
# Real Time Metrics and Analysis of Integrated Arrival, Departure, and Surface Operations

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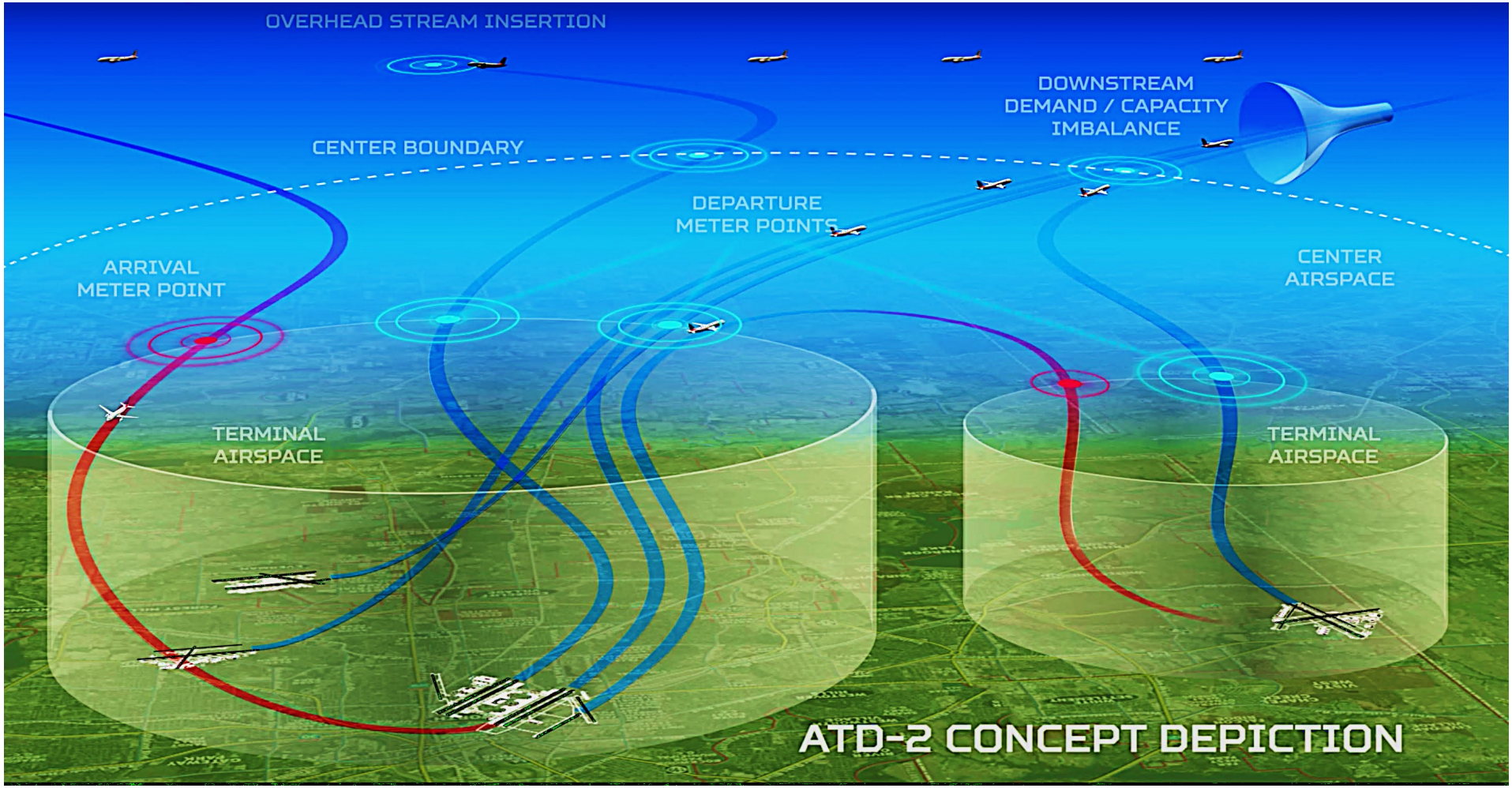
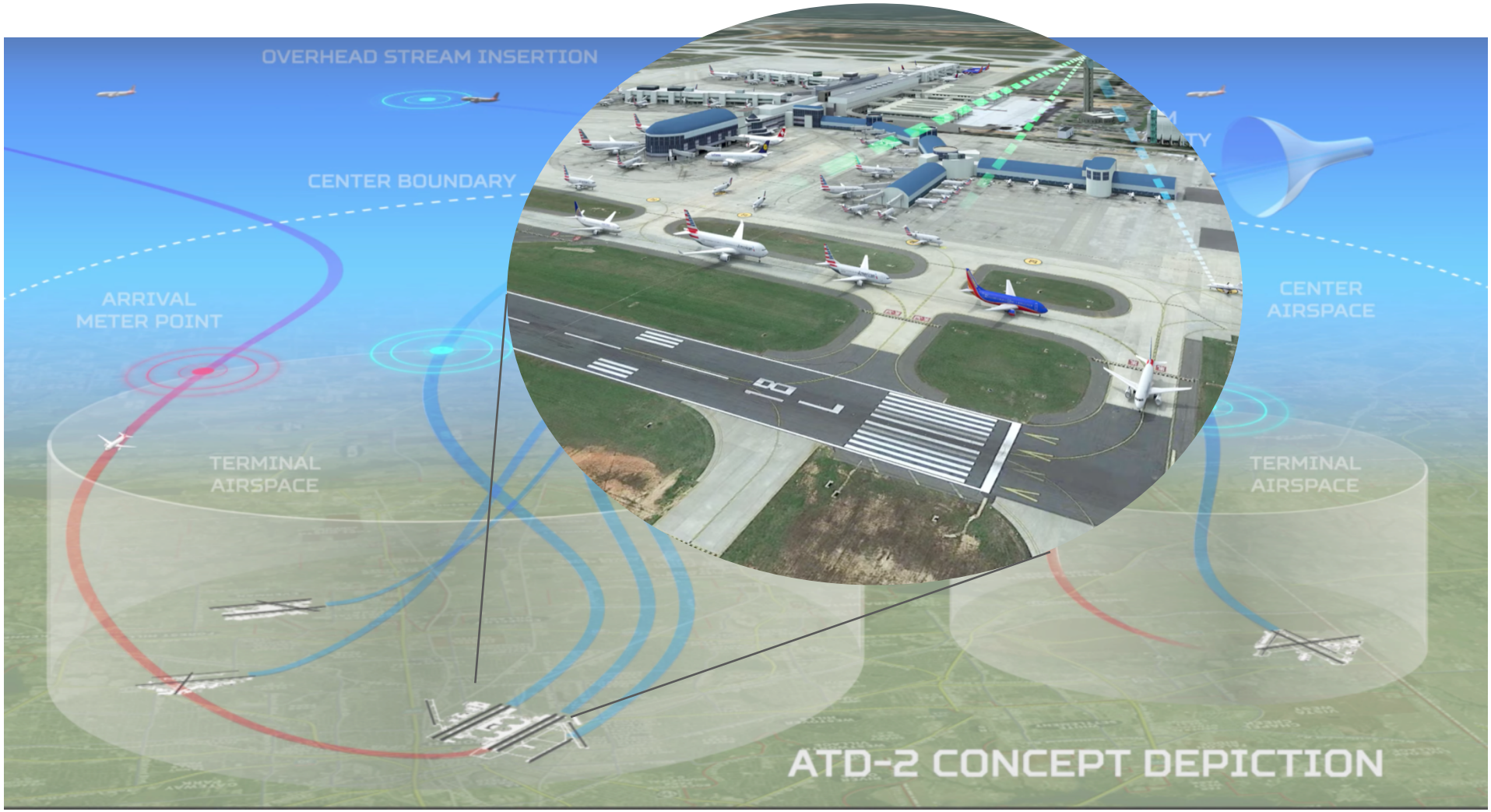
# Integrated Arrival, Departure, and Surface (IADS) Operations




Airspace Technology Demonstration 2 (ATD-2)

# Integrated Arrival, Departure, and Surface (IADS) Operations



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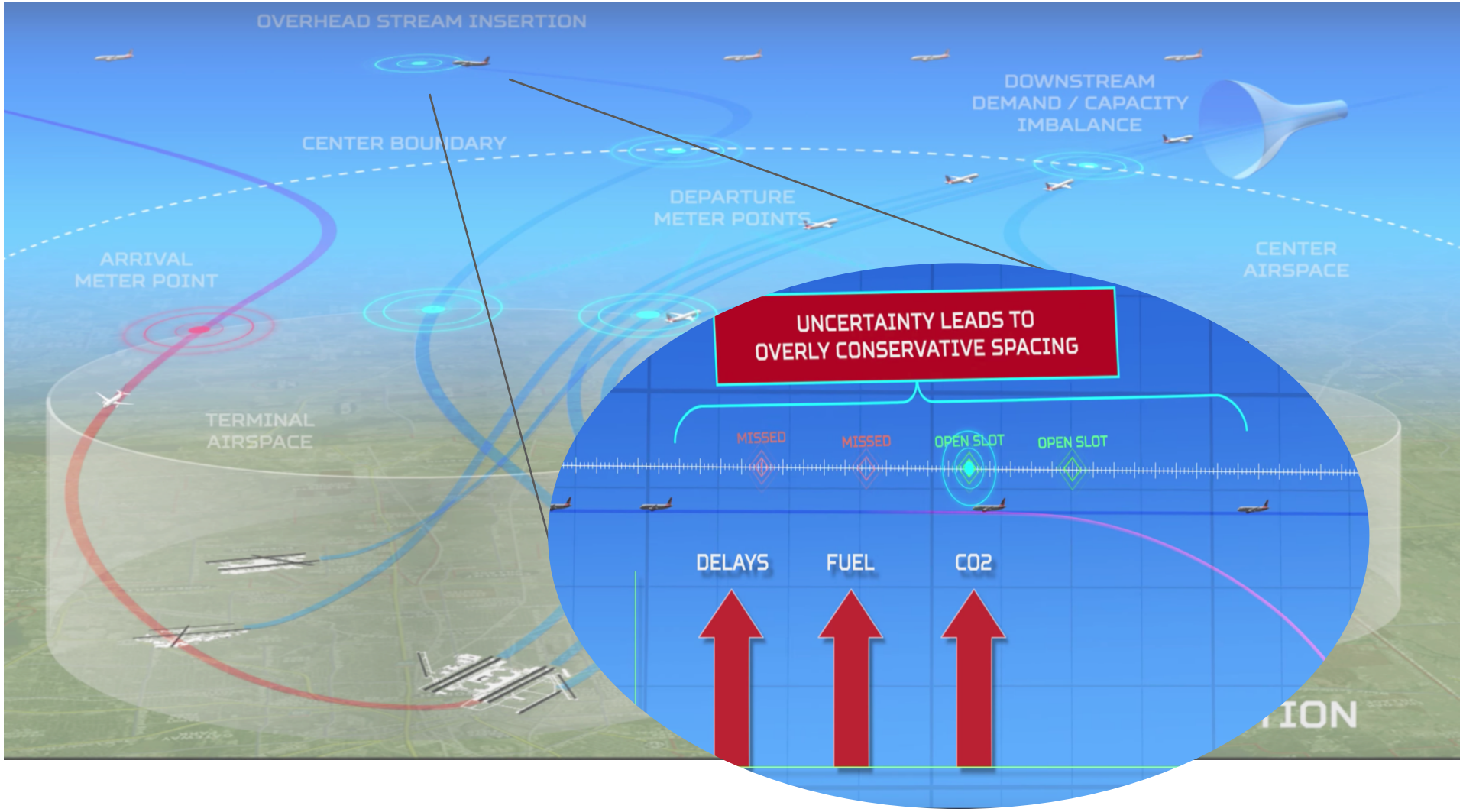

# Overview

- Airspace Technology Demonstration 2 (ATD-2) Background
- Motivation for real time monitoring tool and analysis and method of developing requirements
- Description of data sources
- User interface and initial metrics
- Next steps

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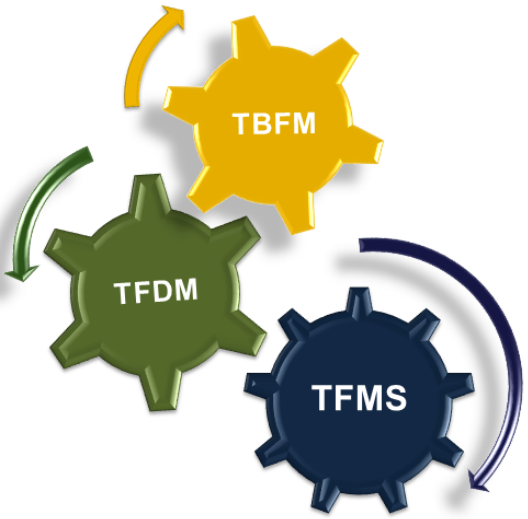
# Contributing Technologies to ATD-2

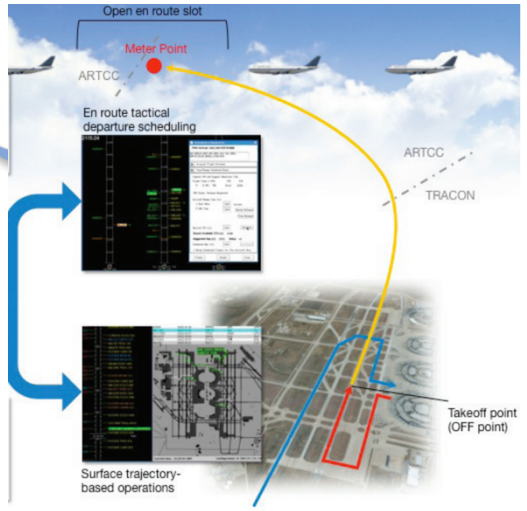

CDM
Collaborative
Decision Making




**Traffic Flow Management System (TFMS)**
Decision support system for planning and mitigating demand-capacity imbalances in the NAS.

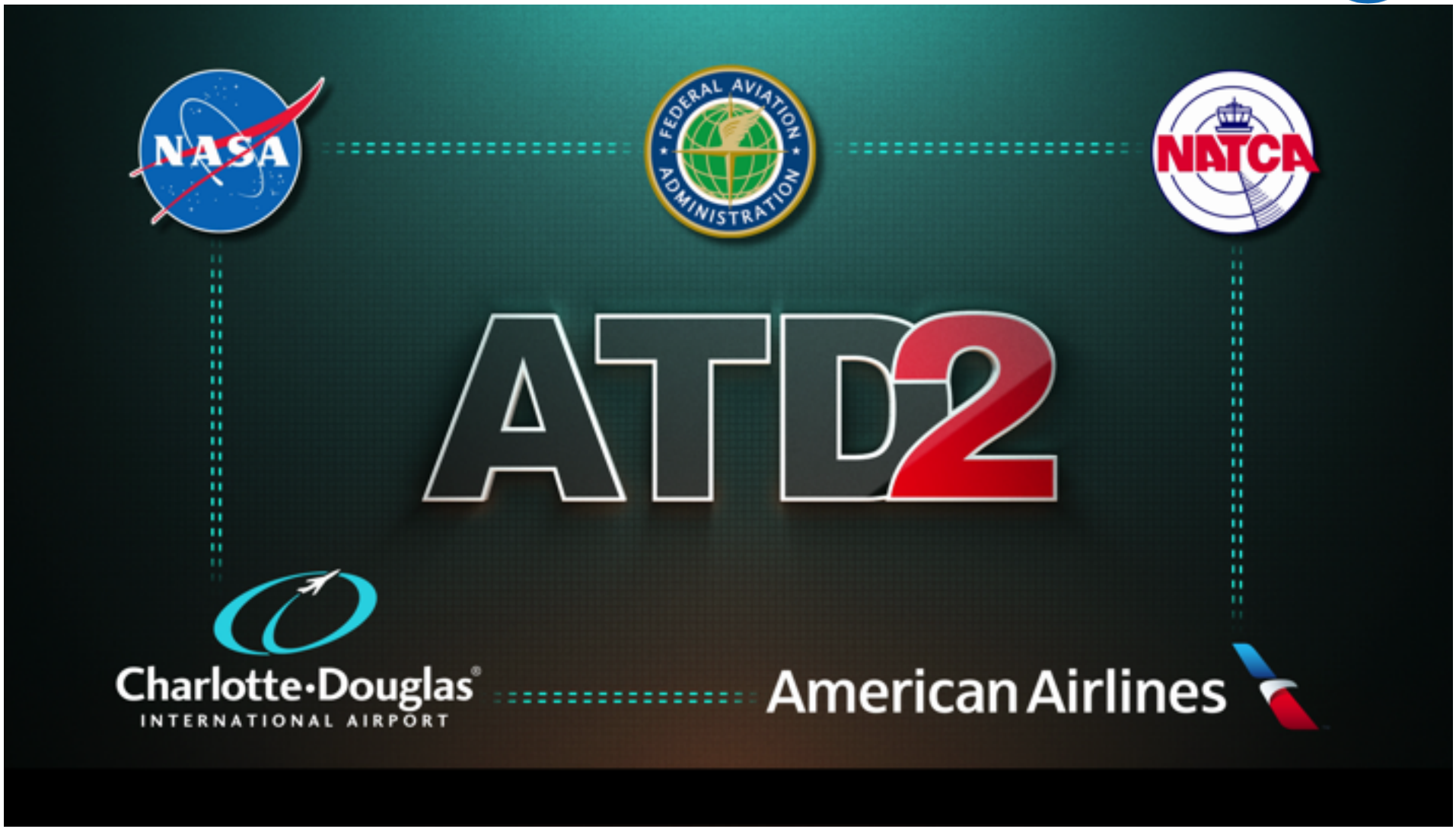
**Time-Based Flow Management (TBFM)**
Decision support system for metering based on time to optimize the flow of aircraft.

**Terminal Flight Data Management (TFDM)**
A new decision support system for airport surface management and ATC tower functions.




Precision Departure Release Capability (PDRC)

# ATD-2 Partners



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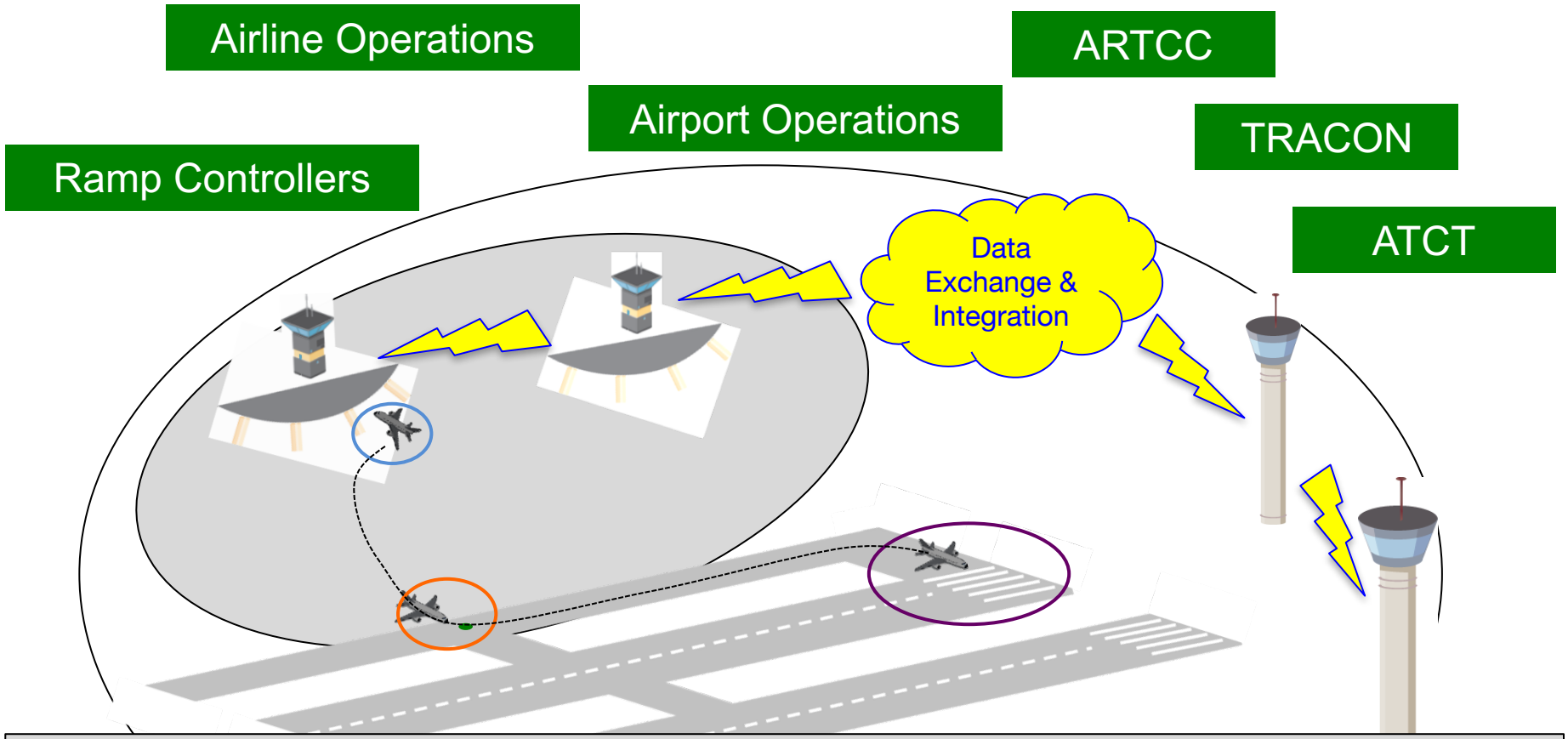
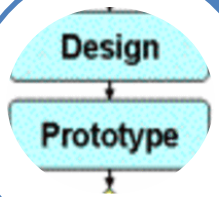
# IADS Data Exchange and Integration




| | | | | | | |
|---|---|---|---|---|---|---|
| *Flow Direction* | *APREQs/ CFRs* | *MIT restrictions* | *Grounds Stops* | *Dep Fix Closures* | *Gate Conflicts* | *Long on Board* |
| *Runway Utilization* | *Runway Assignments* | *EDCTs* | *Runway Closures* | *Flight Cancellations* | *Ramp Closures* | *Data quality updates* |

# Development of Real Time Dashboard




Initially developed as a researcher tool


Prototype development based on S-CDM and TFDM requirements

Field user sessions: agile development process led to user input and refinement of requirements

ATD-2 User Sessions

Held a series of nine user sessions with operational personnel from the Tower, Ramp, Center, and airport operations

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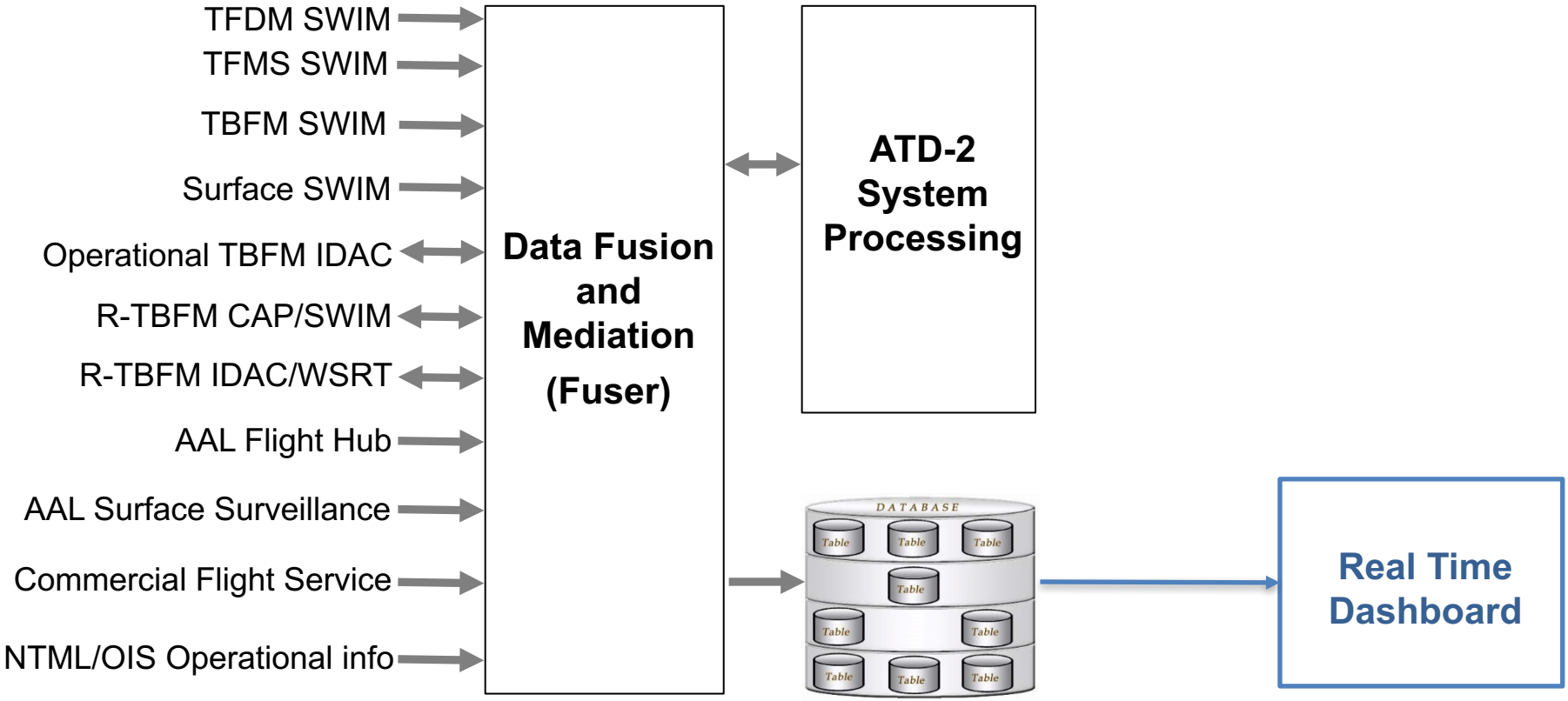
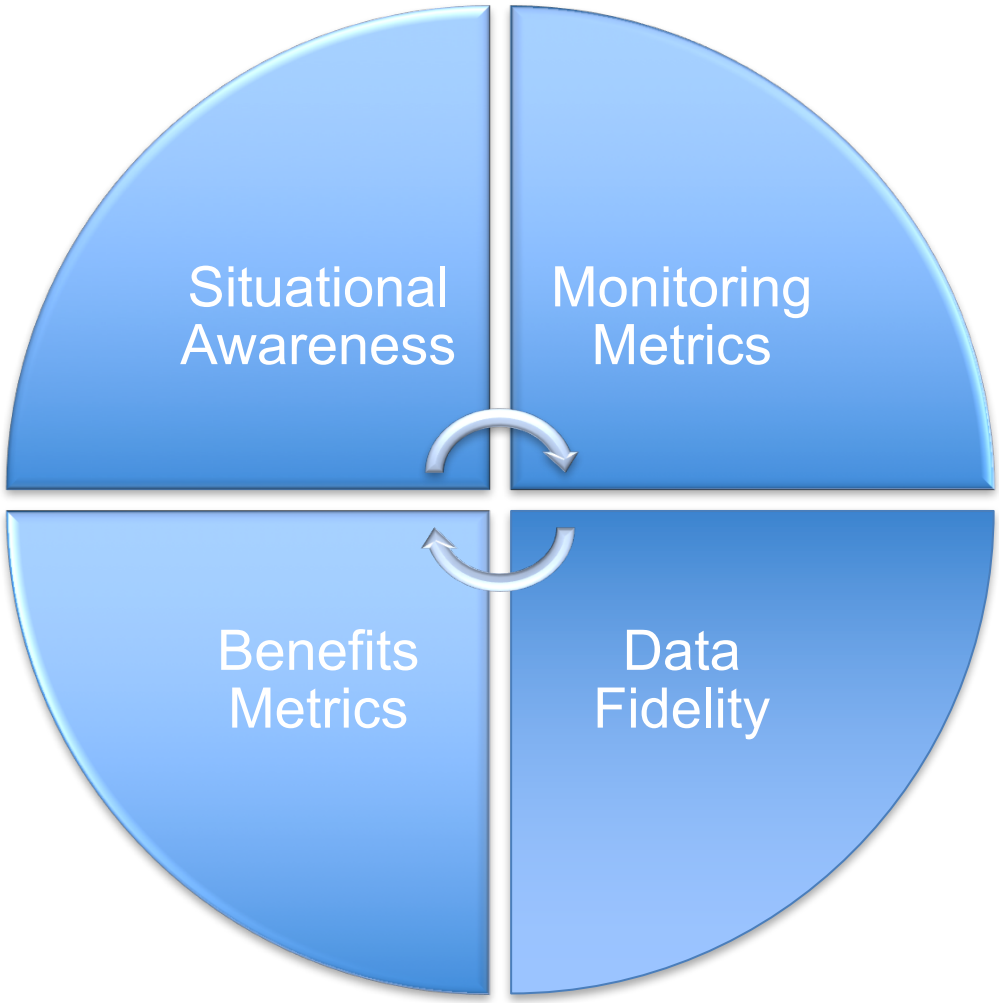
# ATD-2 Logical Data Interfaces

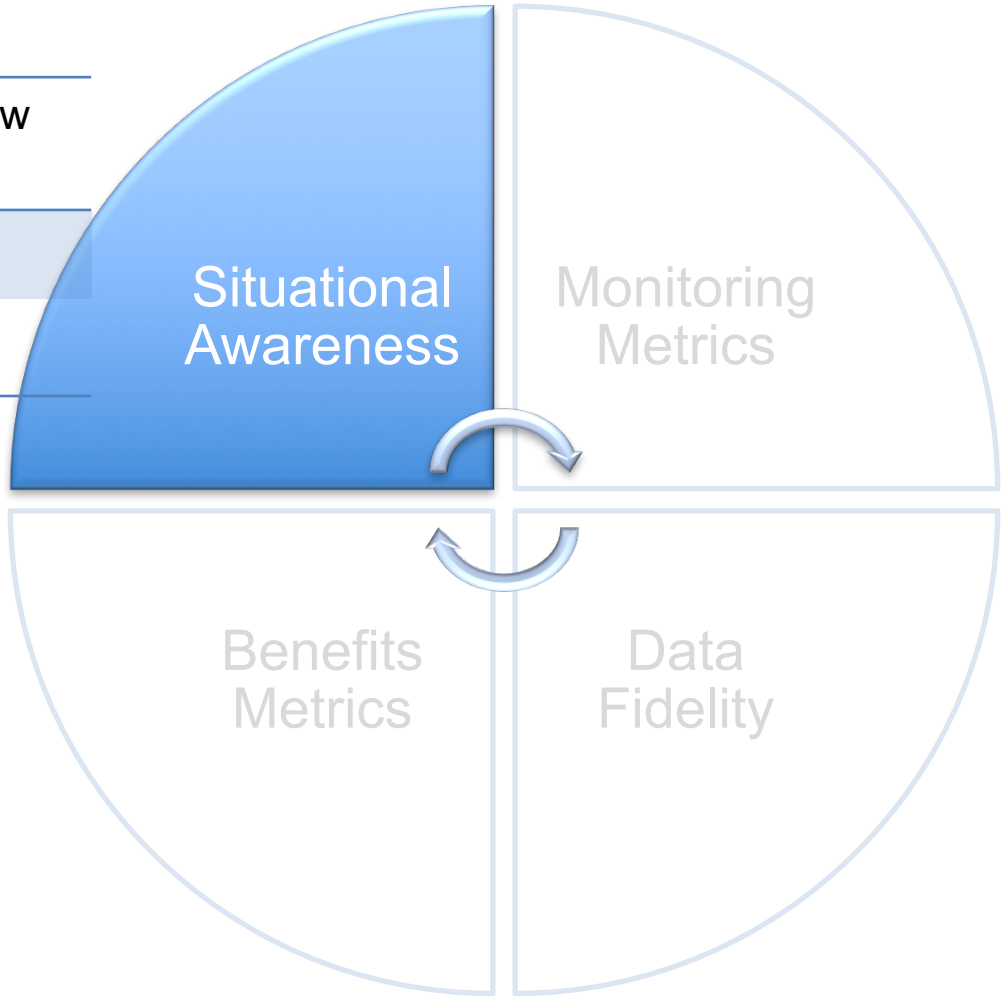


# General Functionality



# General Functionality

- Configuration and Flow Information
- Ramp Status
- Metering Mode



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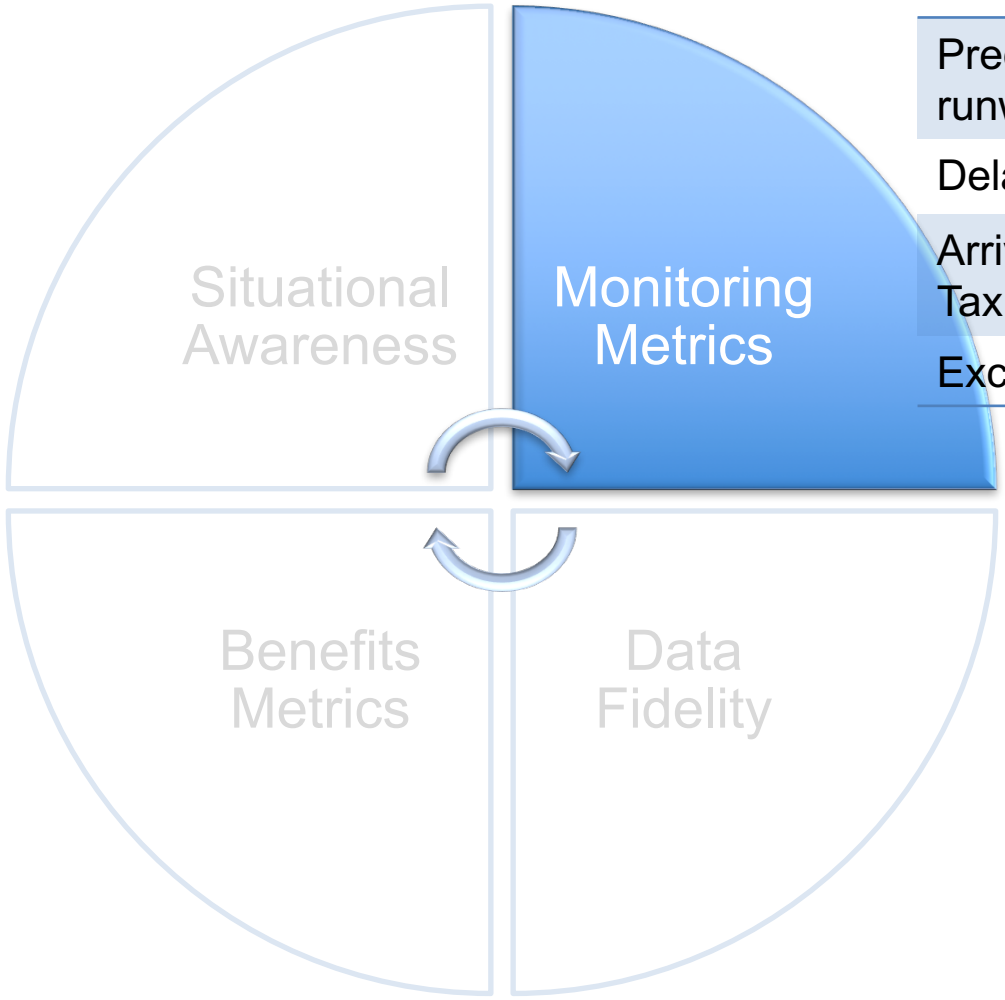
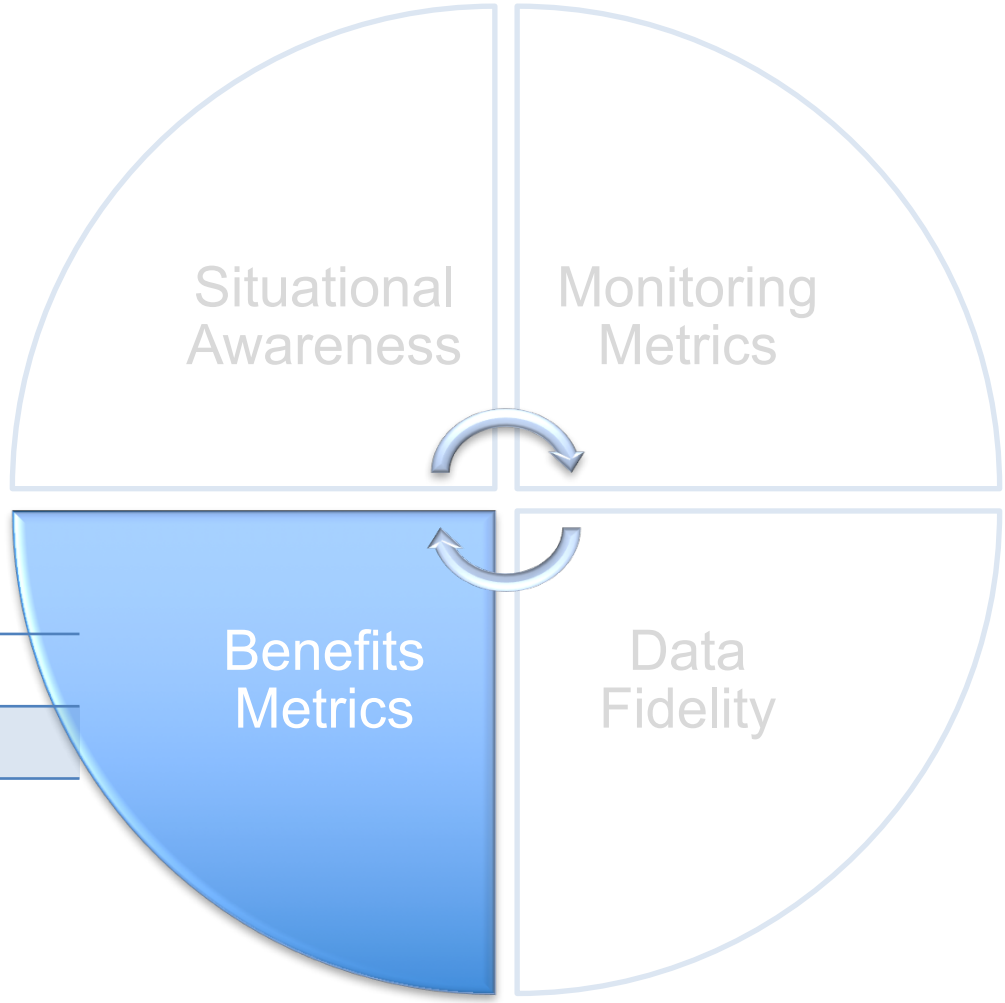


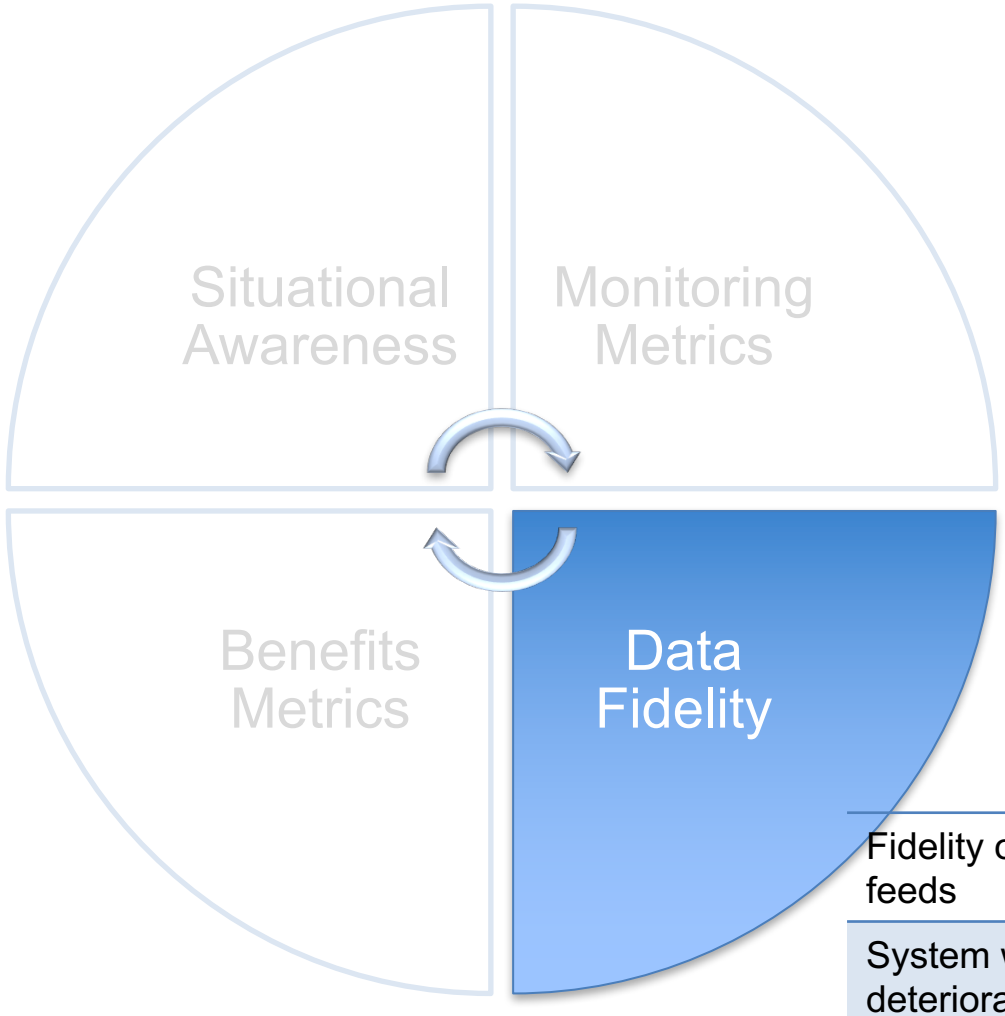

- Throughput
- Predicted and actual runway capacity rates
- Delay values
- Arrival and Departure Taxi Time
- Excess Queue Time

# General Functionality




- $CO_2$ Savings
- Monetary Benefits

# General Functionality




Fidelity of incoming data feeds

System wide data deterioration

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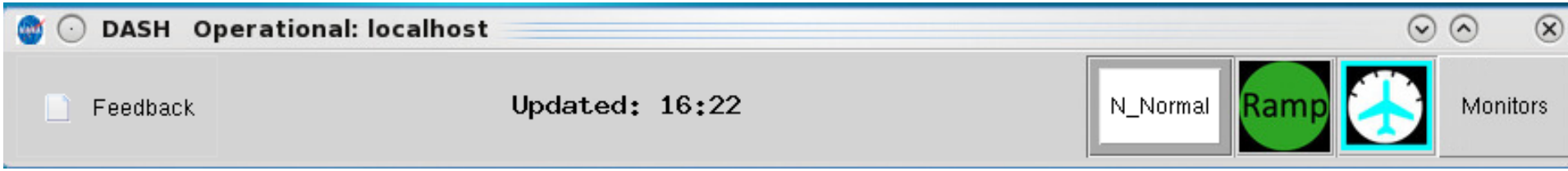
# Toolbar View

Current dashboard features both vertical and horizontal display capability

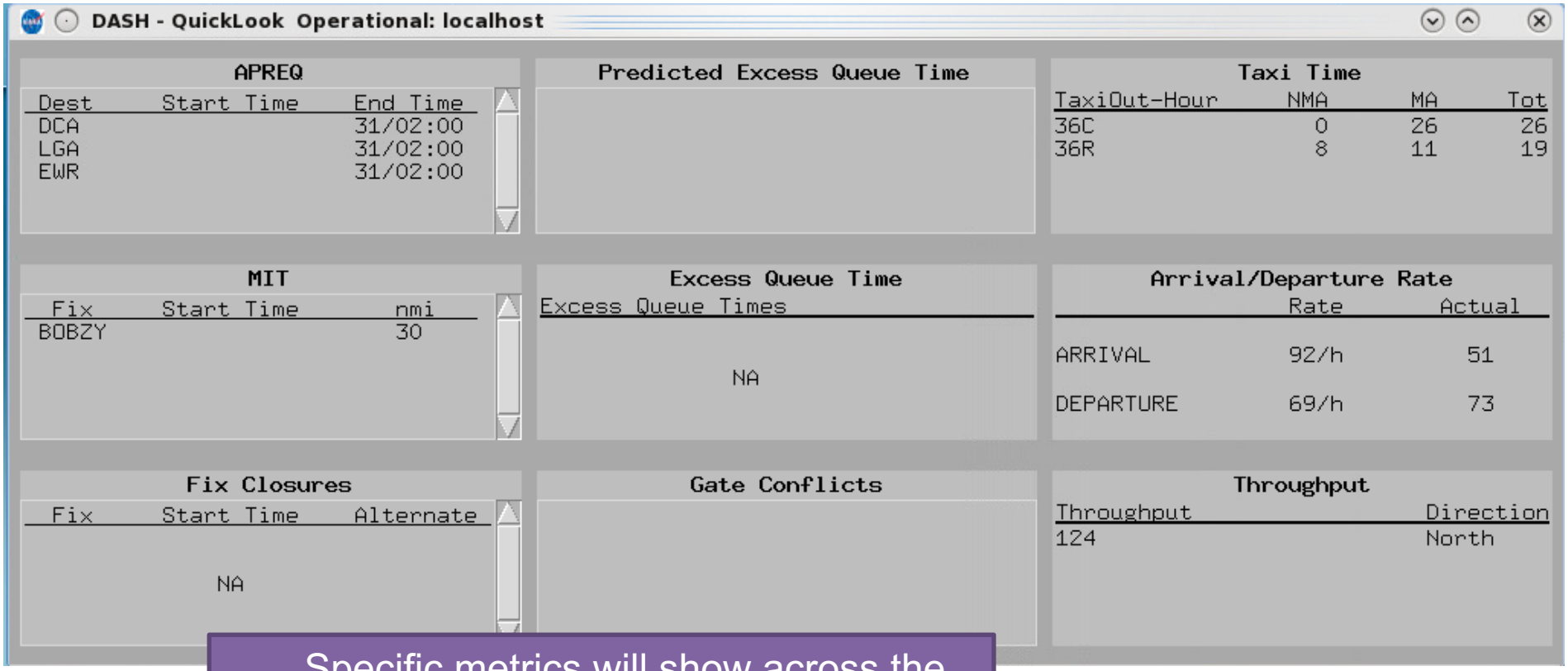
Consistent configuration information and other icons across the system




Feedback button with a link to an online form

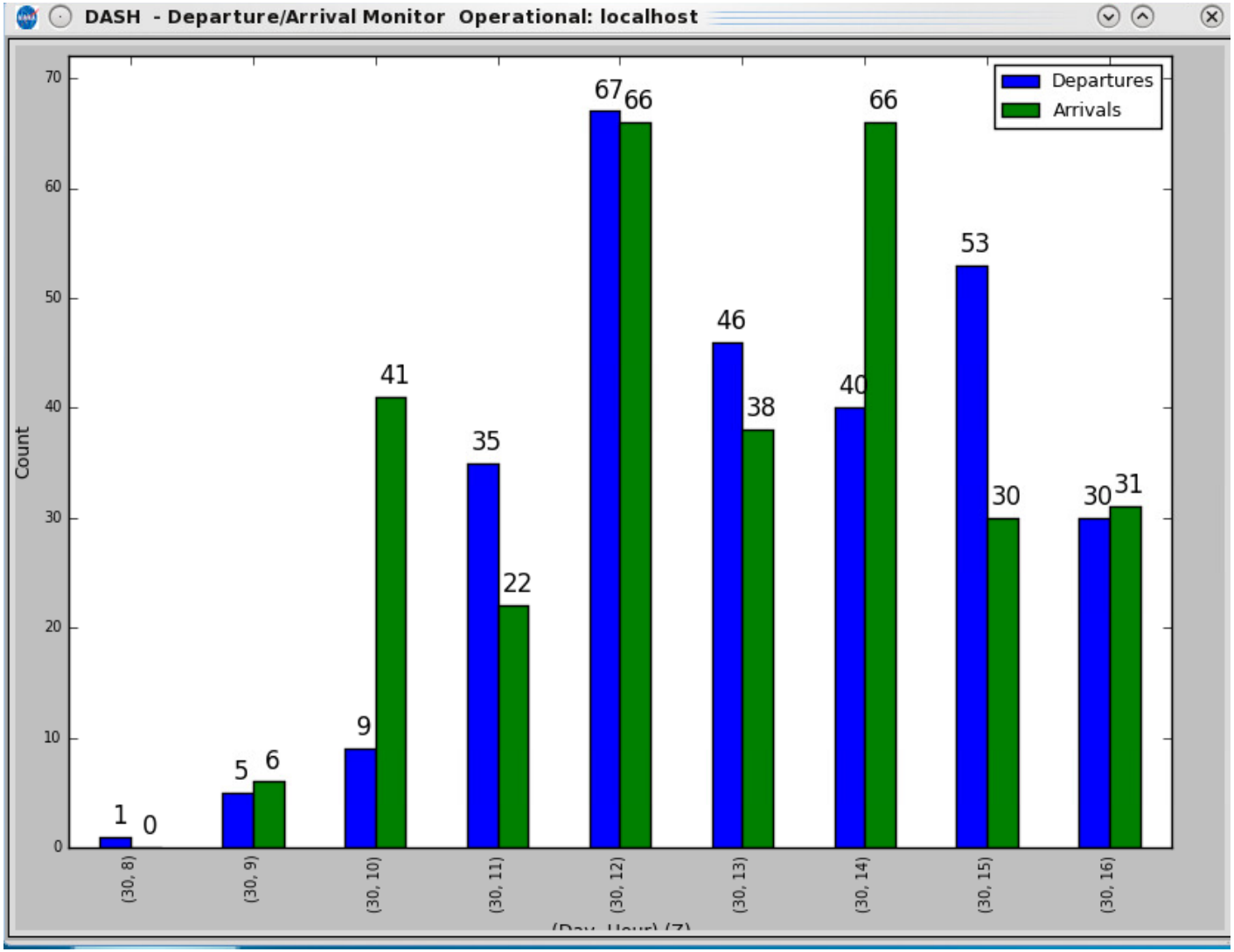
Pull down menu with quick look display and in depth metrics

# Real Time Dashboard – Current Iteration




Specific metrics will show across the last 15 minutes, the last rolling hour, and the last cardinal hour

# Dashboard Pull Down Menu Metrics



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# Next Steps

- Complete requirements for the real time dashboard leading up to Phase I go live date during which a version will be available to center, tower, and ramp controllers

- Constant iteration with operational users on the metric definitions, graphical views, and numerical information conveyed

- Refine requirements for additional features and develop new metrics based on input from operational users focused on predicative information that provides information to mitigate demand capacity imbalances

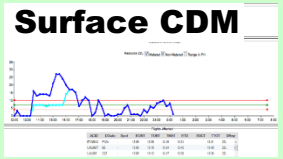
# Backup material

# Phase 1: Baseline IADS Demonstration


- Baseline electronic flight data capability via TFDM EFD

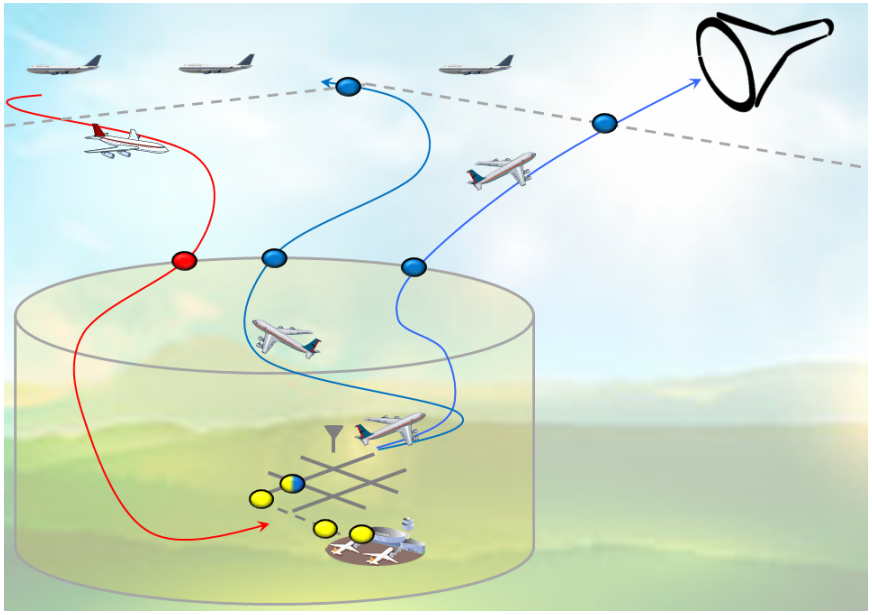
★


- Tactical pushback advisories via RTC/RMTC display




- Predictive mode: strategic metering info for situational awareness and analysis

*Surface Components*



**Phase 1 Demonstration Goals**

- Evaluate the Baseline IADS capability
- Enhance American Airlines CLT “departure sequencing” procedure with ATD-2 surface tactical metering
- Demonstrate improved compliance for a significant percentage of tactical TMIs
- Mature strategic Surface CDM capability via operational use, analysis, and feedback
- Reduce ATCT workload by replacing paper strips with EFD

★


- Tactical departure scheduling capability via STBO display

★


- Tactical departure scheduling via modified TBFM/IDAC

*Airspace Components*

Interfaces to external systems via SWIM plus ATD-2 SWIM extensions


★ = IADS user interface

# Surface Metering Process Flow Diagram

## 1 Generate Demand and Capacity Predictions

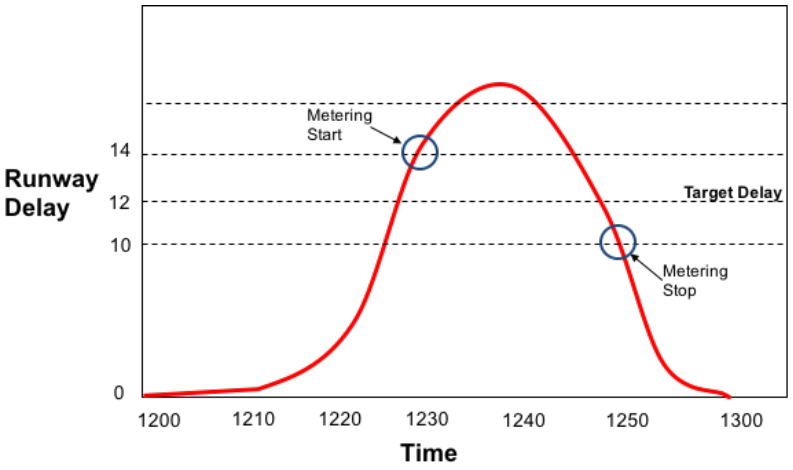
ATC TMC Runway Utilization Intent →
TRACON controller runway intent →
Highly accuracy TBFM de-conflicted ON time estimate →
TFM SWIM ETAs →
TMIs. Controlled Take Off Times (CTOT) →
Carrier provided EOBTs →
Tactical airline intent (ramp controller) →

**IADS Automation Assisted Capacity Predictions**

Surface modeling logic
- Earliest IN time estimate
- Earliest OFF time estimate
- Latest OUT estimate
- Pushback duration model
- Ramp and AMA taxi time
- Hovering logic

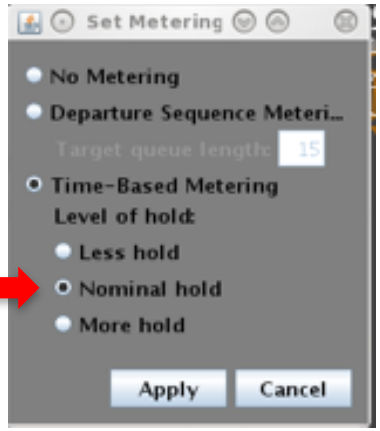
Scheduling Logic:
- Converging runways
- Flight spacing requirements
- Dual use runways
- Runway crossing delays
- Departure fix separation
- Use of flight state

## 2 Monitor Surface Demand Capacity Imbalances




If Surface Metering, Go to Step 3

## 3 Enable Metering. Set Hold Level

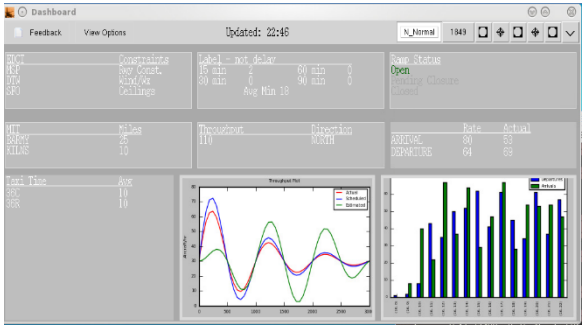



## 4 Honor TOBT and TMAT advisories

TOBT Advisory →


TMAT Advisory →


## 5 Evaluate Metering Effectiveness



# IADS Tactical Departure Scheduling

APREQ/CFR departures merging into overhead streams

Flights subject to EDCTs due to downstream flow constraints

Washington ARTCC (ZDC)

IDAC-style scheduling between IADS at CLT and TBFM at ZDC

# Concept Overview – Users


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

# General Functionality

| Health/Situational Awareness |
| --- |
| Configuration and Flow Information |
| Ramp Status |
| Metering Mode |

| Monitoring Metrics |
| --- |
| Throughput |
| Predicted and actual runway capacity rates |
| Delay values |
| Arrival and Departure Taxi Time |
| Queue length |

| Benefits Metrics |
| --- |
| $CO_2$ Savings |
| Monetary Benefits |

| Data Fidelity |
| --- |
| Fidelity of incoming data feeds |