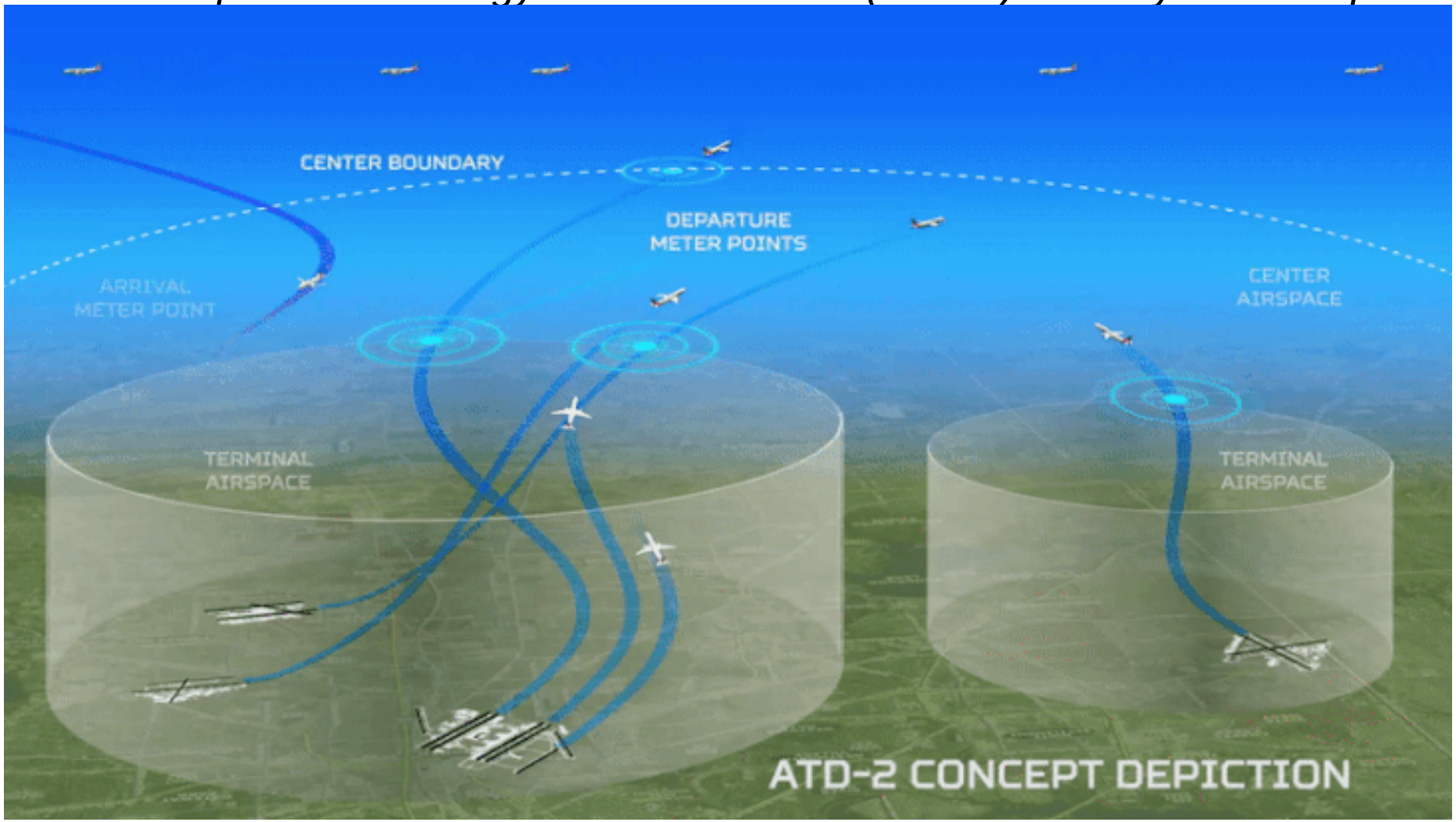
Welcome!

Welcome to the

NASA Airspace Technology Demonstration 2 (ATD-2) Industry Workshop!

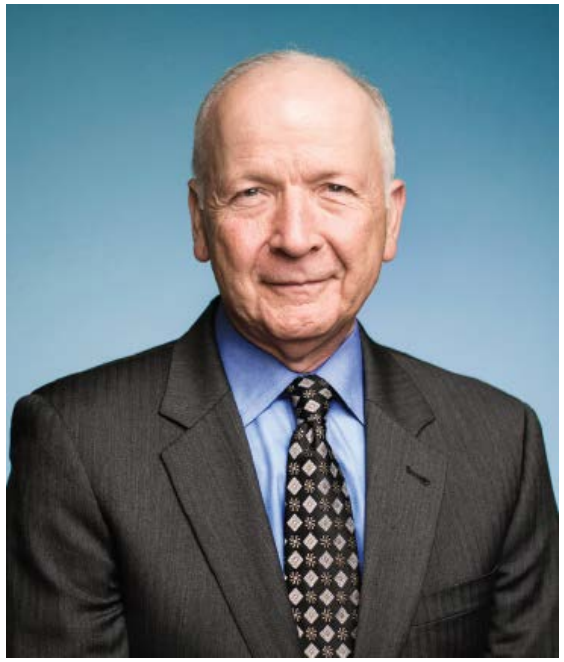


Day 2 Welcome

- Keynote Speaker
  - **Lorne Cass**

- Current Position
  - Vice President, Operations / Industry Affairs at American Airlines

- Among his many accomplishments
  - Prior to current position, held vice president role of American's Integrated Operations Center
  - Served as Director of Surface Efficiency within FAA ATO
  - More than 35 years experience in airlines operations control with multiple airlines (including American Airlines, Delta Air Lines, Western Airlines, Northwest)
  - Incredibly diverse aviation leadership experience with certifications as a pilot, dispatcher & air traffic control



Lorne Cass, Vice President, Operations/ Industry Affairs at American Airlines

NASA ATD-2 Industry Workshop

Airport Surface Management – Working Together to Solve a Complex Problem

Lorne Cass

September 5, 2019

Initial elements of the Pre-IOE Plan

A Simple, Low-Risk Approach with a Foundation in Data Sharing

It Started in 2000

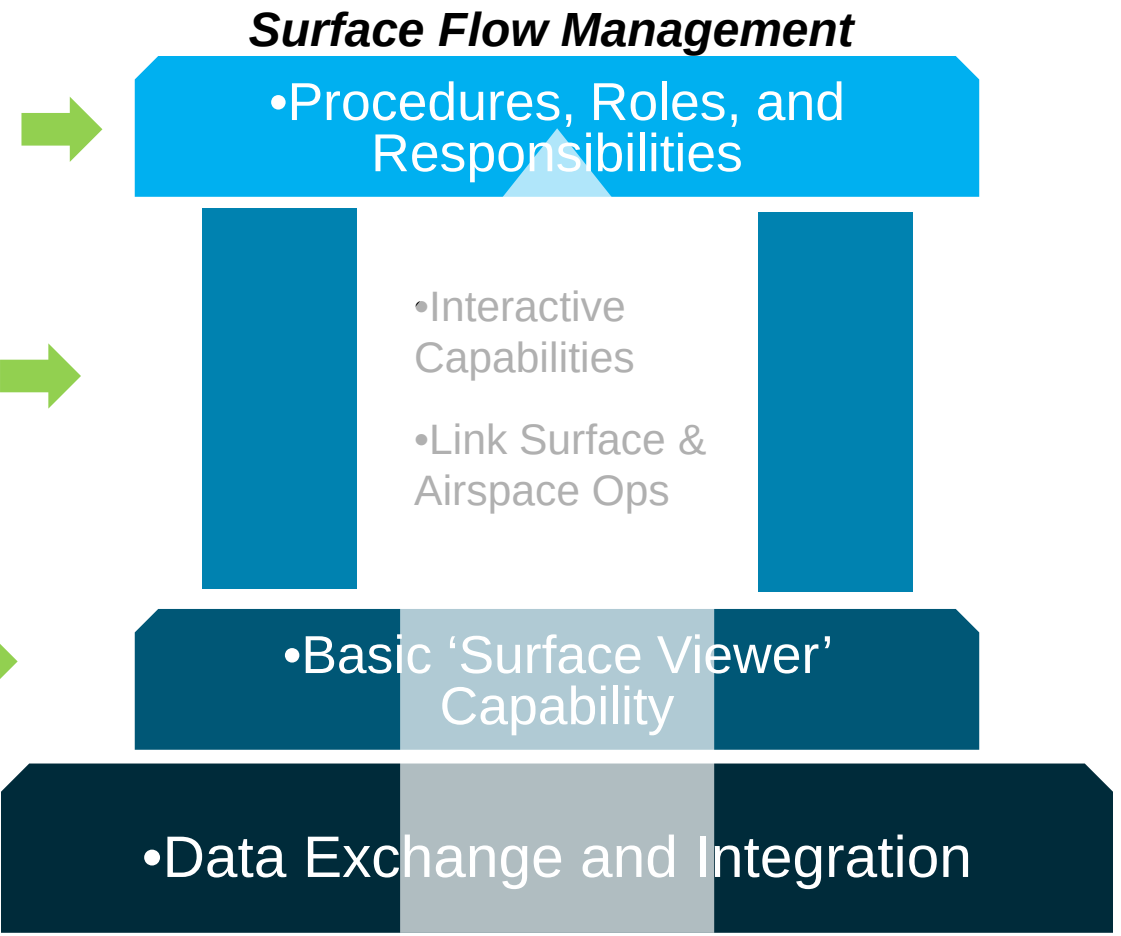
'Surface CDM' Conops Validation

Overarching - completes surface management integration across domains and with industry outreach

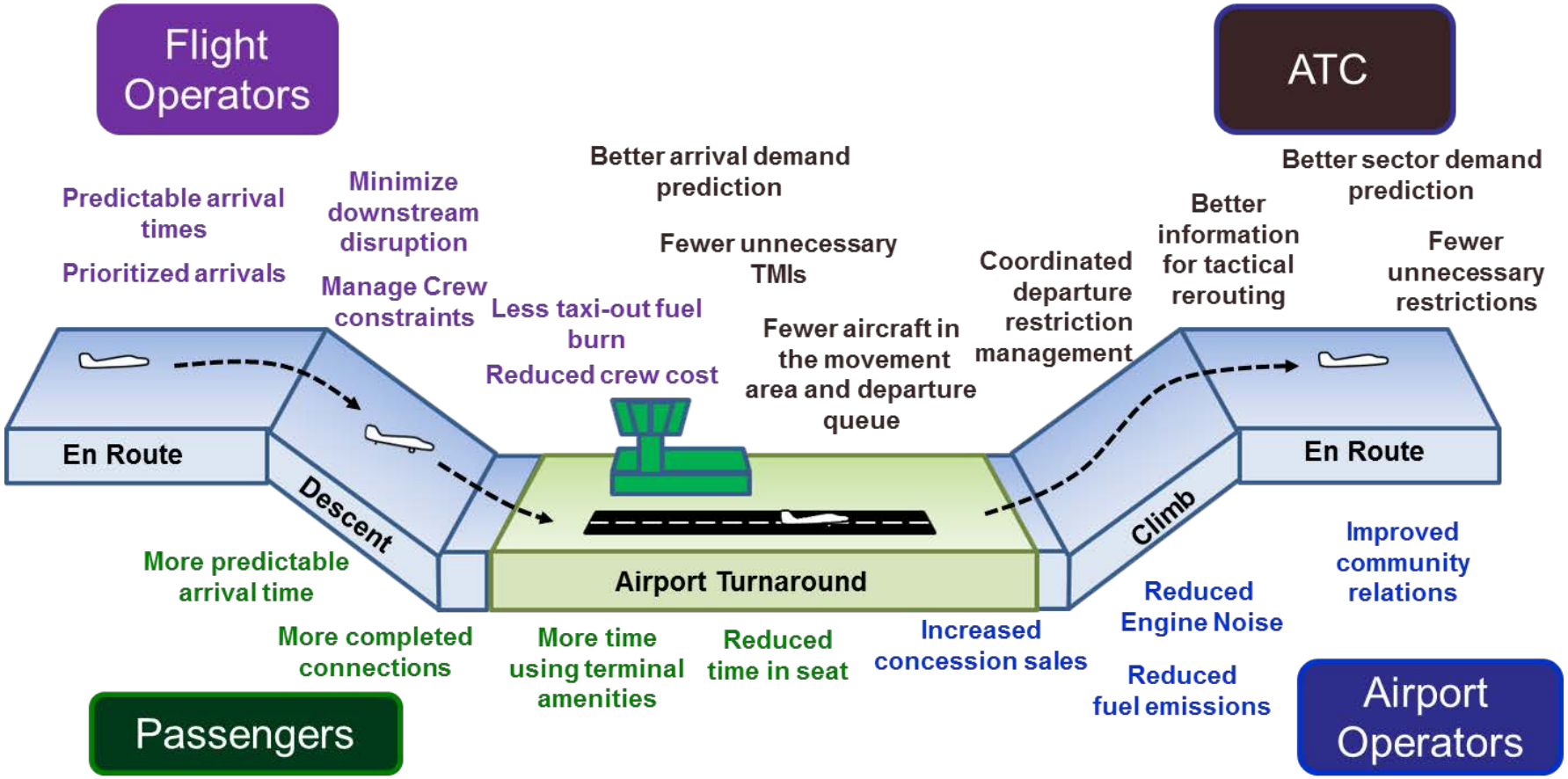
Enhances decision making

Establishes common situational awareness

Improves predictability and existing Decision Support Tools



The Turn Process
Central Component to Improving Surface Efficiencies



Collaborative management of airport surface traffic flows via data exchange is pivotal to achieving estimated benefits of TFDM

Today's Agenda

0830 - 0940	Discuss early results of ongoing evaluation of Trajectory Options Set (TOS) with Surface for Metroplex departures	Workshop Panel	Texas Learning Center
0940 - 0950	**Break**		
0950 - 1050	BREAKOUT 5 – Topic A		Texas Learning Center
	BREAKOUT 5 – Topic B		Trinity II
	BREAKOUT 5 – Topic C		Park West E/F
1050 - 1100	**Break**		
1100 - 1215	Opportunity for formulation input into NASA's future aviation plans (with NASA ATD and ATM-X projects)	NASA ATD and ATM-X Project Representatives	Texas Learning Center
1215 - 1345	**Lunch**	**Dover's Grille or Morsels (Omni) Shuttle to Torchy's Tacos & nearby eateries**	
1345 - 1445	BREAKOUT 7 – Topic A		Texas Learning Center
	BREAKOUT 7 – Topic B		Trinity II
	BREAKOUT 7 – Topic C		Park West E/F
1445 - 1455	**Break**		
1455 - 1555	BREAKOUT 8 – Topic A		Texas Learning Center
	BREAKOUT 8 – Topic B		Trinity II
	BREAKOUT 8 – Topic C		Park West E/F
1555 - 1605	**Break**		
1605 - 1705	Workshop wrap-up and discussion on any additional tech transfer needs of the ATD-2 team	Al Capps	Texas Learning Center
1705 - 1800	(Optional) Extra-Innings Q/A Session with ATD-2	ATD-2 Technical Lead Representatives	Trinity I (Demo Room)

5-Sep	5	0950 – 1050	Industry/FAA future needs/expectations for the implementation of TFDM into the NAS.	Understanding TMIs in the NAS (Part 2)	Simulation and modeling used in surface analysis
5-Sep	6	1100 – 1215	Opportunity for formulation input into NASA's future aviation plans (with NASA ATD and ATM-X projects)		
5-Sep	7	1345 – 1445	Substituting flights in TFDM with SWIM	Analytical evidence of surface compliance leading to more efficient overhead stream scheduling	Ramp Traffic Console Capabilities and Use in Operational Environment (part 1)
5-Sep	8	1455 – 1555	Benefits of good EOBTs to Surface Metering	Metroplex TOS Departures, initial results and next steps input	Ramp Traffic Console Capabilities and Use in Operational Environment (part 2)

Early Results of Ongoing Evaluation of Trajectory Options Set (TOS) With Surface for Metroplex Departures

- Panel Objectives
  - Discuss the preparation for and the early results of ATD-2, phase 3 testing with FAA and Airline representatives

- Panelists
  - Eric Chevalley (NASA ATD-2 Team)
  - Joseph Friend (DFW Tower)
  - Josh Griffith (Southwest Airlines)
  - Tim Niznik (American Airlines)
  - Ron Ooten (Southwest Airlines)
  - John Short (DFW Tower/NATCA National ATD Representative)
  - Mike Sterenchuk – (American Airlines)
  - Kenny West (Fort Worth Center)

- Panel Format
  - Panel Introductions (10 minutes)
  - Overview of ATD-2 Phase 3 (15 minutes)
  - Questions from moderator (25 minutes)
  - Questions from audience (20 minutes)

Discuss Early Results Of Ongoing Evaluation Of Trajectory Options Set (TOS) With Surface For Metroplex Departures

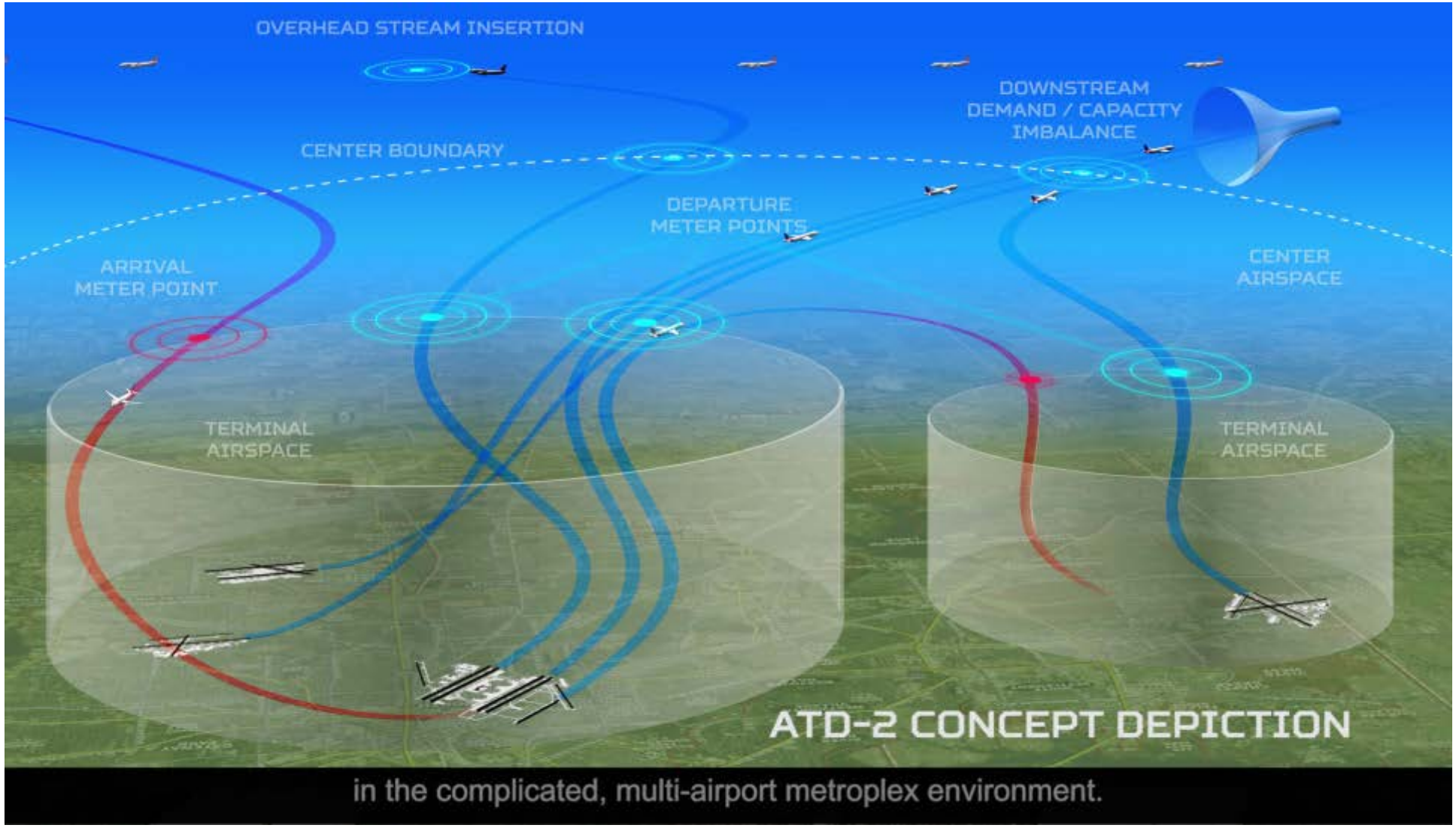
Discussion Panel

September 5, 2019

Greg Juro and Eric Chevalley

ATD-2 Field Demos Partners

Metroplex Airspace

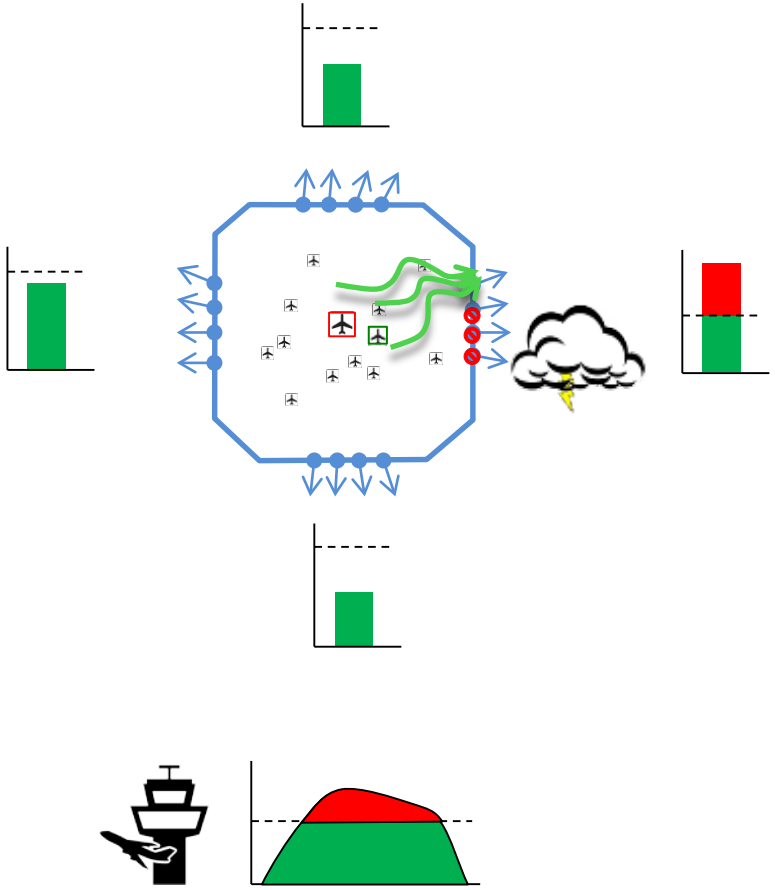


Overview video online at: http://aviationsystemsdivision.arc.nasa.gov/research/tactical/atd2.shtml

Demand Capacity Imbalances in D10 TRACON Airspace

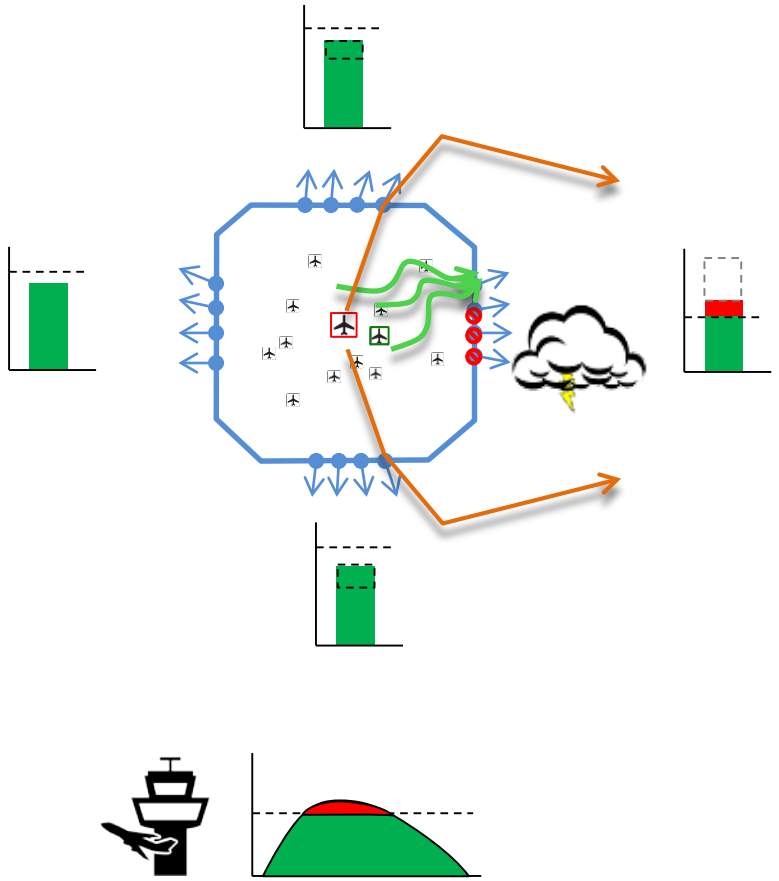
Fix compression caused by weather events near TRACON airspace

Currently



Load Balancing With TOS

(Trajectory Option Set)



Phase 3 Overview

Surface Meets TOS

A set of Capability that:

- Leverages IADS Surface predictive and scheduling technology (Phase 1-2)
- Expands IADS to the terminal boundary
- Provides Trajectory Option Set (TOS) to identify when alternative routes are available to reduce surface delay for departures out of the North Texas region
- Leverages CDM products, such as CDR, Playbook
- Identify potential solutions to bridge 3T technology gaps

Phase 3 Stormy 19 and 20 Objectives

Crawl – Walk – Run

- Stormy 19 (Exploratory Research in Summer 2019)
  - Identify Requirements through Shadow Sessions
  - Develop an initial capability in an *agile* manner
  - Incremental built of capability (3 micro-phases)
  - Test and use incrementally in operational environment
  - Collect data, observation, feedback
  - Identify monetizable benefits
  - Mature capability
  - Identify goals for Stormy 20

- Stormy 20 (Formal Evaluation)
  - Implement Lessons Learn from Stormy 19
  - Identify technology transfer deliverables
  - Develop larger capability leveraging SWIM components
  - Test and Collect data
  - Measure benefits

TOS Alternative Routes – Process Flow

1 Before Day-Of Ops. Formulate 'Static TOS'

- ATC and operators identify acceptable alternative routes to be notified on
- Routes codified in ATD-2 static adaptation
- NASA and operators agree on Relative Trajectory Cost algorithm

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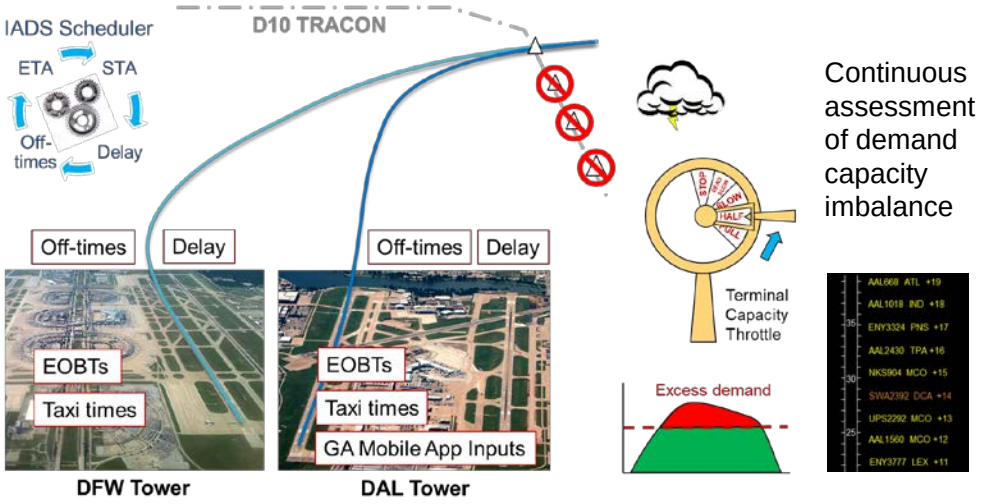
2 Terminal Predictive Engine Determines Impact



Continuous assessment of demand capacity imbalance

3 'Candidate TOS' are Presented to Operators

- Assess delay savings on alternative routes
- When the RTC thresholds are met, the operator is informed of 'candidate TOS routes"
- Operators can then submit an acceptable TOS

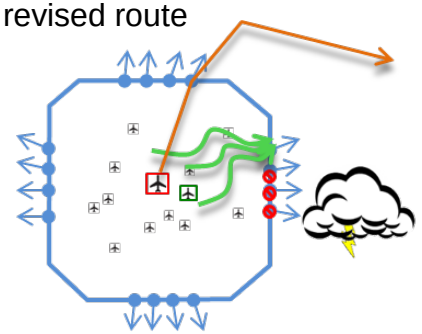
Delay savings > Relative Trajectory Cost ?

Settings Filter Field Color Alerting — **Flight TOS**

Callsign	Dest	Route	CDR	Dist	+nm	Terminal Gate	RTC	Delay	Delay Savings	Eligibility State	Coordination State	Scratch pad
AAL1560	MCO	KDFW MRSSH2 ZALEA CREEM CEW J2 OJHAP OTK PIGLT4 KMCO	--	880	--	EAST	--	+18	0	N/A	Filed Route	Crew time out 18:10
AAL1560	MCO	KDFW FORCK2 FORCK ELD MEI OTK PIGLT4 KMCO	DFWMCO0P	885	+5	EAST	+1	+18	0	Potential	Not Submitted	
AAL1560	MCO	KDFW AKUNA7 MLC RZC ARG MEM J41 SZW OTK PIGLT4 KMCO	DFWMCO1N	1112	+232	NORTH	+15	+0	-18	Candidate	Not Submitted	Coordination
AAL1560	MCO	KDFW DARTZ7 TNV IAH LCH J2 SZW OTK PIGLT4 KMCO	DFWMCO1S	998	+118	SOUTH	+30	+2	-16	Potential	Not Submitted	Op. Submit / Undo

4 Operator Submitted TOS's Presented to ATC

- ATC is notified of the Operator approved TOS route
- ATC evaluates the TOS routes for operational feasibility. If approved, all users are notified, the filed route is amended, and pilots are cleared on the revised route

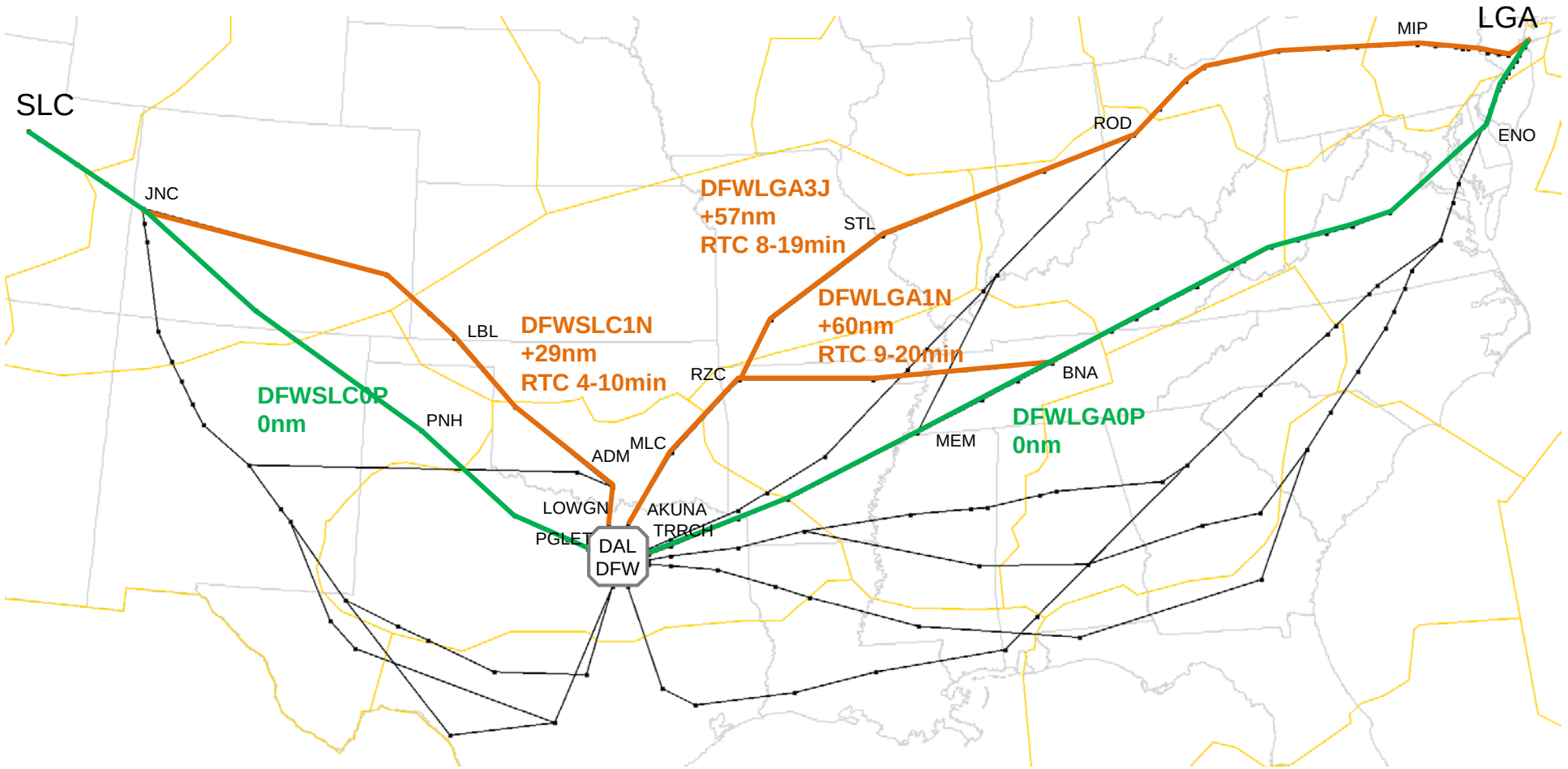


5 Post Ops Eval

- Benefits
- Lessons
- Refinements
- Data
- Reports

Stormy 19 – Static TOS

CDRs as TOS alternative routes



Restriction Handling

- ZFW TMC enters the restriction in NTML
  - ATD-2 system parses the TfmFlow data (SWIM)
    Looks for restrictions for given requesting and providing facilities
  - ATD-2 system then populates the clients with the restriction information

- Alternatively, TMC personnel may enter or modify the restriction in the NASA user interface

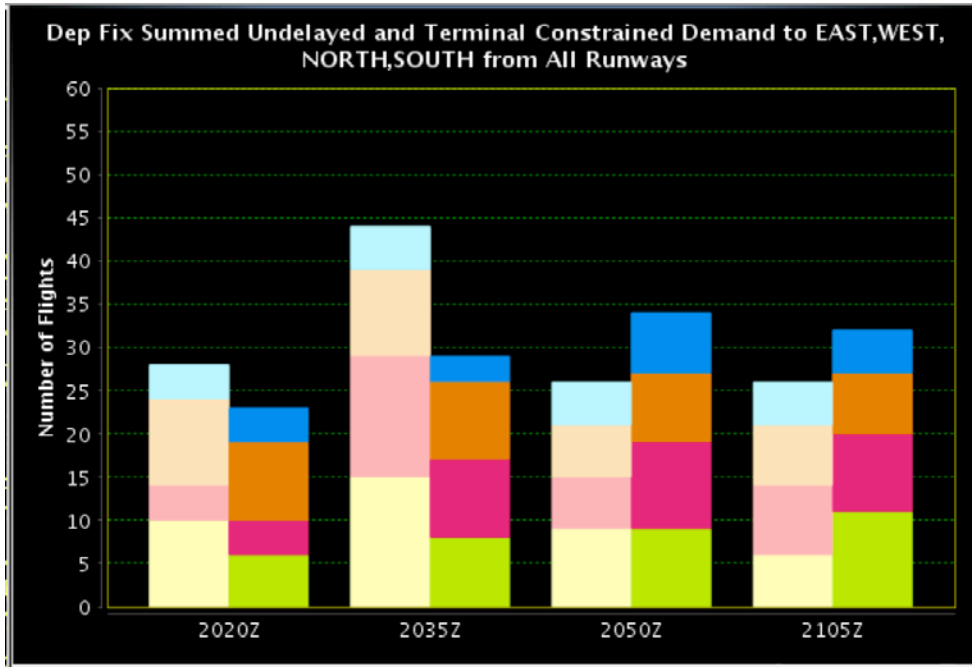
Timeline & Graph

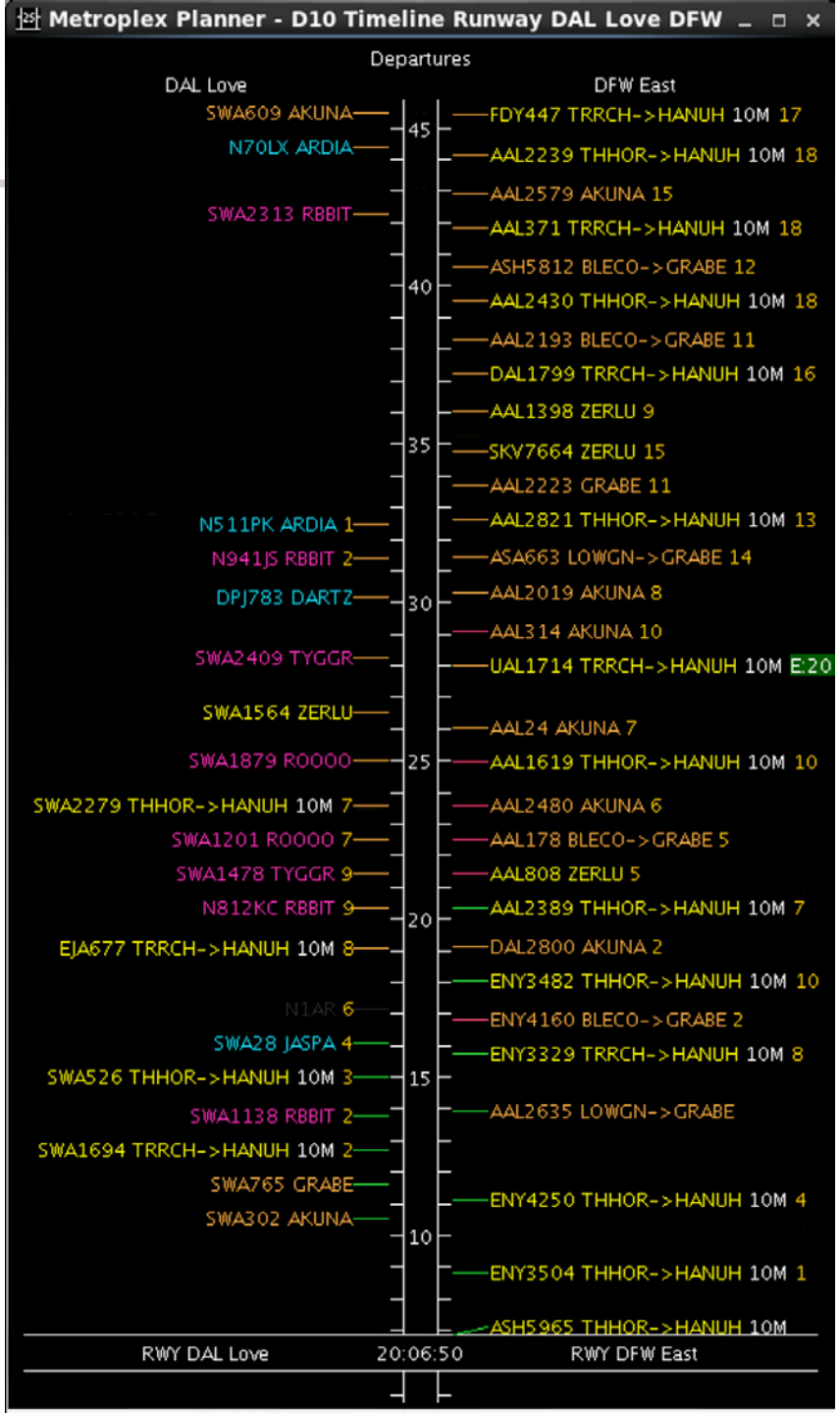
Timelines at Runways or Departure Fixes

- Undelayed and Estimated Times
- Delay
- TMIs
- TOS State
- Flight data

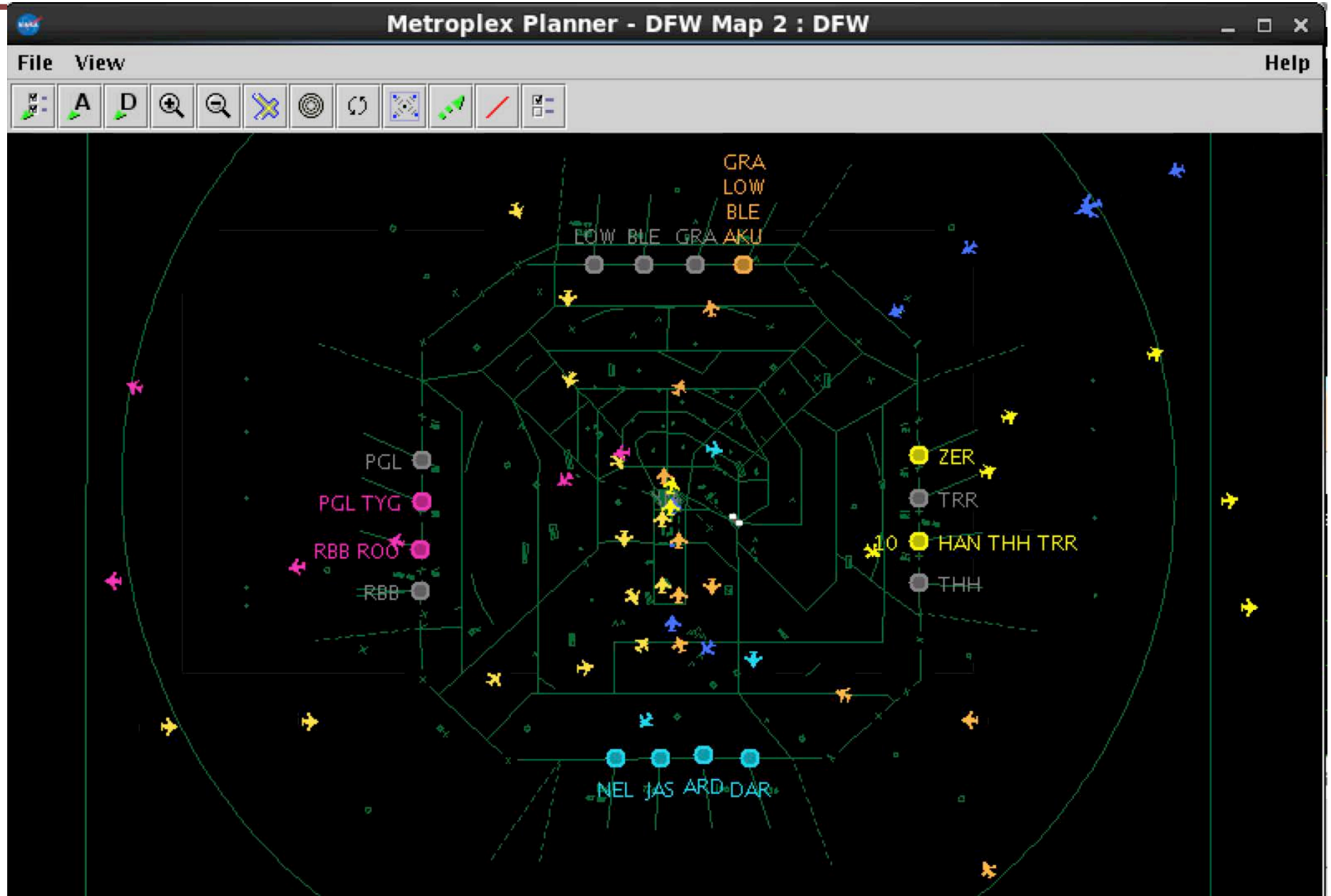
Graph at Runways or Departures Fixes

- Undelayed and Estimated demand





Map


Metroplex Planner - DFW Map 2 : DFW
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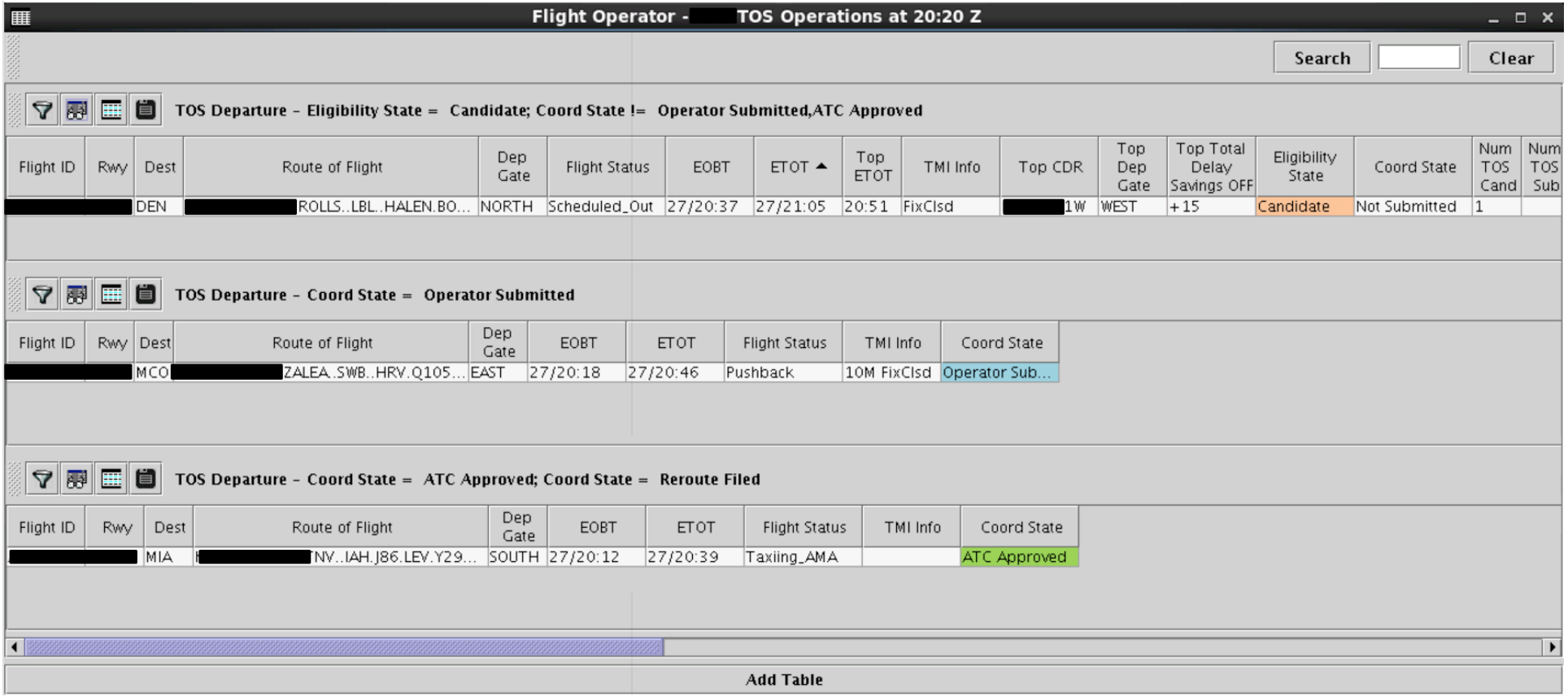
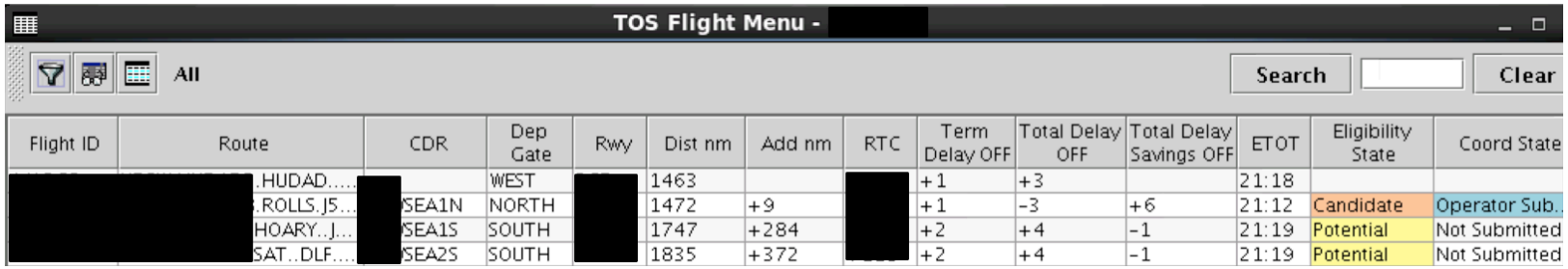
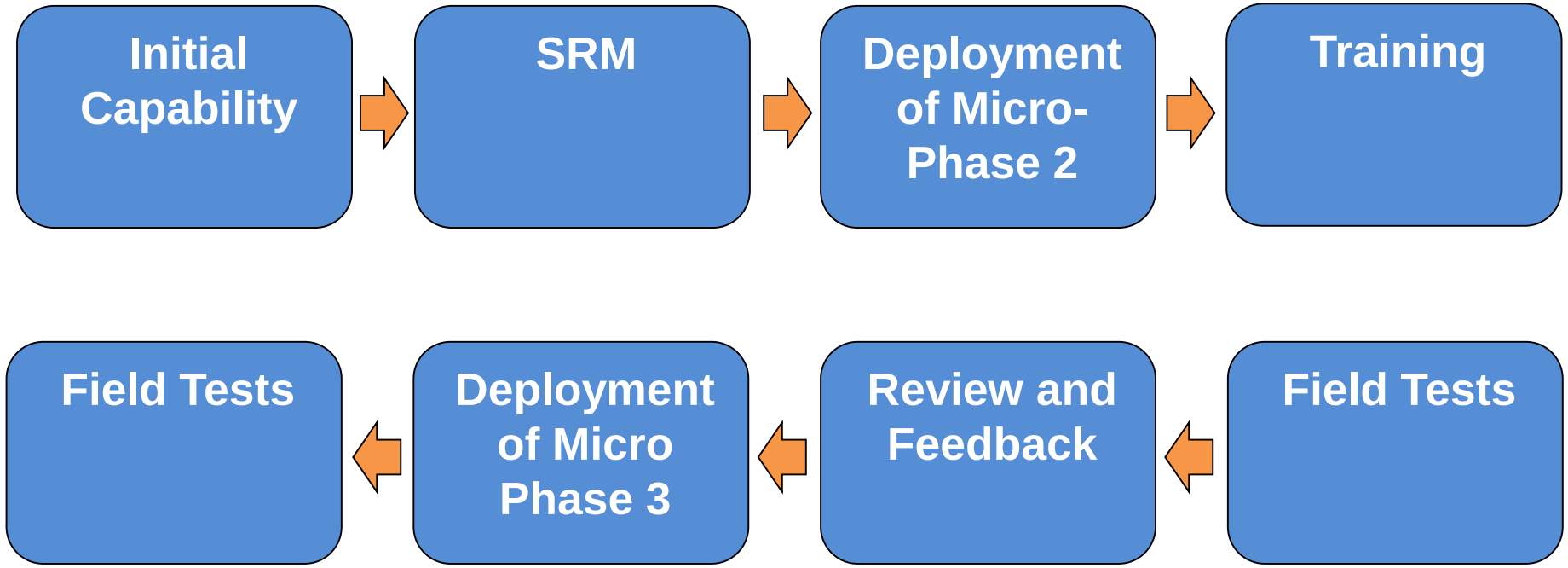
TOS Operation Table & Flight TOS Menu





Stormy 19 – Agile Development And Field Test



As of Aug 26th, we logged 54h during 11 days of operational tests from Mid-July to Mid-August

Results as of August 26

- 23 alternative routes for 23 flights were SUBMITTED by Flight Operators
  - 8 times when 10-15 MIT (with and without fix closed)
  - 15 times when no TMI
- 3 routes were then unsubmitted

- 16 alternative routes were APPROVED by ATC
  - 7 times when 10-15 MIT (with or without fix closed)
  - 9 times when no TMI

- 10 reroutes were filed (amended) by ATC

- 8 flights actually flew an alternative route
  - Total of ***49.5min of estimated delay savings*** (avg 6.1min)
  - 3 times when MITs – total of ***28.5min of estimated delay savings*** (avg 9.5min)
  - 5 times when no TMI – total of ***21.1min of estimated delay savings*** (avg 4.2min)

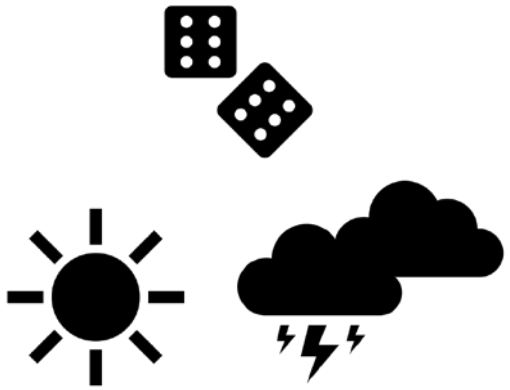
- 6 procedural tests were conducted without executing any reroute
- 2 flight crew rejected the reroute based on mx and wx issues

Major Benefits and Needs Identified So Far

- Identified Benefits
  - Parsing and disseminating NTML entries
  - Computation of Demand prediction and Capacity Constraints at the runway and at the departure fixes
  - Identification of Surface Delays and Delay Savings Estimates
  - Awareness of TOS routes
  - Use of data to identify flights that are CPDLC-DCL ready

- Identified Needs (near and far term)
  - Near Term
    - Provide ability to En Route STMCs to Manage/Advise TOS CDR route availability (TMI or WX)
    - Detect when NAS Wide TMI restrictions impact the “O” in the TOS
  - Far Term
    - Submit TOS to SWIM
    - Modify routes as needed (WX)
    - Modify RTC as needed

Panel Discussion



This Morning's Agenda

AGENDA
WEDNESDAY, SEPTEMBER 4, 2019

Time	Description	Presenter	Location
0730 - 0800	Registration		Fountain View
0800 - 0815	Welcome	Akbar Sultan, NASA	Texas Learning Center
0815 - 0845	Workshop Overview and Perspectives	Al Capps	Texas Learning Center
0845 - 1000	Preparing for the Transition to TFDM and a Data-Driven NAS. Perspectives from Industry and FAA leaders	Workshop Panel	Texas Learning Center
1000 - 1015	**Break**		
1015 - 1130	BREAKOUT 1 – Topic A		Texas Learning Center
	BREAKOUT 1 – Topic B		Trinity II
	BREAKOUT 1 – Topic C		Park West E/F
1130 - 1245	**Lunch**	**Dover's Grille or Morsels (Omni) Shuttle to Salata & nearby eateries**	

Color	Workshop Tracks – Descriptions Below
Yellow	Surface System Capabilities (TFDM pre-cursor lessons learned)
Orange	Understanding and Quantifying NAS Performance and Benefits (Analytical Focus)
Grey	Understanding TFDM from a multi-system decision support viewpoint
Green	Future Vision and Needs of the NAS (Enabled by TFDM, SWIM and collaboration)

Table 1- Legend of Available Tracks

Breakout Sessions Overview

Submit your questions online via our NASA Conference I/O tool; see arc.cnf.io links below for each room

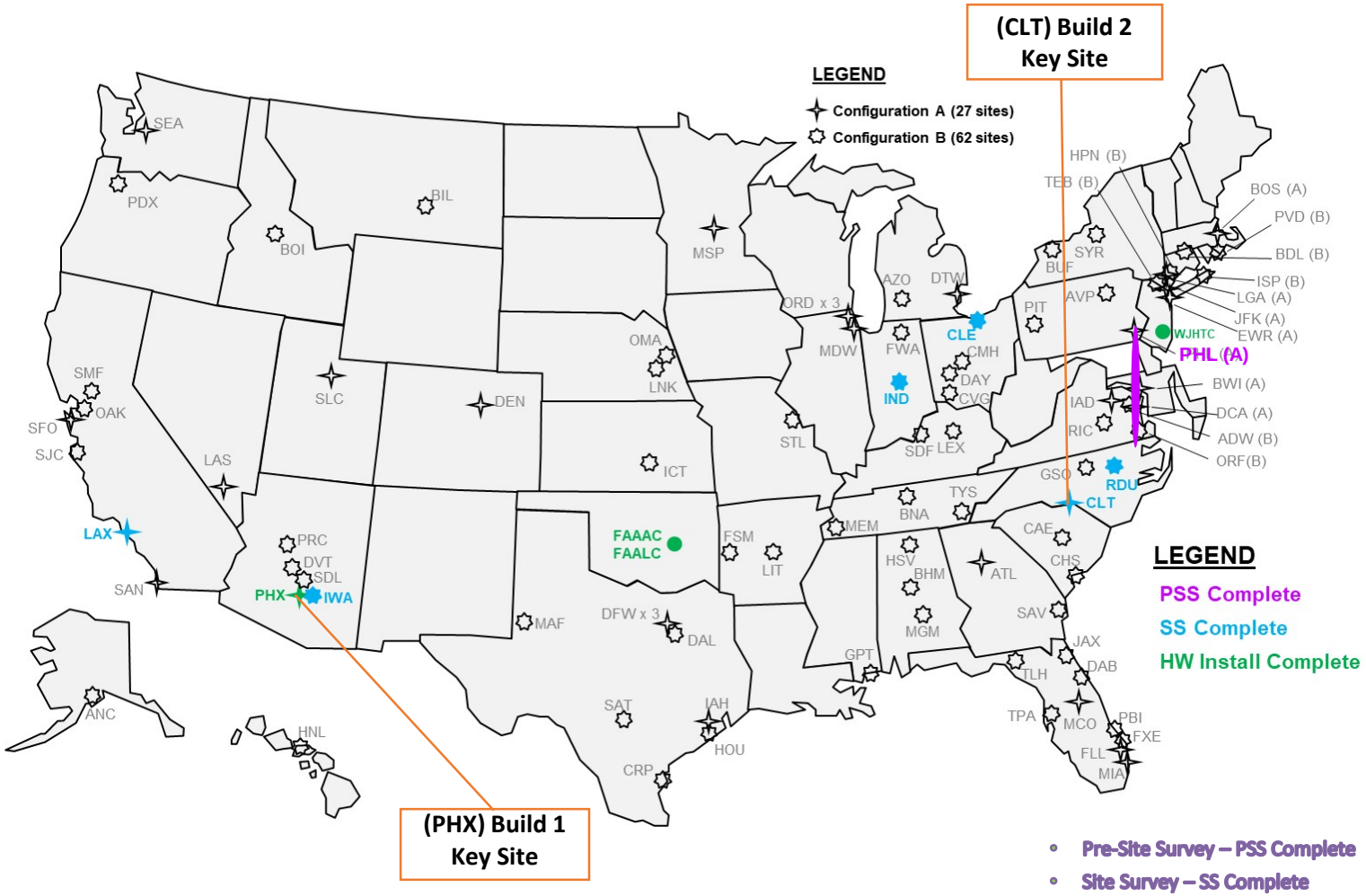
Day	Breakout	Time	Topic A - Texas Learning Center //arc.cnf.io/sessions/qznr	Topic B – Trinity II //arc.cnf.io/sessions/zynb	Topic C - Park West E/F //arc.cnf.io/sessions/hn3b
4-Sep	1	1015 – 1130	'Fuser in the cloud' overview and latest updates/needs	Future surface decision support overview (with ATD-2 demo)	SWIM-Fused data products used by ATD-2 analysts for quantifying NAS performance and benefits (part 1)
4-Sep	2	1245 – 1345	Latest strategic surface metering system and progress status in CLT (extending freeze horizon)	Understanding TMIs in the NAS (Part 1)	SWIM-Fused data products used by ATD-2 analysts for quantifying NAS performance and benefits (part 2)

Day 2 Wrap Up

1605 - 1705	Workshop wrap-up and discussion on any additional tech transfer needs of the ATD-2 team	Al Capps	Texas Learning Center
1705 - 1800	(Optional) Extra-Innings Q/A Session with ATD-2	ATD-2 Technical Lead Representatives	Trinity I (Demo Room)

- Summary of feedback and additional ATD-2 tech transfer input
- Ongoing work activities
  - TFDM pre-cursor
  - SWIFT, Fuser in the Cloud, Data-driven Finale
  - Surface meets TOS
  - Future Work Formulation
- Closing

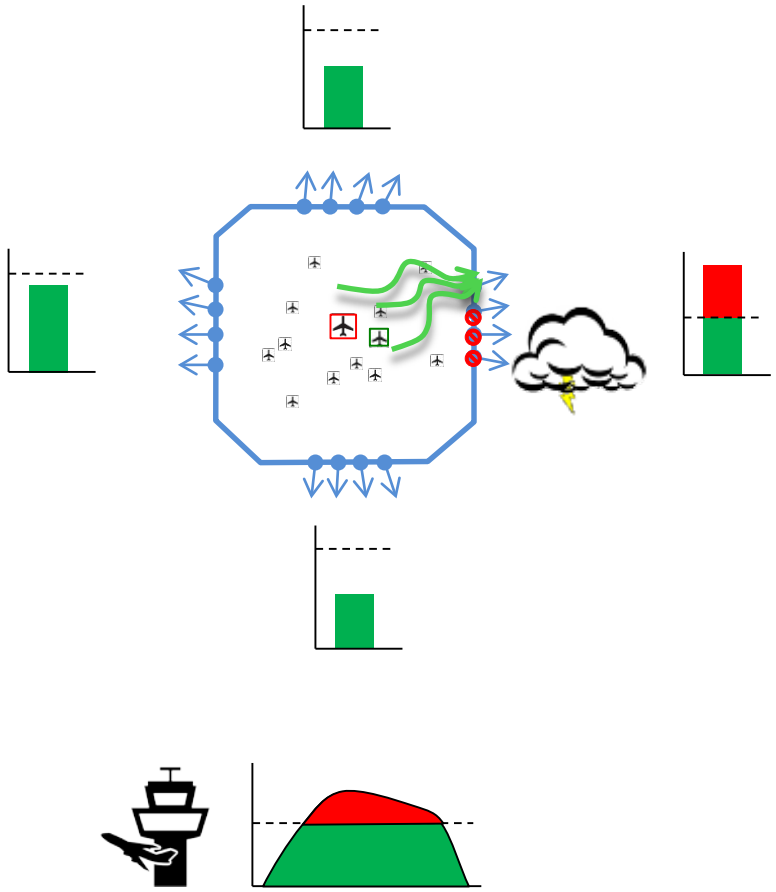
Implementation Sites by Configuration



Demand Capacity Imbalances in D10 TRACON Airspace

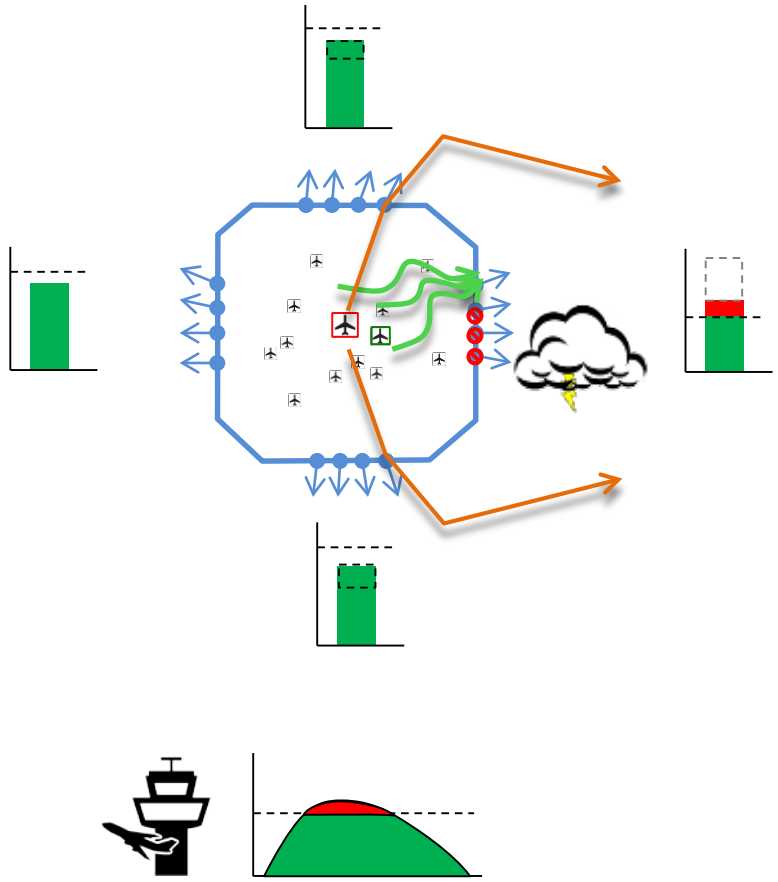
Fix compression caused by weather events near TRACON airspace

Currently



Load Balancing With TOS

(Trajectory Option Set)



- **SWIFT Workshop #8:**
  - **Date: November 7, 2019**
  - **Location: Delta Airlines @ Atlanta, GA**

- **https://www.faa.gov/air_traffic/technology/swim/swift/**

Building on the Pathfinder - NAS Services in the Cloud Examples

Producer

- TFMS
- TBFM
- TFDM
- ERAM
- STARS
- Surface

SWIM

Services

Congestion Prediction

Fuser Service

Options Identification

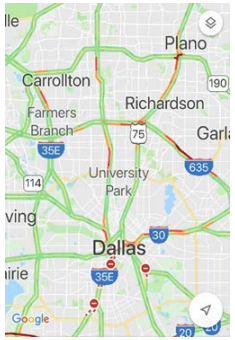
The same Fused data that drives ATD-2 is used to build new services **without additional needs on the FAA systems**. Examples are described on the following slides.

Consumer

Cloud

Cloud

Cloud

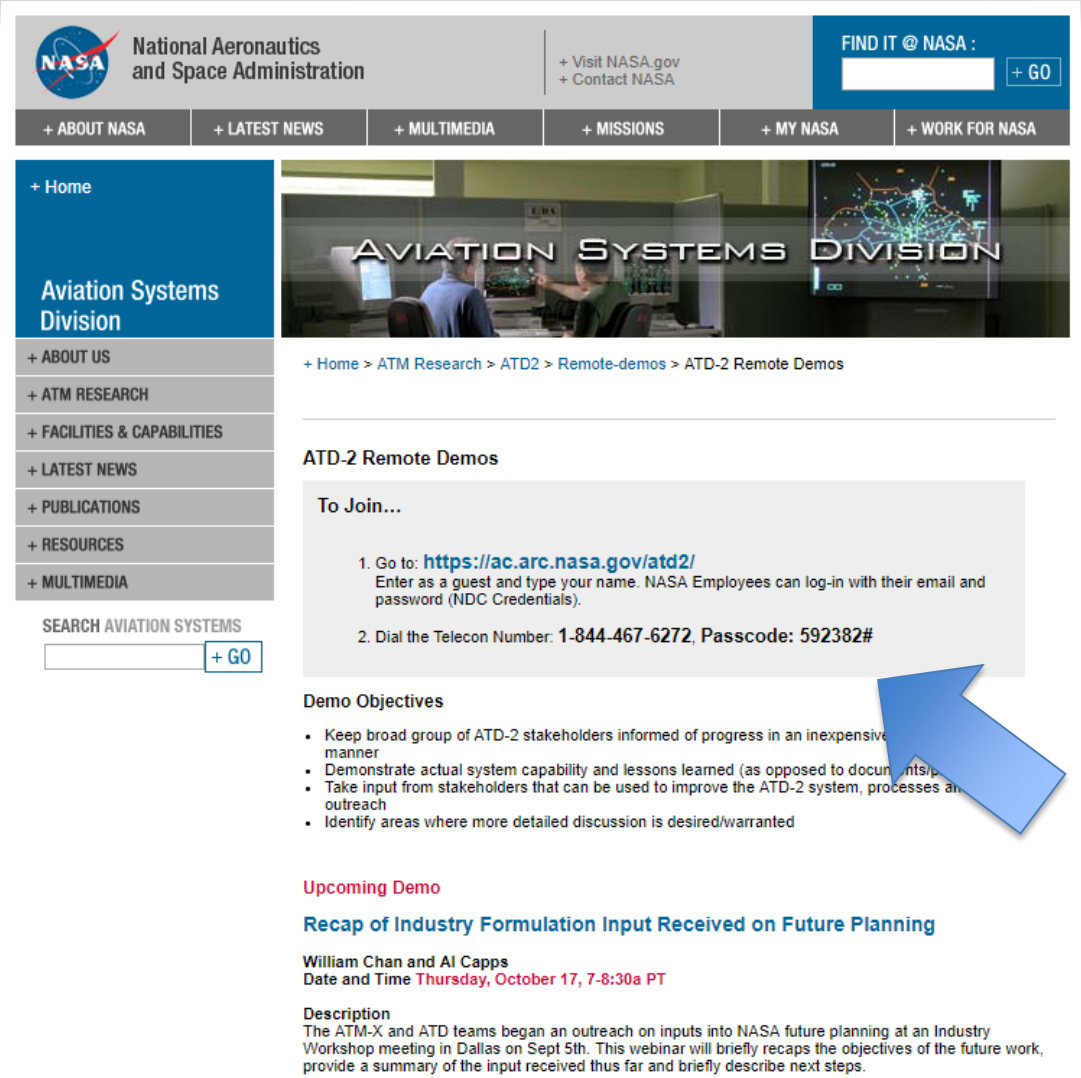


Fuser in the Cloud

Real-time trajectory synchronization data to help construct ***your New* Service**

In this concept, the 'Fuser in the cloud' is published to cloud data stream. This allows others to innovate (and validate) with the same data NASA is using to build new community services.

Follow up Webinar- Continuing the Dialog



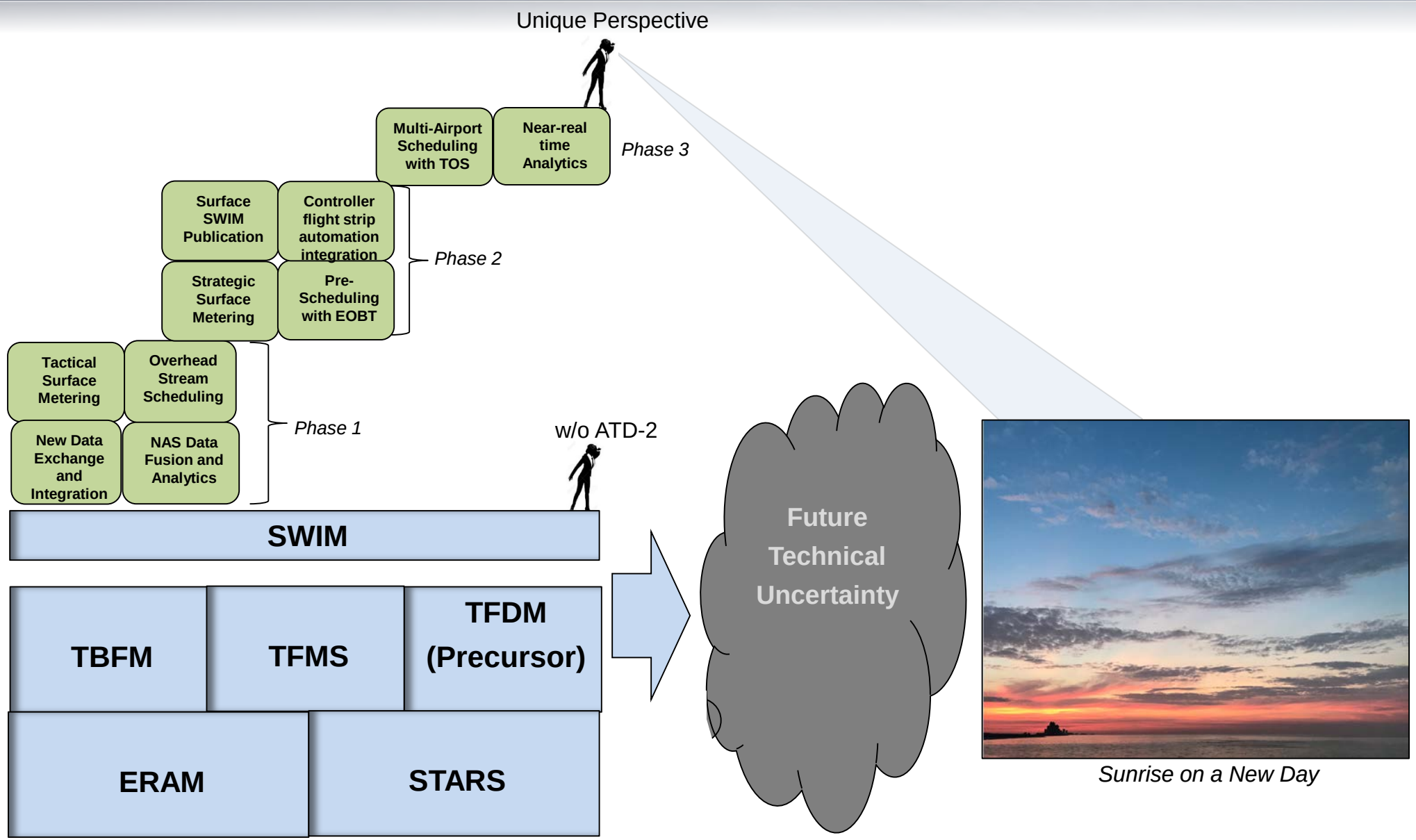
The input we are requesting today will likely require thoughtful consideration

We are offering follow-up opportunities to provide input

You are invited to join the follow-up Webinar on Oct 17th, 10-11:30 Eastern

- https://www.aviationsystemsdivision.arc.nasa.gov/research/atd2/remote-demos/index.shtml

Potential Future NAS



Sunrise on a New Day

Thank You!

Thank you for supporting this Workshop!