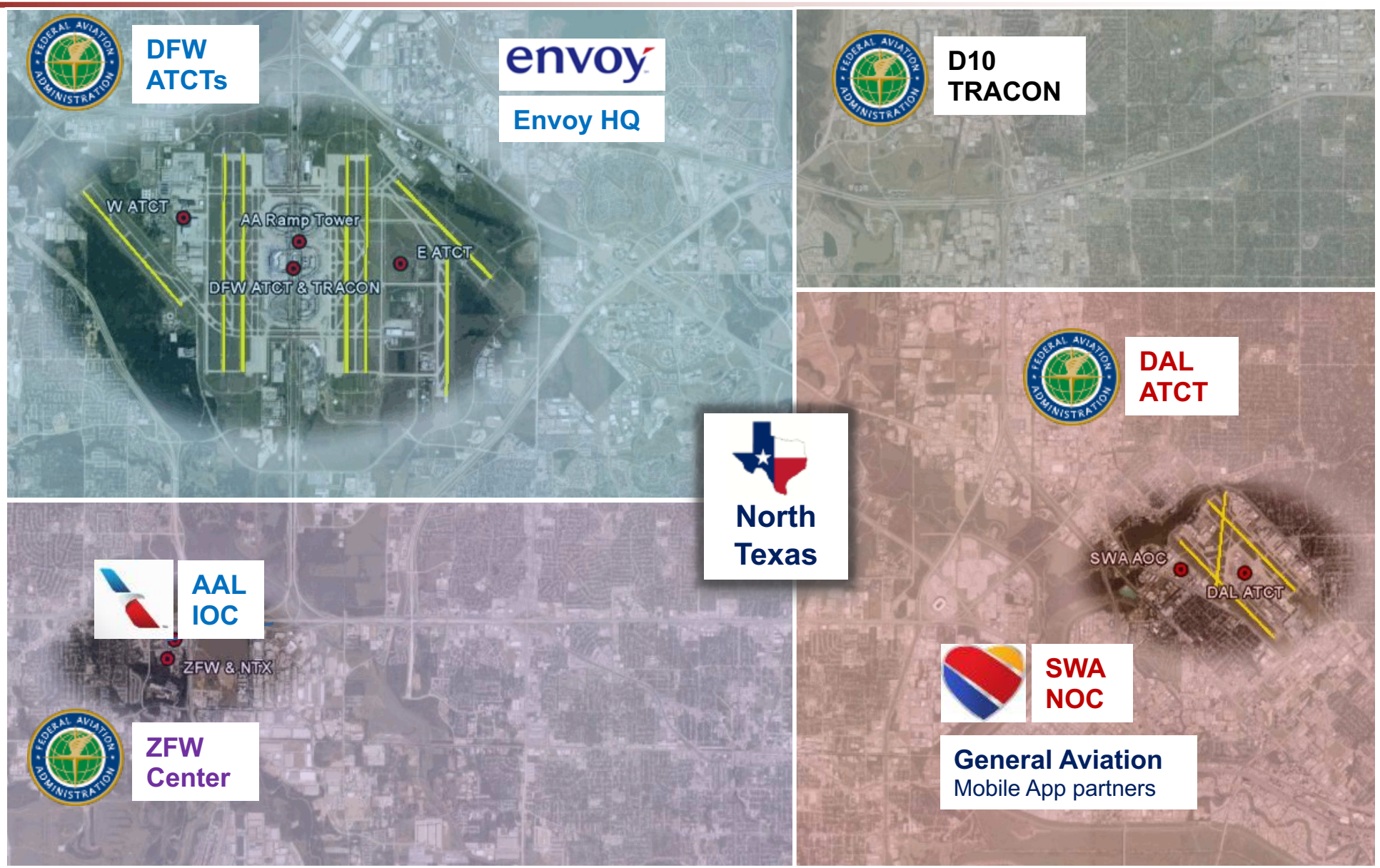


ATD-2 system enables flight operators to intelligently request reroutes from ATC for departure fix ***load balancing***

Objective of ATD-2, Phase 3

- Use the ATD-2 System as a means to leverage the existing TOS automation exchange methods that the FAA and Industry have already developed in a terminal environment involving multiple airports and airlines
- Transfer technology, data and lessons learned to the FAA & Industry in order to accelerate TOS evolution consistent with FAA/Industry plans.
- Two Evaluation Periods
  - Stormy 2019 – July through September – (Crawl/Walk)
  - Stormy 2020 – April 1 - ongoing – (Walk/Run)

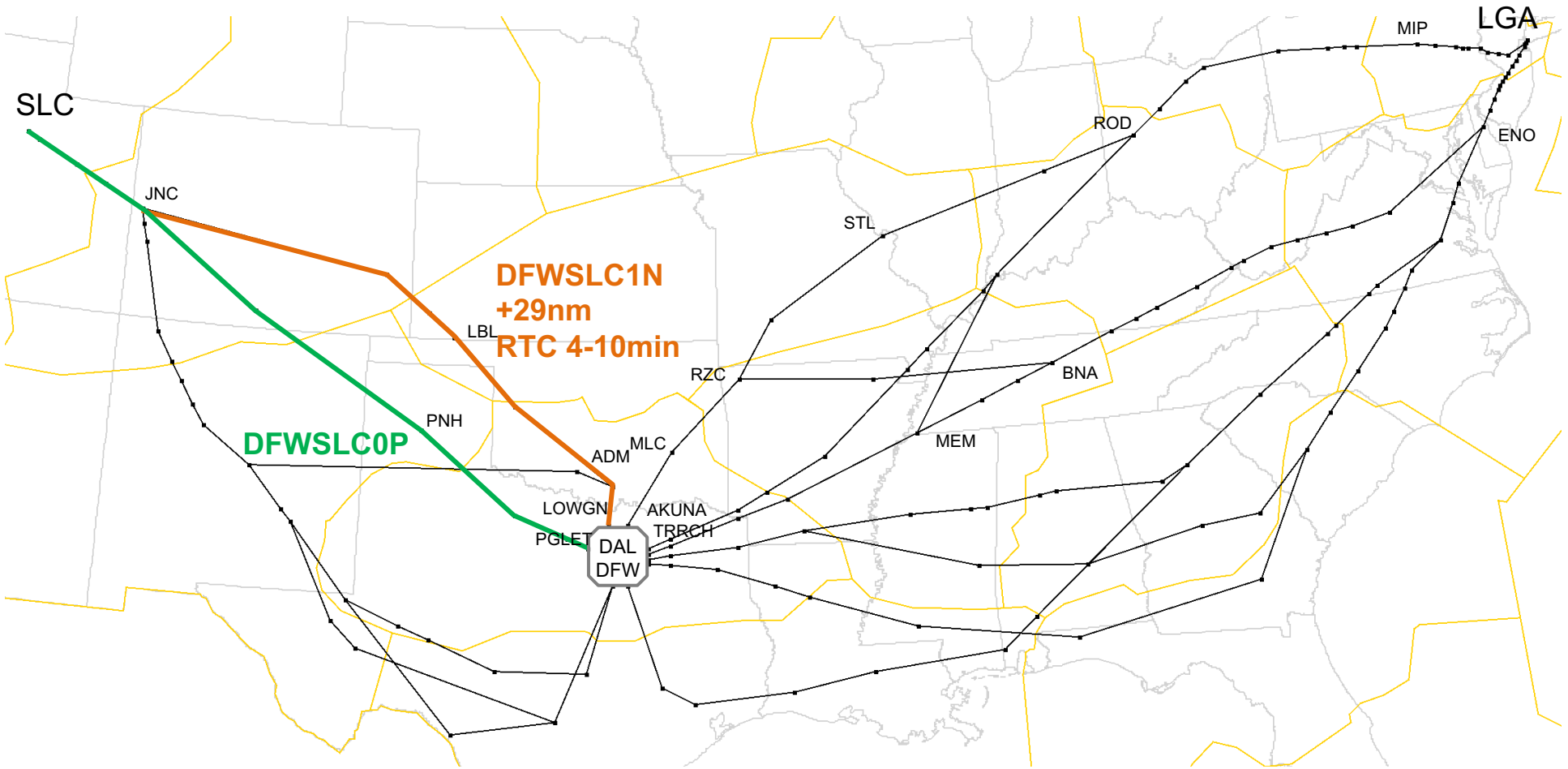
Phase 3 Partners



Providing TOS Opportunities

- Information Integrated from FAA & Flight Operators to Provide TOS Opportunities
  - Earliest Off Block Times
  - EOBT Type Information via Mobile App (GA Aircraft - Voluntary) – (GA Aircraft not participating in TOS submittals during phase 3)
  - ASDE-X (DFW Only)
  - Runway Configuration
  - Relative Trajectory Cost (RTC) Values
  - CDR's – Used as alternate TOS routes
  - Flight Distances (Winds are not currently integrated, so route mileage is used)
  - NTML – Fix closures, route combinations, SWAP's (ZFW-D10)
  - DCC GDP, GS, AFP, Reroutes (not FCA related reroutes yet)
  - APREQ's
  - ATC Manual Entries

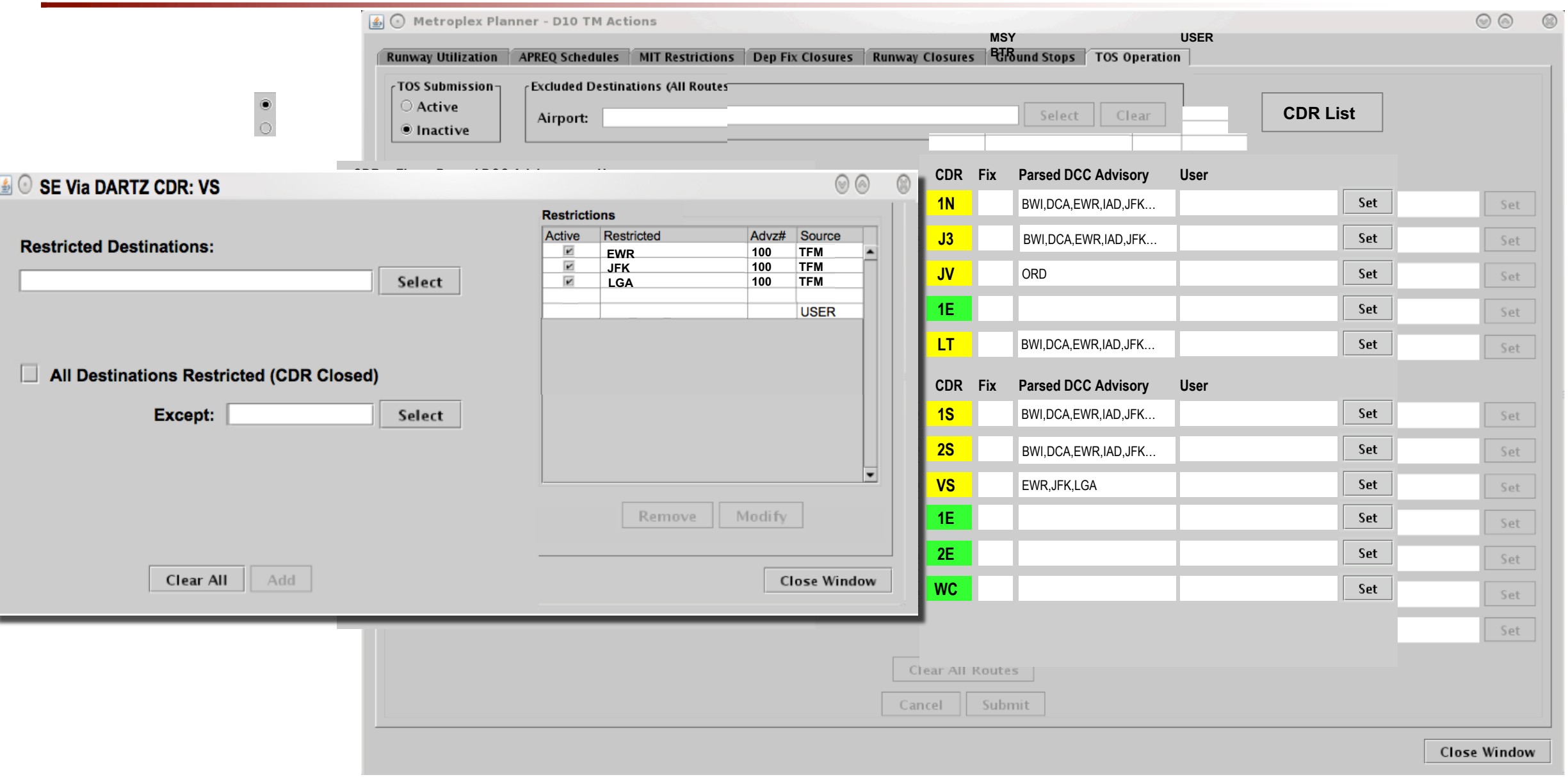
Static TOS – CDR and RTC



Notes:

- Subsets of CDRs as TOS alternative routes
- Examples with default RTC values

Parsing DCC Reroute Advisories



How to Project Delays to Leverage TOS Benefits

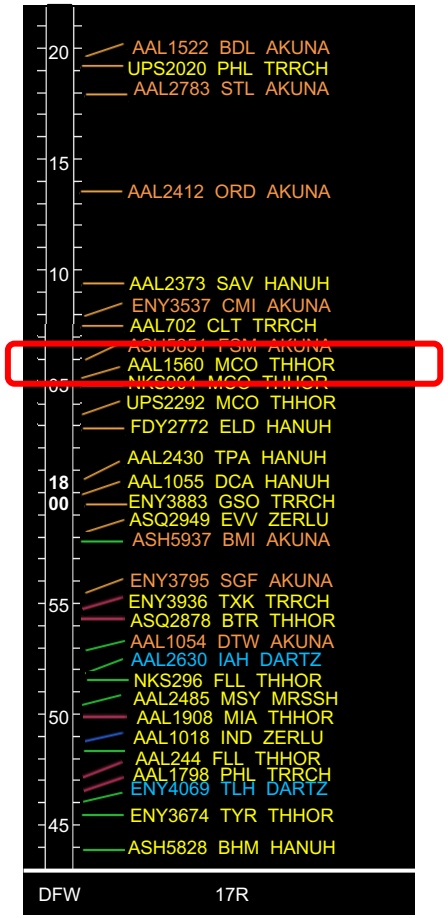
Spacing and sequencing at RWY = Surface delay

Restriction is entered: Fix combined 10MIT

Spacing and Sequencing at Dep Fix = Surface + Terminal delay

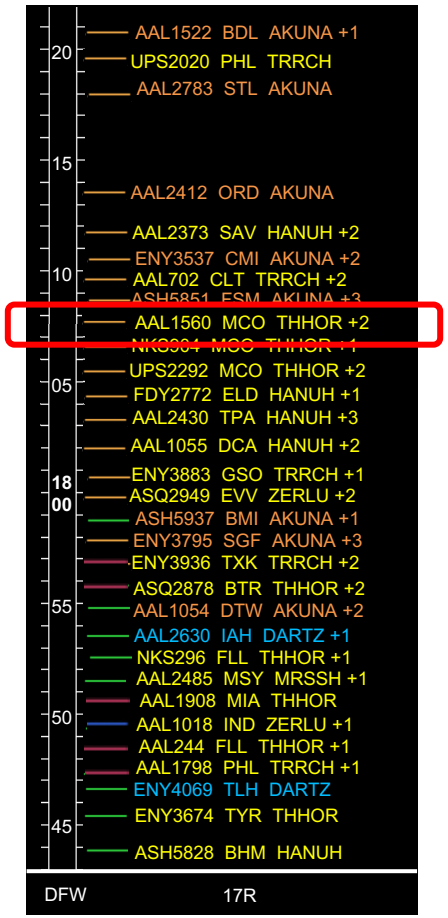
TOS Reroute Opportunities (Off-loading Demand) = Update demand and delay

Delay AAL1560 = 0min



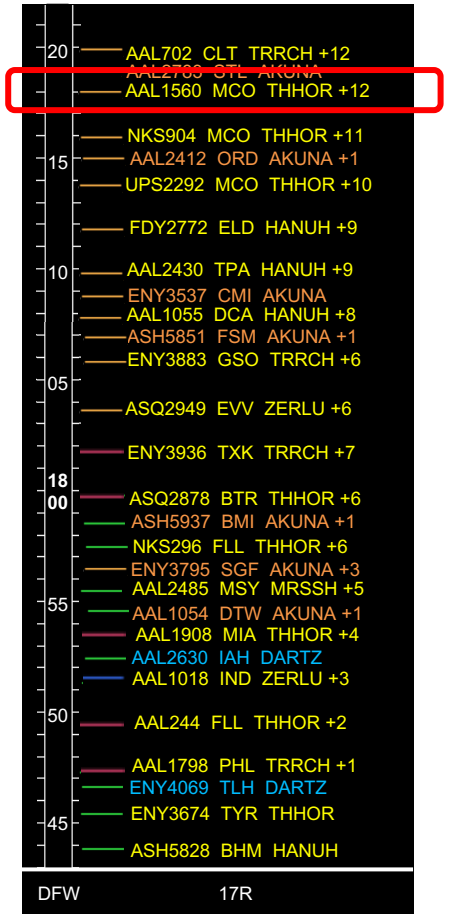
Undelayed TakeOff Times

Delay AAL1560 = 2min



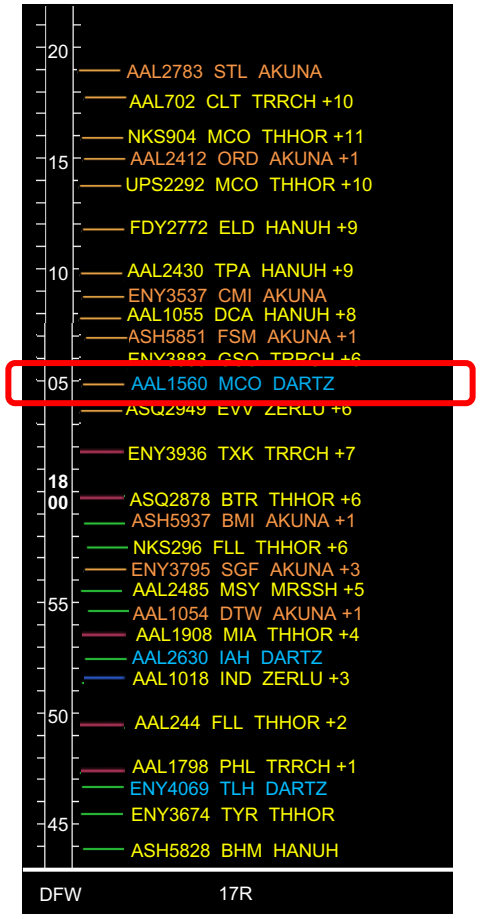
Estimated TakeOff Times Incl. RWY spacing

Delay AAL1560 = 12min



Estimated TakeOff Times Incl. Terminal Restrictions

Delay AAL1560 = 0min
Delay Savings = 10min



Updated Estimated TakeOff Times

Presenting TOS Opportunities

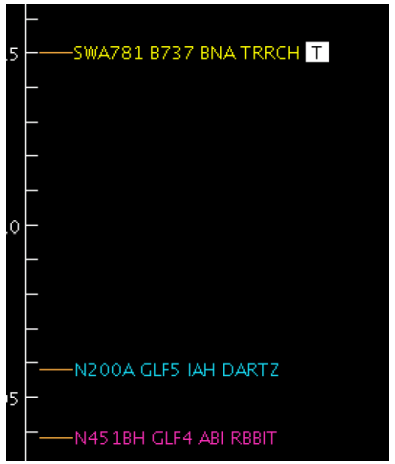
Real Time Metrics

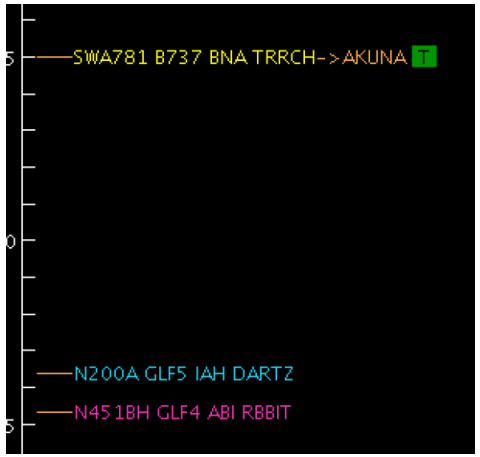
TOS Departure – Eligibility State = Candidate; Airline = AAL

Flight ID	Rwy	Dest	Dep Gate	EOBT	ETOT	Top ETOT	Flight Status	Top CDR	Top RTC	Top Total Delay Savings OFF	Top Prob Del Sav > RTC	Top Agg AAL Fleet Del Sav	Top Agg AAL Mainline Del Sav	Top N AAL Mainline Del Sav	Top Agg DFW Del Sav	Top Agg D10 Del Sav	TMI Info	Eligibility State
AAL373	E17R	CVG	EAST	06/19:46	06/20:34	20:00	Scheduled_Out	DFWCVG1N	+17	-34	81.8%	-82.5	-66.3	13	-98.7	-130.8	35M	Candidate
AAL808	E17R	PHL	EAST	06/19:50	06/20:50	20:03	Scheduled_Out	DFWPHLJ3	+18	-47	91.8%	-86.7	-71.6	13	-102.9	-127.1	35M Fix...	Candidate
AAL2579	E17R	BOS	EAST	06/19:52	06/21:31	20:04	Scheduled_Out	DFWBOSJ3	+9	-86	99.9%	-102.5	-102.5	13	-118.7	-126.8	35M	Candidate
AAL371	E17R	BNA	EAST	06/19:54	06/21:39	20:05	Scheduled_Out	DFWBNA1N	+29	-94	99.9%	-102.1	-102.1	13	-118.3	-126.4	35M Fix...	Candidate
AAL1269	E17R	MCO	EAST	06/19:54	06/21:47	20:05	Scheduled_Out	DFWMCO1S	+36	-102	99.9%	-102.1	-102.1	13	-118.3	-126.3	35M Fix...	Candidate
AAL1919	E18L	LAX	WEST	06/20:22	06/20:59	20:33	Scheduled_Out	DFWLAX1N	+23	-27	0.0%	0.0	0.0	13	-0.0	-5.2	25M Fix...	Candidate

Processing TOS Opportunities

- Flight Operators submits alternative routes for ATC to approve via the ATD-2 client
- ATC approves the flights that will be rerouted via the ATD-2 client
- ATC uses existing FAA systems to amend the flight plans, based on route displayed on the ATD-2 client (CDR name is listed)
- ATCT relays the revised route to the flight crew
  - When the flight is capable of receiving Controller-Pilot Data Link Communication-Departure Clearance) CPDLC-DCL this will be sent via Tower Data Link Services (TDLS)
  - When the flight is capable of receiving Pre-Departure Clearance (PDC)
    - Reads the CDR code via the radio frequency
    - Or reads the full route via the radio frequency





Major Lessons Learned So Far

- Current data and computation of real-time demand and delays provide opportunities to use TOS in an operational environment

- Parsing both local and NAS wide restrictions produces the most viable list of candidates for TOS submission and reduces complexity for the FO & ATC
  - Simplify decision making as much as possible: Only present a list of TOS candidates that can truly be acted upon

- Real-Time Individual and Fleet metrics enable the FO to make the most informed decision whether to reroute flights. If I submit this reroute request:
  - What is the probability of attaining the predicted delay savings?
  - How much do I save not only for the one flight but the entire fleet?

- CPDLC-equipped aircraft are capable of receiving reroutes more expeditiously
  - Reduces workload for both FO and ATC personnel

- Future integration of wind miles or FO's transit times
  - Would provide better cost/benefits information to support FO's decision making

- Alternate routes may not need to be limited to CDR routes
  - Would enable a larger number of TOS opportunities, for ATC's operational necessity and/or for FO's operational benefits.

Questions/Discussion

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