SWIM Industry Collaboration Workshop #4

SWIM, Services & SWIFT (SWIM Industry-FAA Team)

SWIM Stakeholders

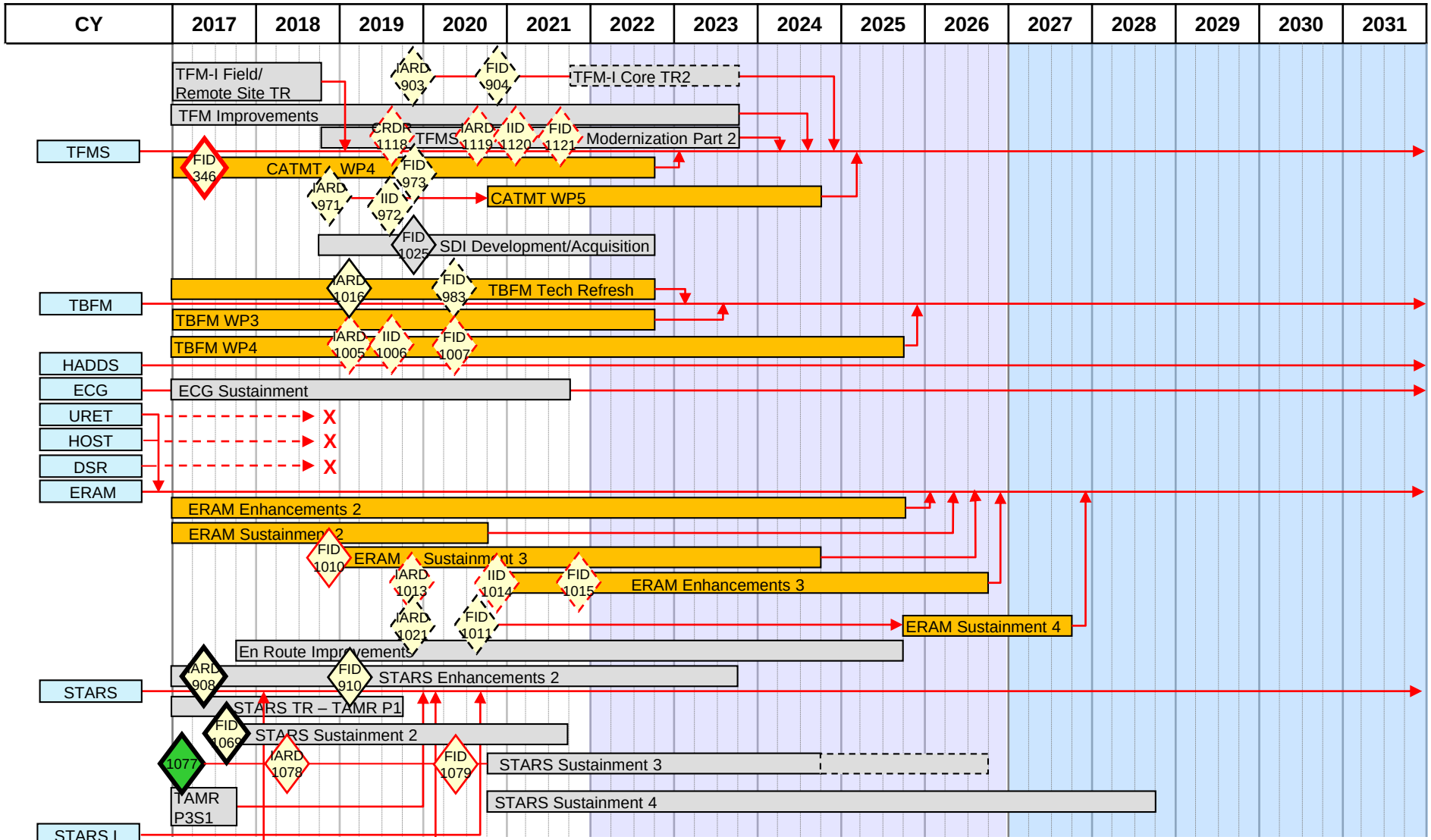
FAA SWIM Program

August 15, 2018

Federal Aviation Administration

SWIFT Collaborative Workshop #4: Agenda

- **Special Guest Introductions**
- **SWIFT Aviation Case Study:**
  - *"Reduced Delays through Early Scheduling"* by Delta Airlines
- **Special Topic: Seeking Operational Improvements**
  - Aviation Case Study Operational Metrics
- **SWIFT Updates**
  - SWIFT Action Items
  - Operational Context & Use Case Focus Group Report
- **Break for Lunch (1 hour)**
- **Special Topic: Tower Flight Data Manager Terminal Publication (TTP)**
- **Producer Focus: Aeronautical Information Management (AIM)**
  - Aeronautical Common Service (ACS)
- **Discussion Items: Vendor Community Engagement**
- **Next Steps**



Automation Roadmap (1 of 4)

SWIFT
Aviation Case Study:

“Improving Customer Service through TBFM Pre-Scheduling”

Rob Goldman

Delta Airlines

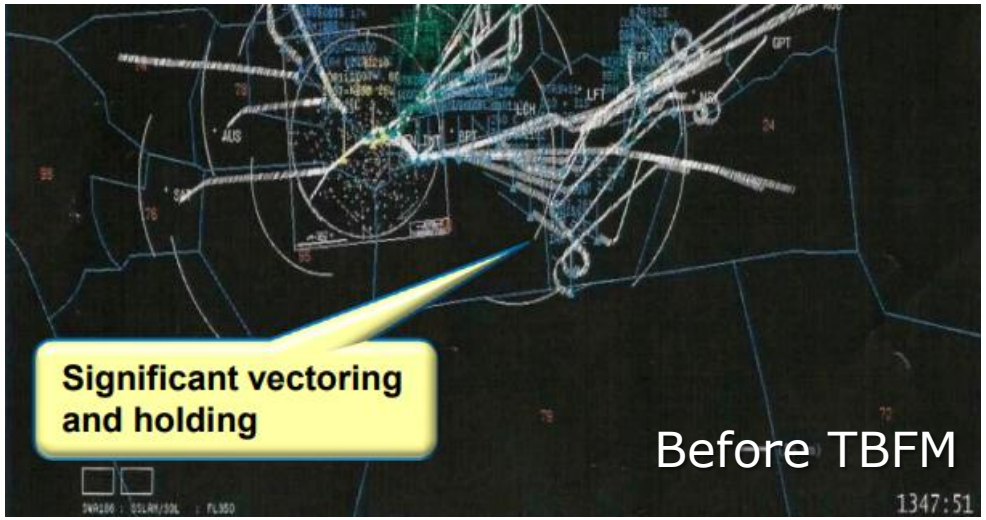
August 15, 2018

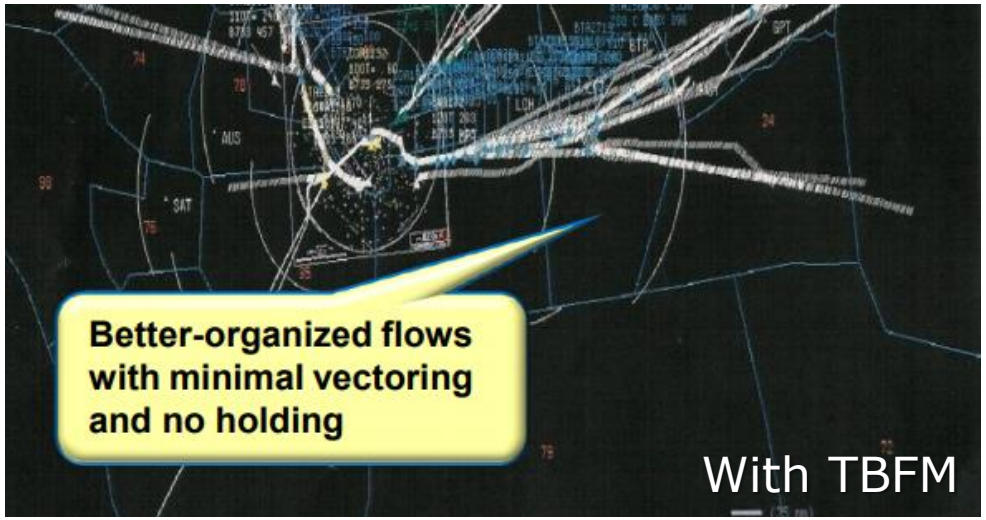
Executive Summary

- **Environment**:
  - Time Based Flow Metering (TBFM) is a Decision Support Tool that optimizes traffic flow by metering airborne traffic and scheduling departures into the overhead stream
  - For a variety of reasons and by design, disproportionate delay is associated with scheduling flights from "close-in airports"
- **Problem statement:**
  - Extended delays (and taxi time) identified as a result of scheduling into the overhead stream, based on TBFM Call For Release (CFR) process
- **Impact**:
  - Ad hoc procedures developed to initiate CFR earlier
  - DAL used SWIM data to prove anecdotal benefit
  - Case study to quantify time savings per flight and influence NAS changes
  - Ingesting Metering Information Service via SWIM directly into internal DAL tools to identify additional efficiencies
- **Goals:**
  - Validate Assertion: Reduce arrival delays using earlier CFR
  - Prove Business Case: Quantify delay savings using SWIM data
  - Verify Ops Improvement: Ensure DAL continues to realize benefits gained

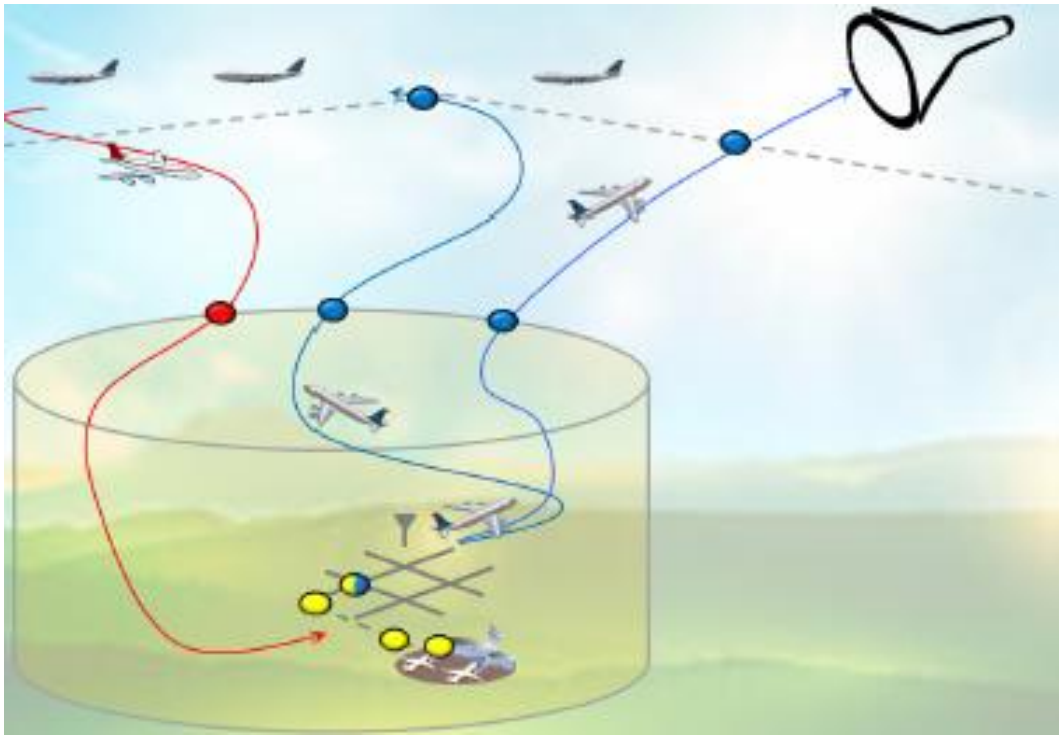
Time Based Flow Management (TBFM)

TBFM Timeline User Interface





Development of TBFM Pre-Scheduling



Ad hoc solutions – calling early reduces TBFM scheduling delays

- ATC issues APREQ upon seeing activity at gate
- Pilot call ahead
- **Data trigger on boarding pass scan**

TBFM Implemented across NAS

Disproportionate delay at "close in" cities

Using SWIM TBFM Data

1. Build database using TBFM XML Data

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<env
  xmlns="urn:us:gov:dot:faa:atm:tfm:tbfmmeteringpublication"
envSrce="TMA.ZDC.FAA.GOV" envTime="2018-08-08T14:05:24.107Z"
targetNamespace="urn:us:gov:dot:faa:atm:tfm:tbfmmeteringpublication">
  <tma msgId="11318609" msgTime="2018-08-08T14:05:24.107Z">
    <air airType="AMD" aid="DAL439" dap="JFK" apt="PBI" tmaId="W05815">
      <eta>
        <mfx>ZJX_AR</mfx>
        <eta_mfx>2018-08-08T14:53:20Z</eta_mfx>
        <eta_dfx>2018-08-08T14:53:20Z</eta_dfx>
        <eta_sfx>2018-08-08T14:53:20Z</eta_sfx>
      </eta>
    </air>
  </tma>
</env>
```

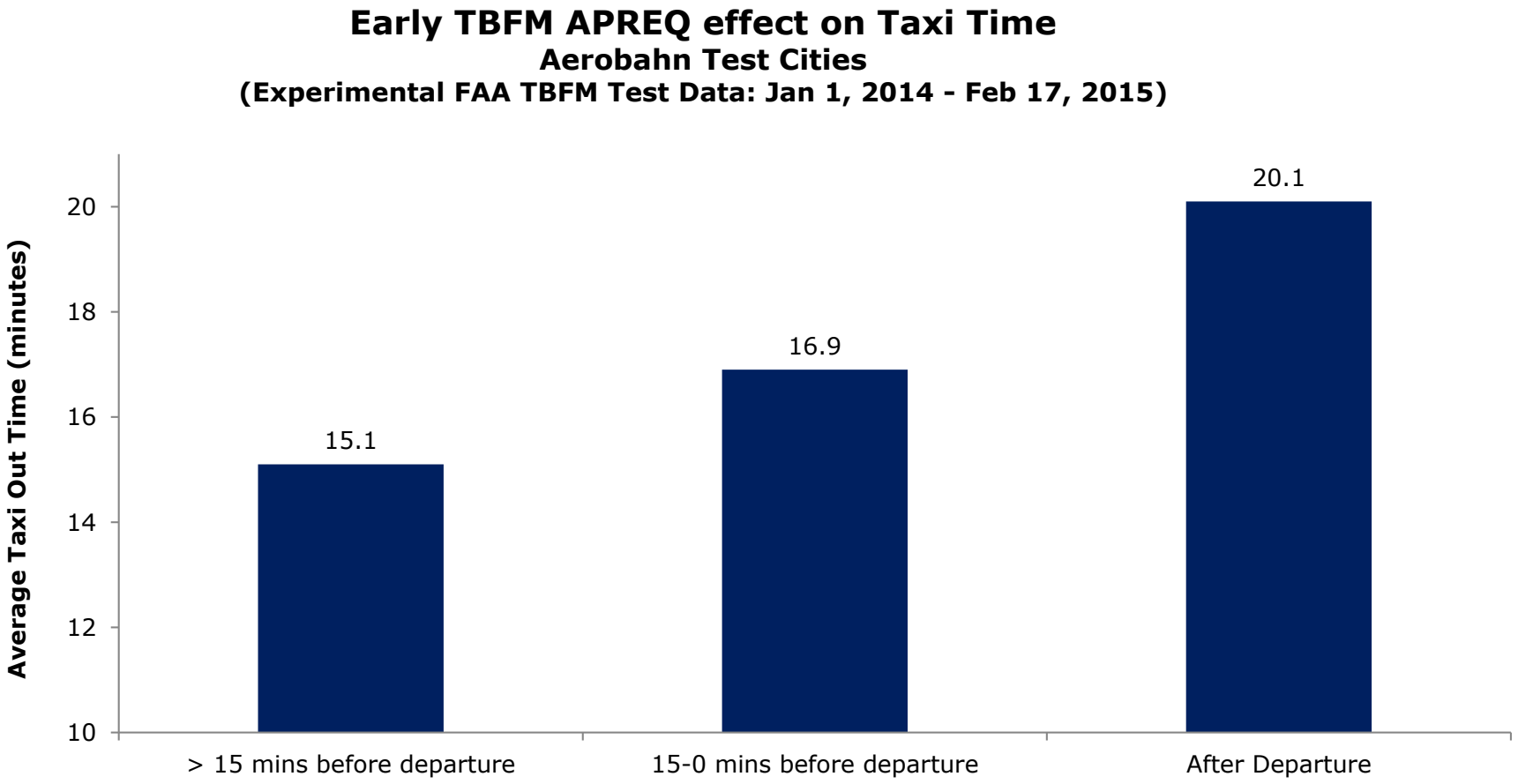
2. TBFM does not provide APREQ time, estimate using first non-null STD message time stamp

```
select  min(msgtime) as apreqtime, acid, tma_id, center, dept_apt, arr_apt, std
from TBFM_SWIM.FLT_SCHEDULED_DEPARTURE
where arr_apt = 'ATL'
and std > '8/6/2018 6:00'
and acid like 'DAL%'
and std is not null
group by acid, tma_id, center, dept_apt, arr_apt, std
order by apreqtime
```

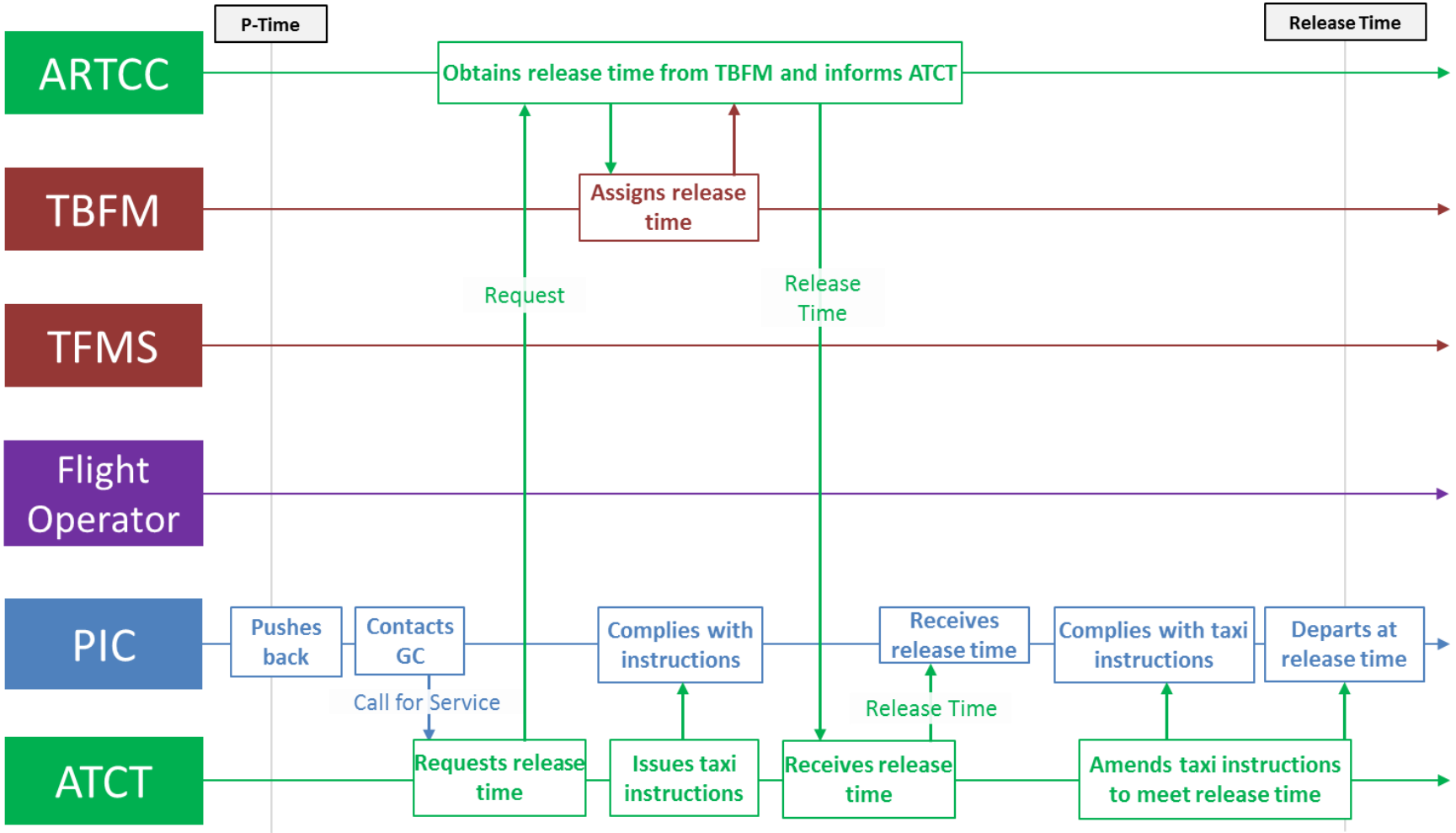
3. Visualize estimated APREQ time data for AOC use

APREQTIME	ACID	TMA_ID	CENTER	DEPT_APT	ARR_APT	STD
08/06/2018 09:47:15	DAL2352	B01612	ZBW	ALB	ATL	08/06/2018 10:16:00
08/06/2018 09:47:21	DAL1065	B02272	ZBW	BDL	ATL	08/06/2018 10:02:00
08/06/2018 09:47:26	DAL926	T03224	ZTL	JAX	ATL	08/06/2018 10:53:00
08/06/2018 09:47:36	DAL1065	B02272	ZBW	BDL	ATL	08/06/2018 10:12:00
08/06/2018 09:47:40	DAL1112	T01484	ZTL	DAB	ATL	08/06/2018 10:10:00
08/06/2018 09:49:08	DAL1583	T05160	ZTL	CRW	ATL	08/06/2018 10:13:00
08/06/2018 09:50:12	DAL2099	T04757	ZTL	SDF	ATL	08/06/2018 10:01:00
08/06/2018 09:54:19	DAL2352	B01612	ZBW	ALB	ATL	08/06/2018 10:13:02
08/06/2018 09:54:47	DAL900	B00768	ZBW	BOS	ATL	08/06/2018 10:15:00

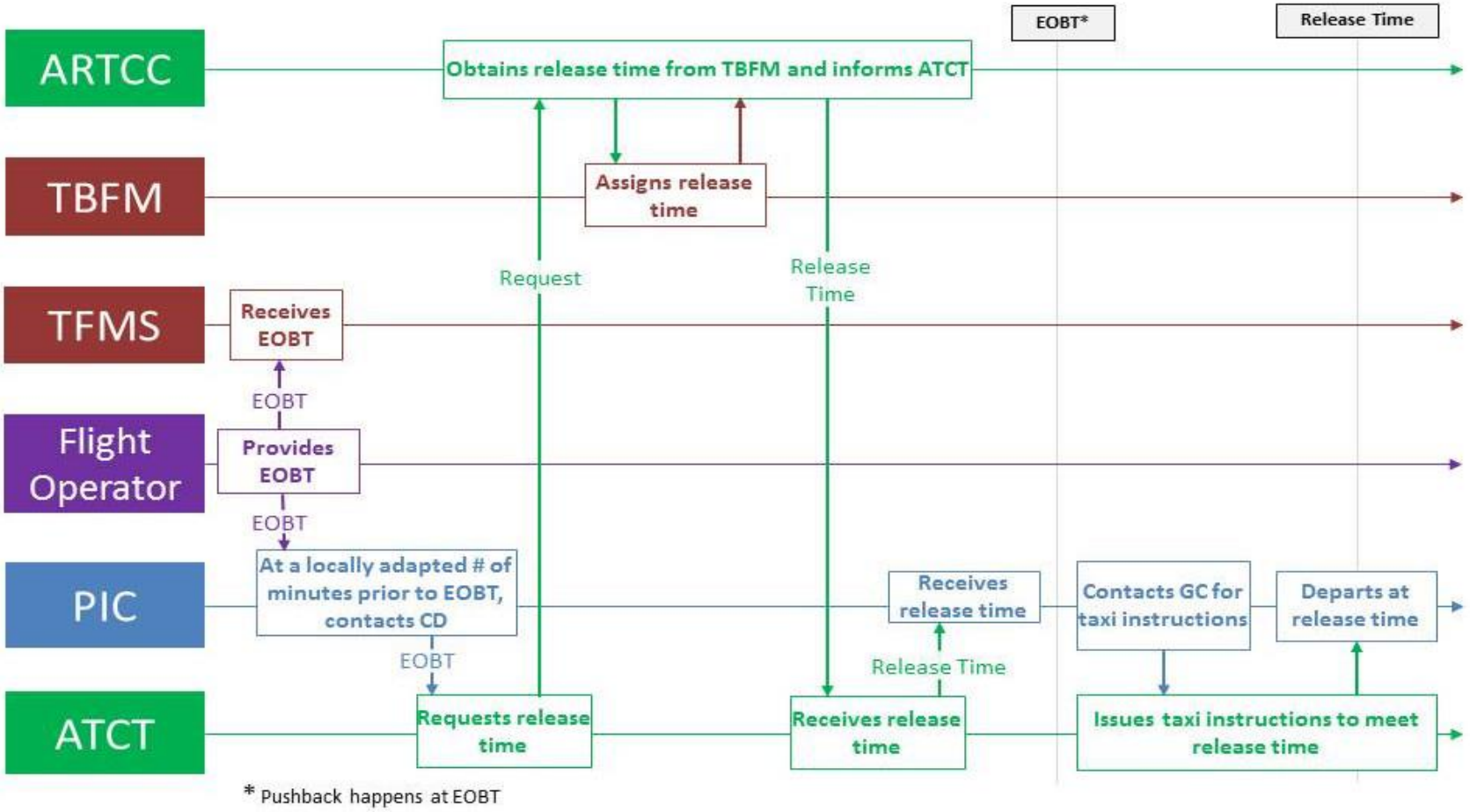
SWIM Data proves anecdotal evidence



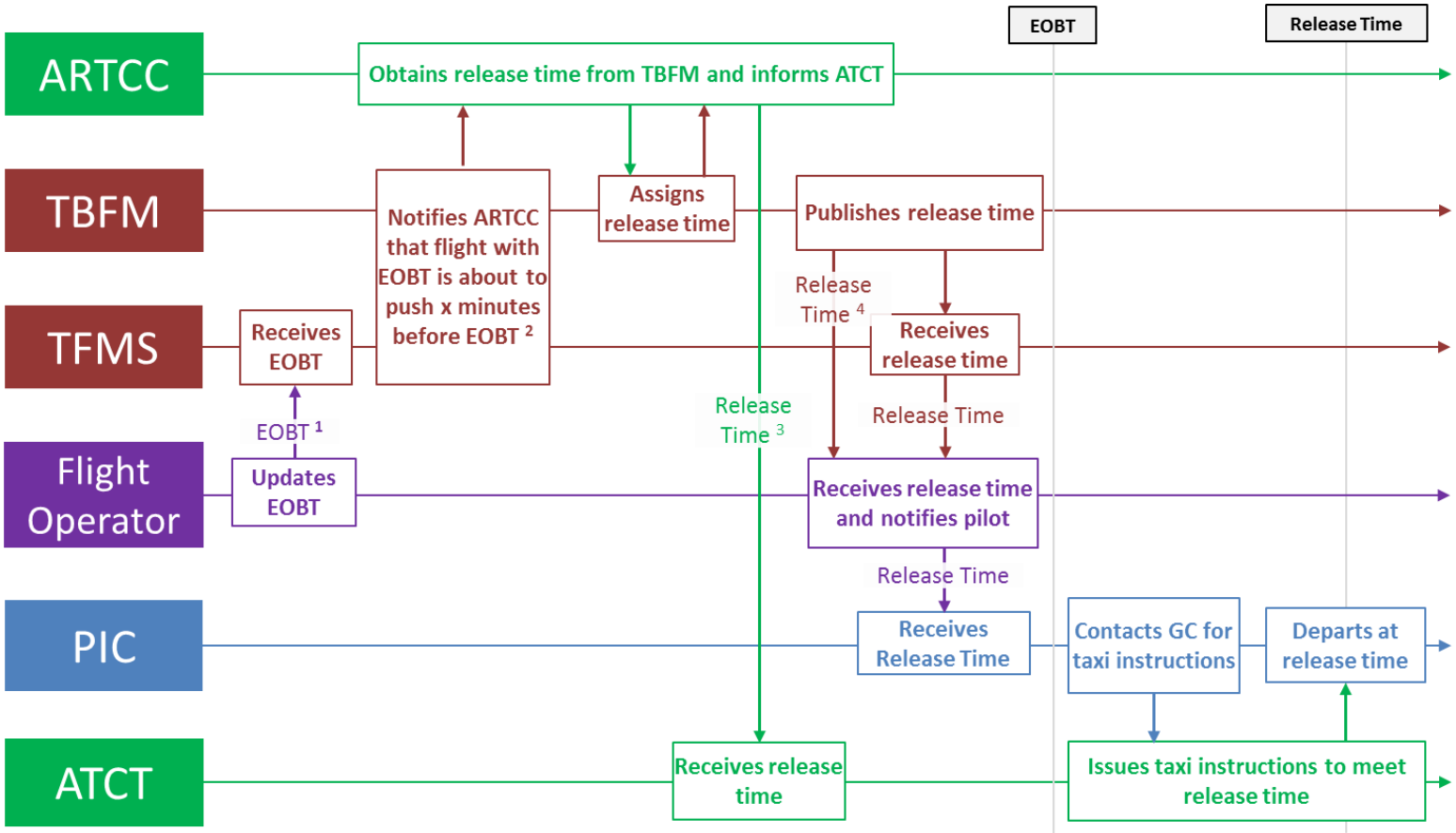
Current Process for Scheduling Departures into a TBFM Arrival Stream



Pilot-initiated Early TBFM Scheduling
Using Verbal EOBT



Notional Automated Process for Early TBFM Scheduling: Process Map



[1] Not yet provided electronically

[2] New TBFM/TFMS functionality required

[3] Planned electronic delivery via TFDM; may be possible in early implementation of EFD

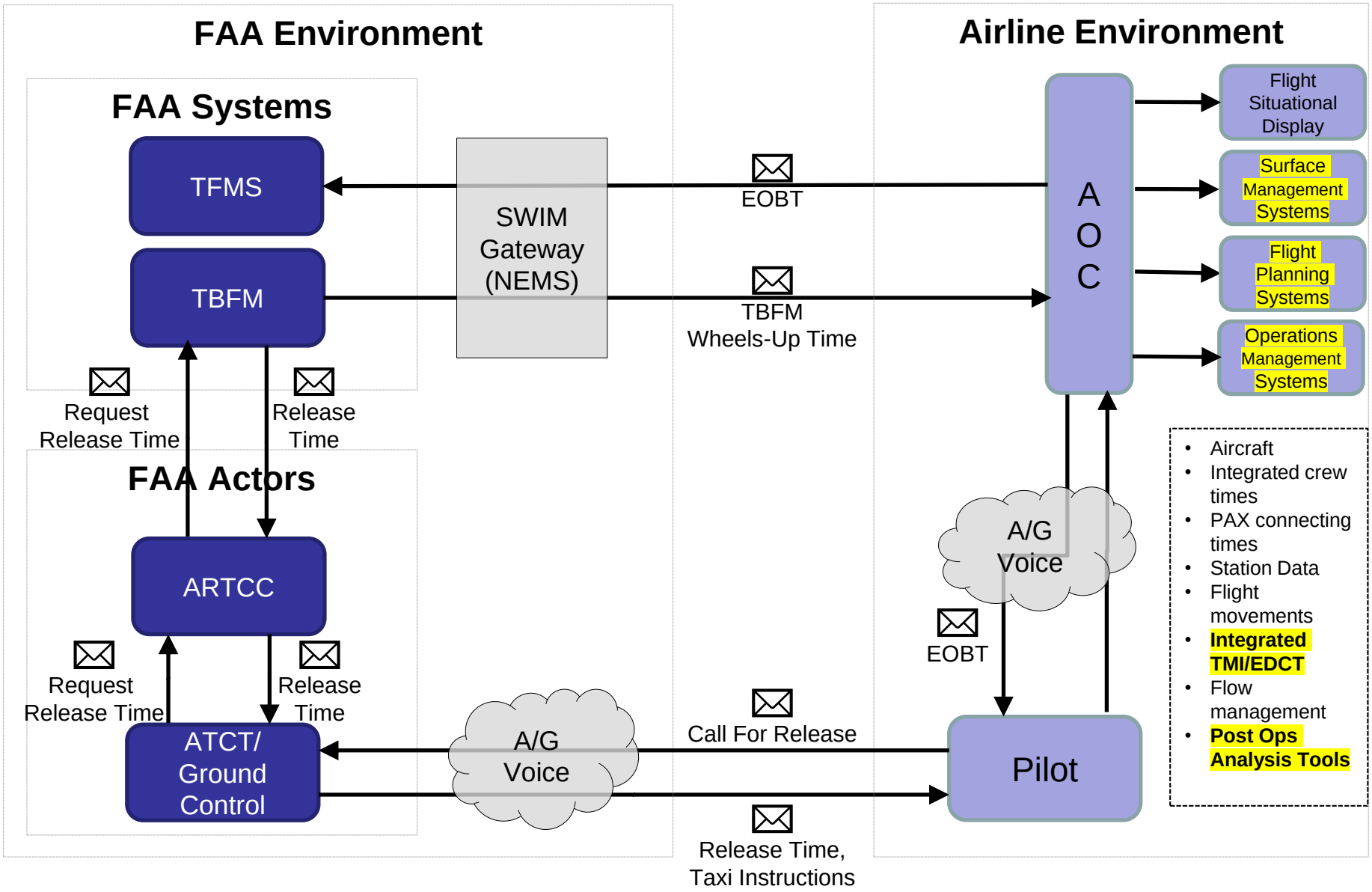
[4] Planned functionality, available TBD

Pre-Scheduling at MSP Time Savings

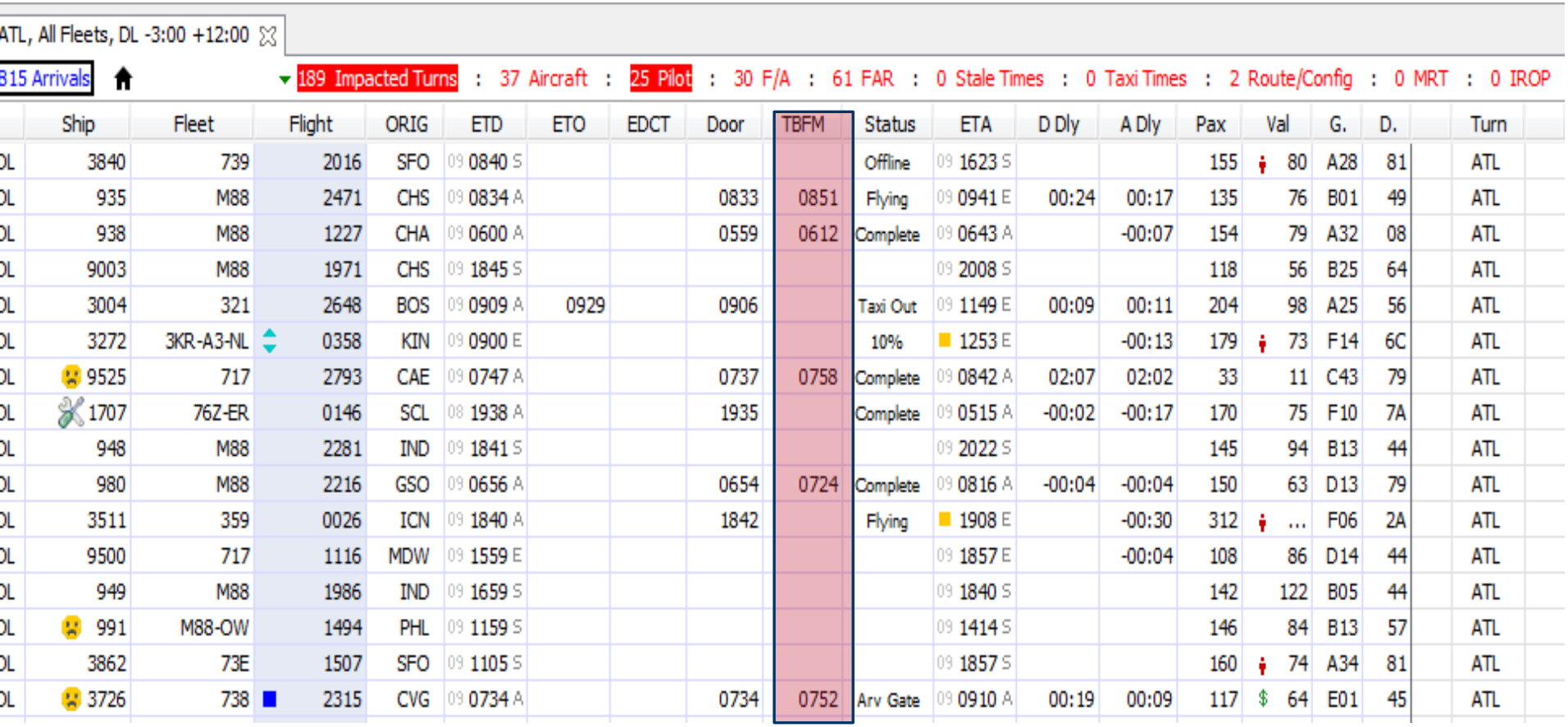
- After TBFM implementation our MSP operation was considerably impacted

- TBFM prescheduling procedures significantly improved operational performance for our customers
  - On Time Departure (D0) Rate improved 22.5% points
  - On Time Arrivals (A0) Rate improved 25.6% points
  - Taxi Out Average improved 3.57 minutes
  - Passenger misconnection rates dropped significantly
  - Net promoter score improved (qualitative customer survey data)

Systems View



Live TBFM Data in Turn Management Tool



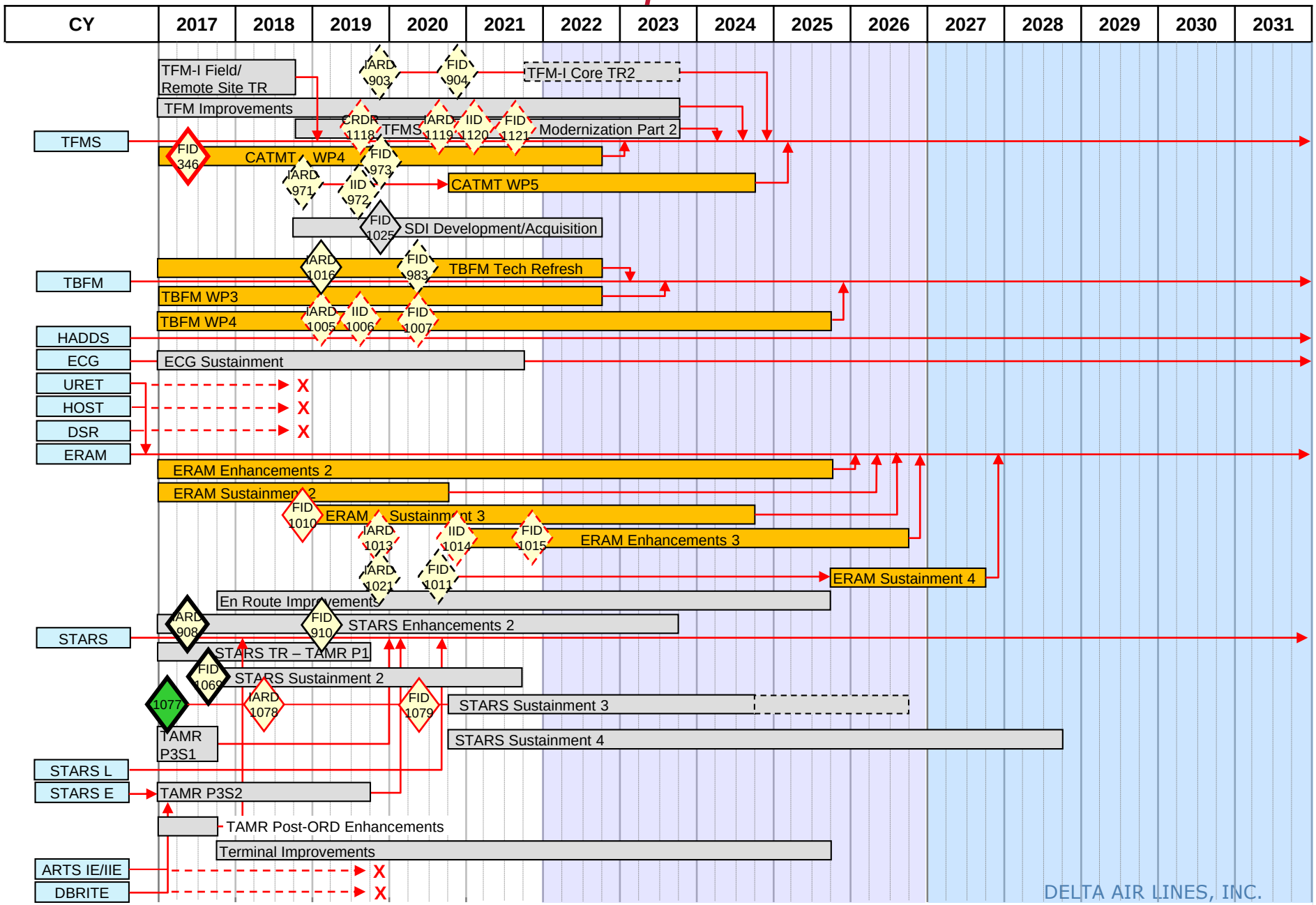
ATL, All Fleets, DL -3:00 +12:00

315 Arrivals | 189 Impacted Turns : 37 Aircraft : 25 Pilot : 30 F/A : 61 FAR : 0 Stale Times : 0 Taxi Times : 2 Route/Config : 0 MRT : 0 IROP

Ship	Fleet	Flight	ORIG	ETD	ETO	EDCT	Door	TBFM	Status	ETA	D Dly	A Dly	Pax	Val	G.	D.	Turn
3840	739	2016	SFO	09 0840 S					Offline	09 1623 S			155	80	A28	81	ATL
935	M88	2471	CHS	09 0834 A			0833	0851	Flying	09 0941 E	00:24	00:17	135	76	B01	49	ATL
938	M88	1227	CHA	09 0600 A			0559	0612	Complete	09 0643 A		-00:07	154	79	A32	08	ATL
9003	M88	1971	CHS	09 1845 S						09 2008 S			118	56	B25	64	ATL
3004	321	2648	BOS	09 0909 A	0929		0906		Taxi Out	09 1149 E	00:09	00:11	204	98	A25	56	ATL
3272	3KR-A3-NL	0358	KIN	09 0900 E					10%	1253 E		-00:13	179	73	F14	6C	ATL
9525	717	2793	CAE	09 0747 A			0737	0758	Complete	09 0842 A	02:07	02:02	33	11	C43	79	ATL
1707	76Z-ER	0146	SCL	08 1938 A			1935		Complete	09 0515 A	-00:02	-00:17	170	75	F10	7A	ATL
948	M88	2281	IND	09 1841 S						09 2022 S			145	94	B13	44	ATL
980	M88	2216	GSO	09 0656 A			0654	0724	Complete	09 0816 A	-00:04	-00:04	150	63	D13	79	ATL
3511	359	0026	ICN	09 1840 A			1842		Flying	1908 E		-00:30	312	...	F06	2A	ATL
9500	717	1116	MDW	09 1559 E						09 1857 E		-00:04	108	86	D14	44	ATL
949	M88	1986	IND	09 1659 S						09 1840 S			142	122	B05	44	ATL
991	M88-OW	1494	PHL	09 1159 S						09 1414 S			146	84	B13	57	ATL
3862	73E	1507	SFO	09 1105 S						09 1857 S			160	74	A34	81	ATL
3726	738	2315	CVG	09 0734 A			0734	0752	Arv Gate	09 0910 A	00:19	00:09	117	$ 64	E01	45	ATL

What's Next?

FAA Automation Roadmap



SWIFT:
Seeking Operational Improvements

SWIFT
Aviation Case Study:

“Taxi out, Return to Gate”

Bill Tuck

Delta Airlines

May 10, 2018

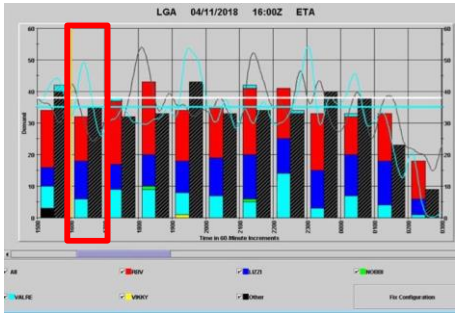
Executive Summary

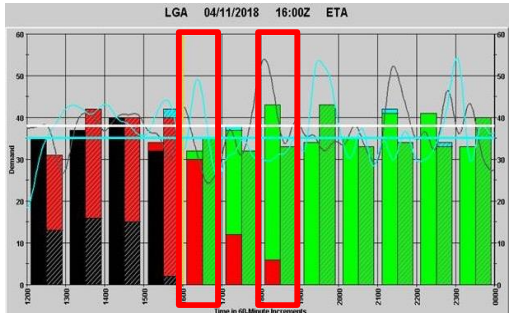
- **Environment**:
  - Delta has an issue with close in traffic destined to LGA from ZDC
  - Flow through ZDC is heavy during certain times of the day
  - Either MIT (TFMS), or metering (TBFM) can affect availability of overhead stream
- **Problem statement:**
  - During the day, there are periods when more than half LGA demand comes over RBV
- **Impact**:
  - GDP can be planned around, but not typically assigned a delay for MIT/TBFM EDC due to overhead stream, until after push from gate
  - Reduce taxi delay to improve satisfaction of traveling public
  - Reduce customer missed connections due to unpredictable delay
  - Reduce taxi length to avoid additional crew block time and potential for daily duty max
  - Reduced taxi time to result in lower crew block time costs
  - Fewer gate returns due to longer reroutes with insufficient fuel
  - Reduce fuel and time costs of longer reroutes
  - Reduce cascading effects from unpredictable delay (e.g., crew misconnects, a/c swaps, last minute gate changes)
- **Goal:**
  - Improve effects of high fix demand by proactive management and wider distribution of negative effects of mitigating reroutes and metering

Description of Issue & Relevant Tools

DCA to LGA Route

LGA Arrival Demand at Departure Time 4/11/18

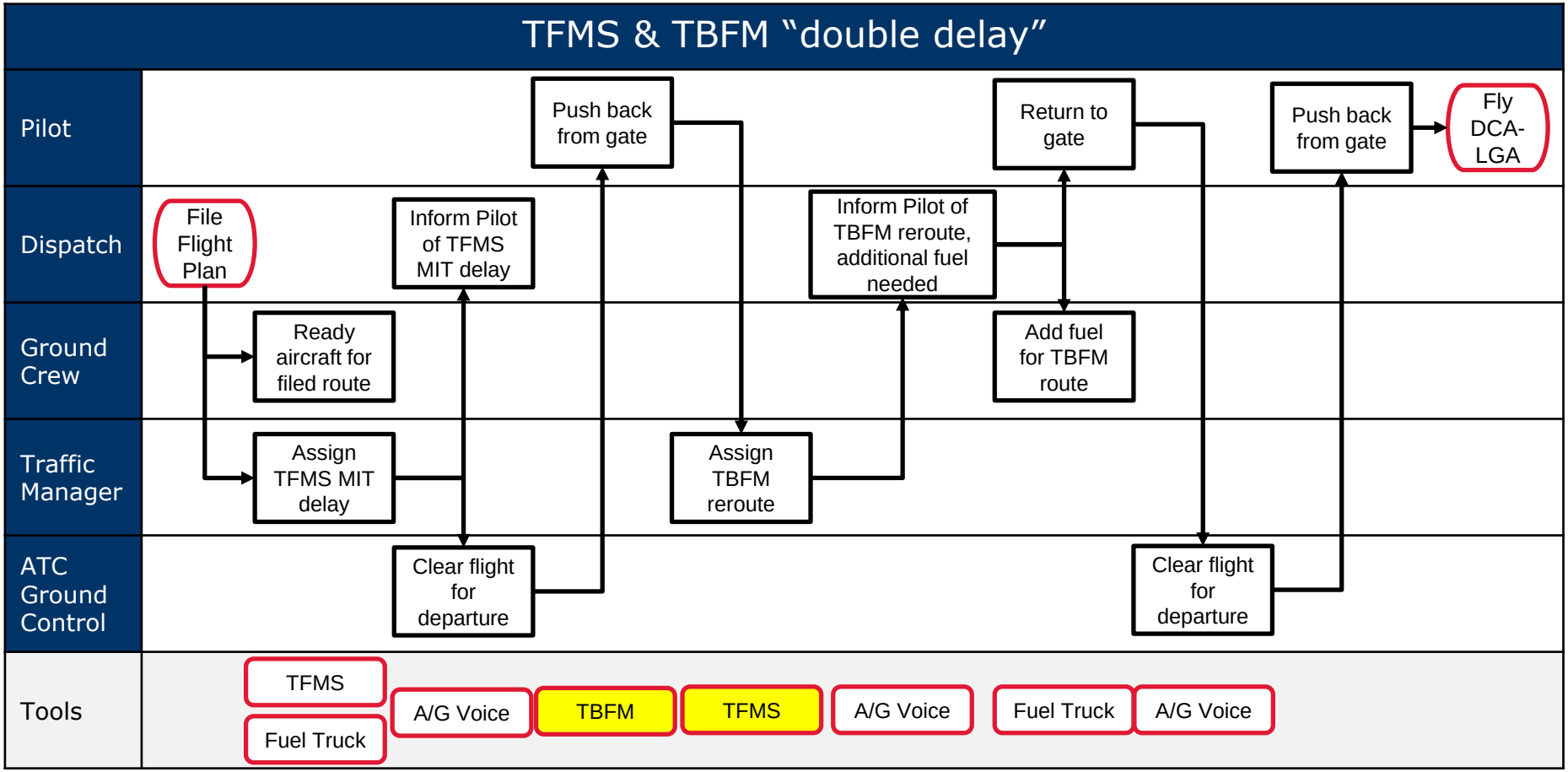




- An hour before RPA6140 departure (16:00z ADL) LGA arrival rate is ~38.
- Overall demand for 18:00z is 43 and 23 are coming over RBV
- RPA6140 was supposed to be in the 17:00z bucket (17:43z) and TMA moved it back to the 19:00z due to demand over RBV

- Appears to be a MIT or TMA restriction at ZDC which affects overall airport landing efficiency
- In overall Status view at 16:00z, there was an arrival spike at 18:00z, over half of which was over RBV

Operational Business Process



Taxi-out, Return to gate Alternative Vignettes

Two-Part Solution:

Enhanced Situational Awareness and CDM Interaction

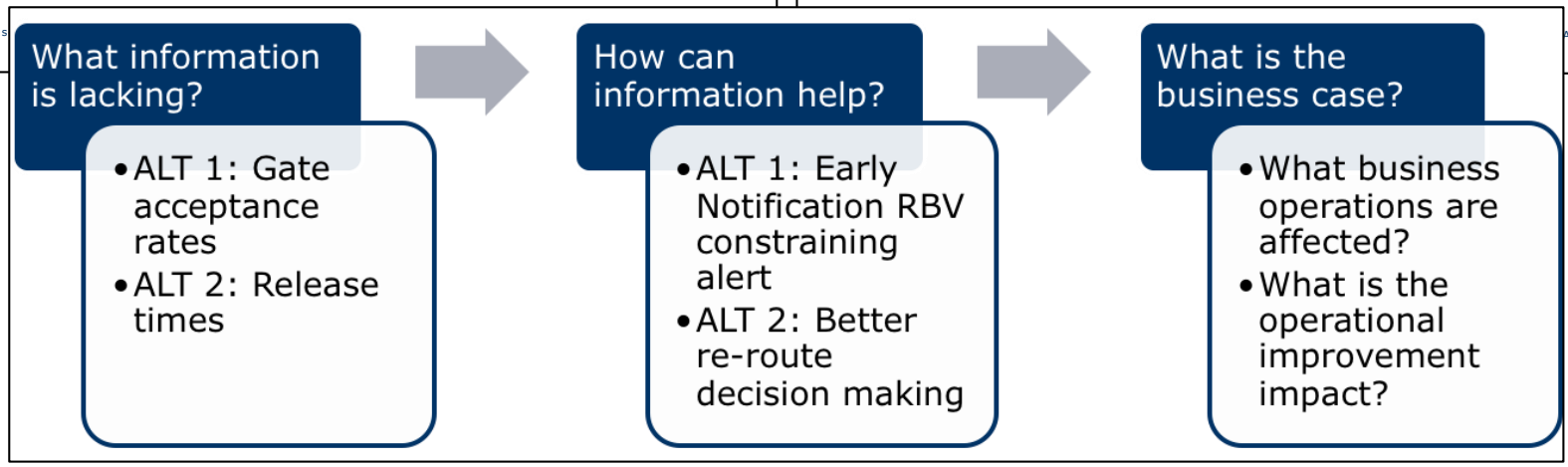
Alternative Vignettes:
Enhanced Situational Awareness and CDM Interaction

Enhanced Situational Awareness

- SWIM data can alert FOC to when the traffic situation begins to resemble a "heavy RBV period"
  - TBFM-Metering Information Service (MIS):
    - Provides gate acceptance rates and meter fix acceptance rates (manually set by TMC) to alert FOC of when traffic over RBV becomes constrained
  - TFMData Service:
    - Alerts FOC when a flight is affected by a TMI
    - Alerts FOC when FEA, FCA created to monitor traffic in constrained areas
  - SWIM Flight Data Publication (SFDPS) and SWIM Terminal Data Distribution (STDDS):
    - Provides En-route (SFDPS) and terminal (STDDS) flight tracking allowing for advanced data analytics
    - Vendor tool could monitor traffic counts and alert FOC when gaps are becoming minimized in overhead stream and situation may become progressively worse at RBV in a few hours

Enhanced Situational Awareness

- SWIM data can alert FOC to when choosing reroute over taking TBFM delay would result in extra delay or a "sub-optimal route"
  - TBFM-Metering Information Service (MIS)
    - Provides release time
  - FOC flight planning tools
    - Provide preferred route options with associated flying times & fuel requirements
    - If TBFM departure delay less than additional reroute flying time, decline reroute
    - If TBFM departure delay more than additional flying time of reroute, accept reroute ONLY if flight is properly fueled upon initial pushback
      - Requires system logic to identify when conditions signal a "heavy RBV period"
      - Directs aircraft on affected routes to load additional fuel to allow for reroutes without returning to the gate to refuel



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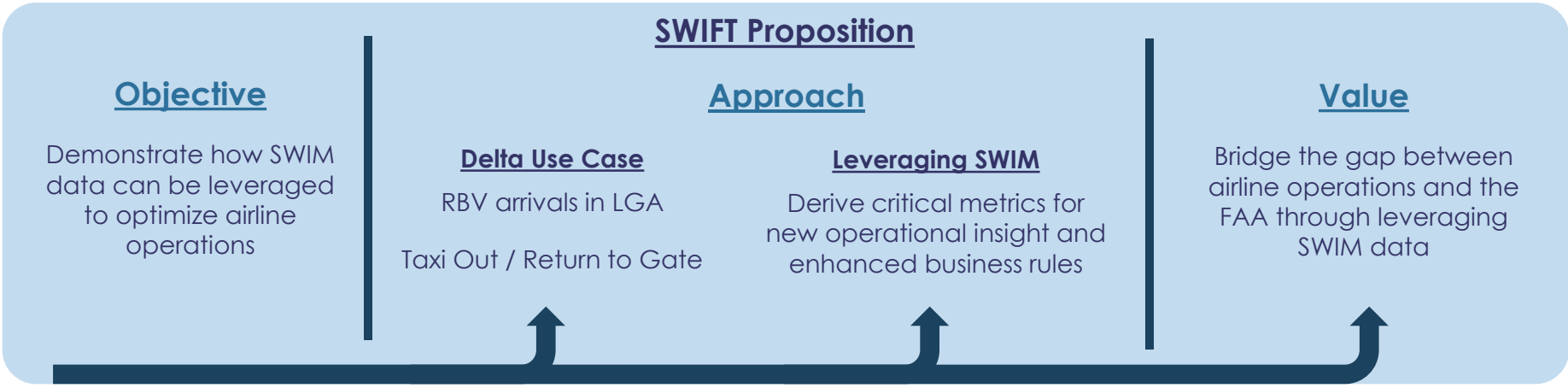
SWIFT Debrief

8/15/2018

Overview

SWIM data can be further utilized in dynamic situations through the derivation of yet to be used metrics to drive new and enhanced business rules



Thales experienced in consuming SWIM data and flow management optimization

- 1st industry partner on boarded to the SWIM network – 2014
- Collaboration with global airline to improve operational efficiency
  - Using predictive tool, identify operational disruptions to reduce in-flight holding on approach
  - Initial use case derived metrics to identify high risk flights likely to experience disruptions

THALES

Experience leveraging data for operational improvements

Ongoing Airline Operations Initiative:

Situation

Global airline operating hub and spoke model operates over capacity during peak periods resulting in excessive airborne holding requiring additional fuel to avoid diversions

Problem

Flight planning function today generates optimized flight profiles but is unable to adequately anticipate and plan for operational disruptions that lead to in-flight holding

Need

To reduce in-flight holding on approach to hub and more effectively prioritize high value flights to avoid costly operational disruptions

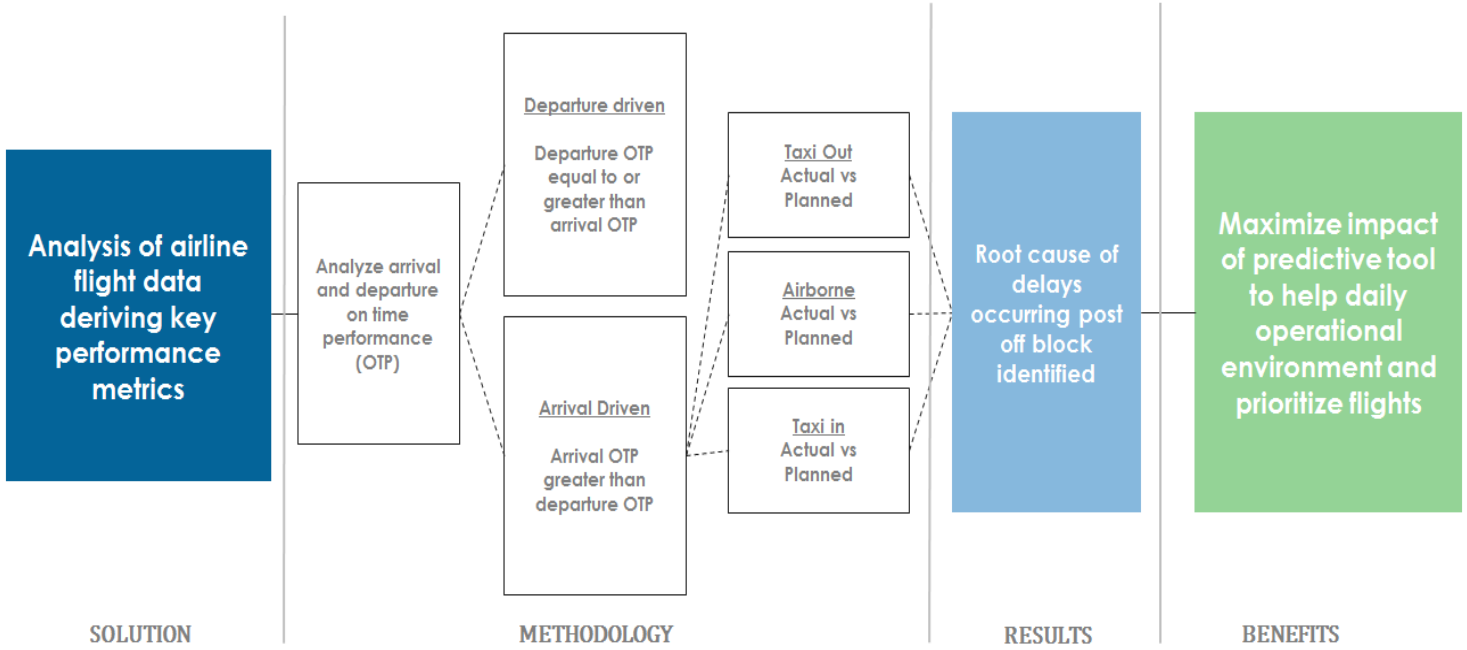
Thales Effort

Driven by Thales's data-centric predictive tools leveraging SWIM like data, flight planning function can adjust operating schedule to the anticipated operational environment

THALES

Demonstration of predictive tool driven by key metrics with global airline

- **Methodology focused on identifying where operational improvements exist within airline's control and where in the schedule business rules can be enhanced**
- **Analysis derived metrics from SWIM like data to identify flights to target for schedule adjustments to reduce in flight holding:**



SWIFT Goal

Leverage analogous methods to demonstrate how SWIM data can be derived to develop new metrics for optimized business rules in addressing proposed use cases

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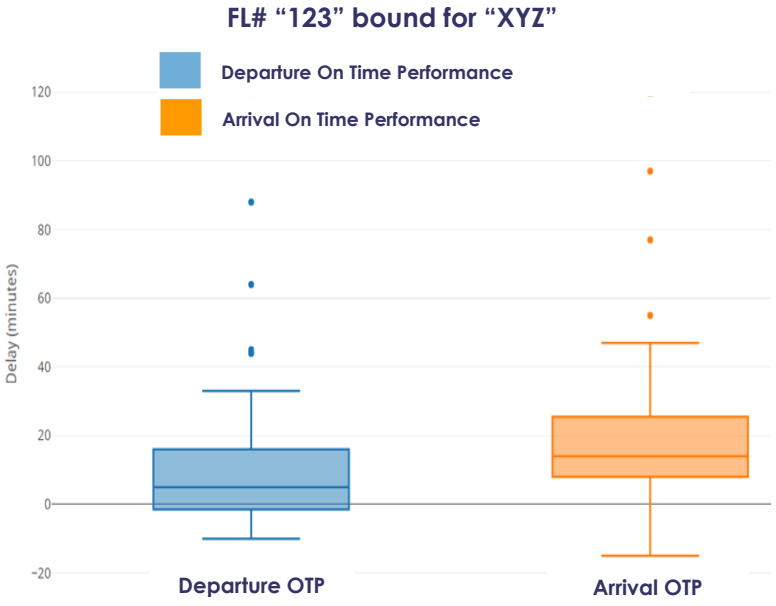
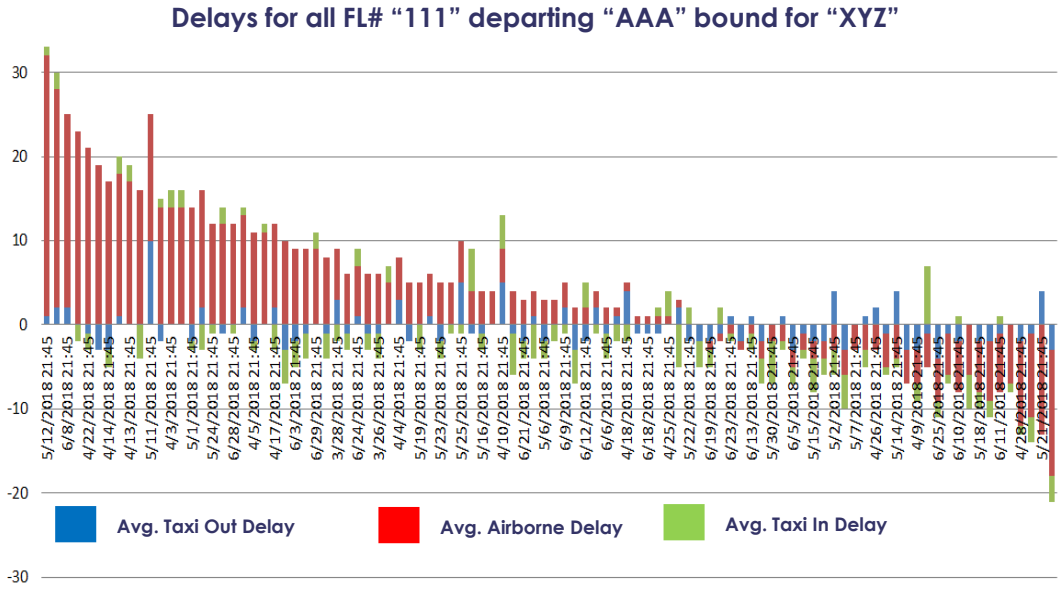
Example: Poor arrival OTP due to regular airborne delays for FL# “111”

Analysis identifies flight example as target for operational improvement to reduce airborne delays

- Dep Station: “AAA”
- Dep Region: Europe
- Schd. Time Arv: 2:35 UTC

	Avg.	STDEV	Median
Taxi Out Delay (min)	-5.5	3.7	-6
Airborne Delay (min)	9.7	9.7	9
Taxi In Delay (min)	-1.6	2.8	-3





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Use Case Example 1: Robbinsville Arrivals into LGA

Use Case Example: Robbinsville (RBV) arrivals into LGA

Taxi Out, Return to Gate for arrival fix utilization over RBV for LGA

- Periods exist when more than half the demand on LGA comes over RBV, causing excessive metering delay and potential double layered delays when GDP in effect
- To avoid MIT/TBFM EDC delay, reroutes are occasionally offered requiring additional fuel & time still resulting in arrival delay

Identify how metrics derived by SWIM data can enhance business rules

Approach:

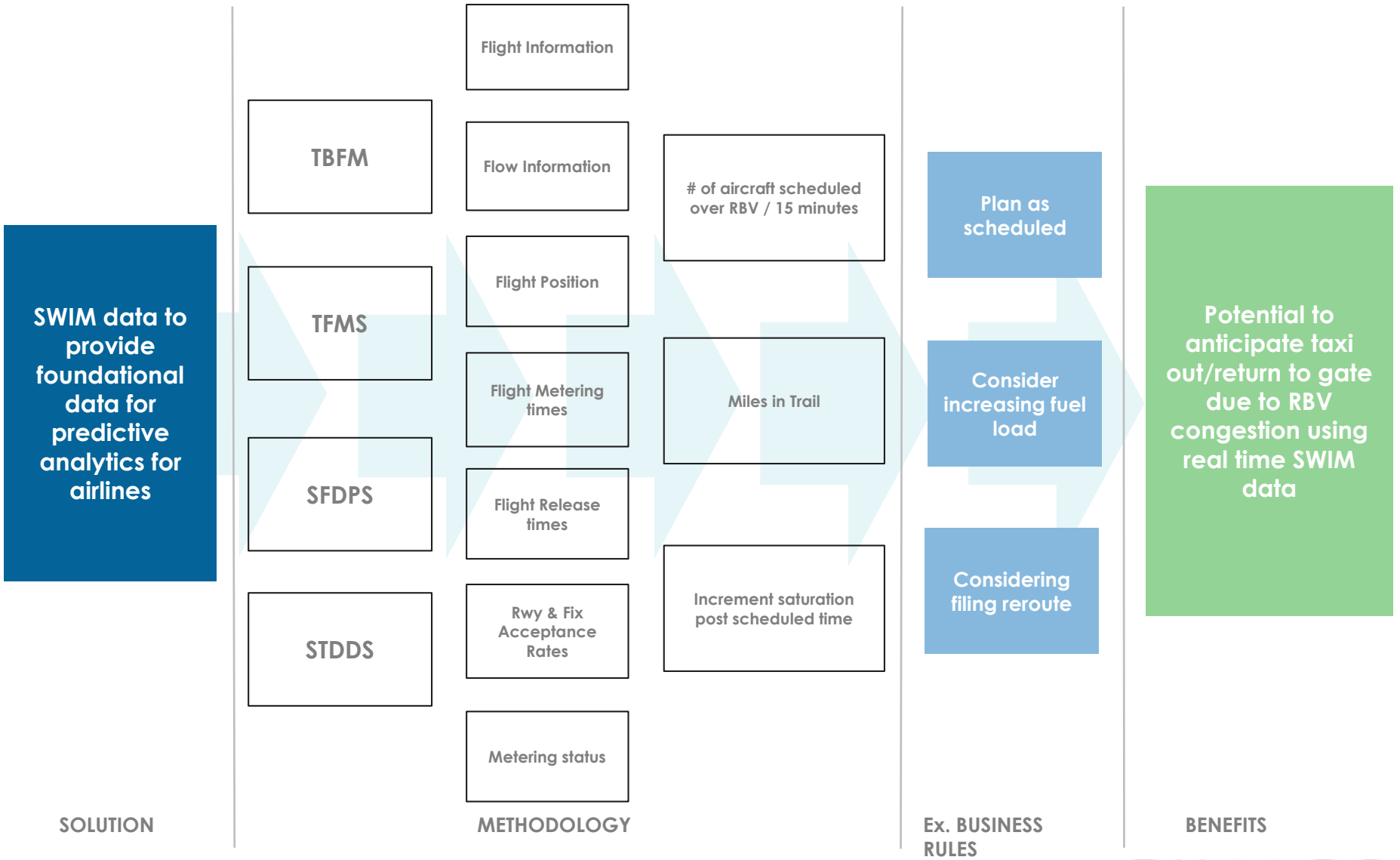
- With insight into environment over RBV, following decisions can be made pre-departure:

Plan as scheduled	Consider increasing fuel load	Consider filing reroute

- Example metrics required to drive business rules to make pre-departure decisions:

# of aircraft scheduled over RBV / 15 minutes	Miles in Trail (MIT)	Increment saturation post scheduled time

Expanding on SWIM data to anticipate RBV congestion impacts



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Metrics derived from SWIM data to drive business rules & provide new insight

Monitoring traffic flight counts:

X # of RBV scheduled aircraft / 15 minutes	Y Miles in Trail	Z # of 15 min Increments saturated post scheduled time	
< X	No MIT	≤ Z saturated slots	Plan as scheduled
> X	> Y	≥ Z saturated slots	Consider increasing fuel load
> X	> Y	≥ Z saturated slots	Consider filing reroute

Advanced data analytics:

Flying time from the TRACON outer fix to wheels down **>** X minutes → Begin planning for possible upcoming TMIs

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Next Steps

Completing Task: Generate a Report

- Identify SWIM data elements to be used in creation of a report generating new metrics for taxi in/out use case
- Identify example metrics derived from SWIM data elements capable of assisting airlines to forecast potential traffic congestion related to Use Case 1
- Leverage historical data illustrating relevant metrics to address operational issues leading to taxi out/return to gate
- Document selected SWIM data elements defining the metrics to be created/used and a mock-up of the tool to display the metrics and capabilities available in subsequent phases

Enhancements and Future Potential Deliverables

- Collaborate with SWIFT to develop relevant metrics and specific, operational process improvements to **build a decision support capability** that inputs the identified SWIM data elements to **compute metrics in real time**
- Leverage tool effectively illustrate the impact of data on operations and prove out any addition al use cases.

SWIFT Demo:
SWIM Widgets

SWIFT Lunch

SWIFT Updates

Progress to Date

- **Developed Ops Context / Use Case Docs:**
  - STDDS – SMES
  - TFMS Flow
  - TFMS Flight
  - TBFM
  - SFDPS Flight
- **Received and responded to feedback:**
  - Added data formatting / restriction information
  - Improved consistency between documentation
  - Added references to supporting documentation
  - Linked specific messages to use case scenarios
  - Added technical writer to review process

Current Schedule

July 2018	Sept.* 2018	Oct. 2018	Nov. 2018	Dec. 2019	Jan. 2018	Feb. 2019	March 2019	April 2019
TBFM Closeout	**SFDPS Flight** Closeout	**SFDPS Airspace** Closeout	**TAIS** Closeout	**FNS** Closeout	**ITWS** Closeout	**ADPS** Closeout	**TFMS Status** Closeout	**SFDPS General** Closeout
SFDPS Flight Review	**SFDPS Airspace** Review	**TAIS** Review	**FNS** Review	**ITWS** Review	**ADPS** Review	**TFMS Status** Review	**SFDPS General** Review	**ISMC** Review
SFDPS Airspace Preview	**TAIS** Preview	**FNS** Preview	**ITWS** Preview	**ADPS** Preview	**TFMS Status** Preview	**SFDPS General** Preview	**ISMC** Preview	

*Delayed one month to respond to SFDPS Airspace Use Case Feedback

TBFM OPS CONTEXT: FEED BACK

TBFM Operational Context Document

- **Due to feedback, modified scope and structure of Operational Context documents moving forward**
  - In development of TBFM document, received feedback from SWIFT focus group that the Operational Context documents were not descriptive enough in how the system itself works
  - Provided additional content on the underlying systems
  - Included a new “References” section to include citations of other documentation or resources to help build an understand of the system
  - Goal is not to include the full ConOps in the body of the Operational Context document, but provide enough information so the reader can understand how the system works in the context of the NAS as a whole

Information Service Documentation

- **Documentation currently available:**
  - Concept of Operations (ConOps)
    - Explains from an operator viewpoint, why the system was developed, the operational concept, capabilities, procedures for system use, and system benefits
  - Java Messaging Service Description Document (JMSDD)
    - Briefly explains what service does, how it works at a message and interface level, and how to connect to the service
- **Operational Context Document:**
  - Bridges the gap between the ConOps and JMSDD
  - Explains how the underlying systems and service work and goes deeper to tie individual messages to operational activities

SFDPS AIRSPACE PREVIEW: FEEDBACK

Problem Statement

- Flight planning and flight operations are negatively impacted by difficulties determining the status and timing of Special Activity Airspace (SAA).
  - Some SAA is published as active during certain time frames but is not activated.
  - Some SAA is managed by NOTAM but often the NOTAMs are not current.
  - Military airspace is often restricted for use, but is not actually being used by the military.
  - SAA can become active after a flight departs and the flight has been planned thru that area, causing an unplanned reroute.
  - SAA data is not available in a format that allows sorting or filtering to determine impacts
  - This creates difficulties for ATC, pilots and AOCs.

Perspectives

Air Traffic Control:

- Responsible for safe and efficient use of airspace
- Success is defined by efficient use of airspace, effective strategic planning, minimized impacts of SAA, and minimal use of tactical interventions that add delay to flights

Airline Flight Ops:

- Responsible for ensuring regulatory compliance, ensuring on-time operations, managing resources, maintaining flight schedules, fleet management, and applying the airline's business model.
- Success is defined by regulatory compliance, predictable operations, on-time operations, effective resource management, reduced fuel use and positive customer experience.

Flight Crews:

- Responsible for safety risk management, fuel management, SAA avoidance, on-time operations, regulatory compliance
- Success is defined by maintaining appropriate safety margins during flight, efficient fuel management, regulatory compliance including SAA avoidance, on time operations.

Current State

- Information about SAA is often outdated, imprecise or inaccurate
- Message formats do not allow for filtering to determine whether SAA will impact individual flights.
- The lack of precise information and inability to filter SAA data creates problems for airspace users and ATC in efficiently planning and operating flights.
- Incomplete or inaccurate airspace data results in sub-optimal decision making by airspace users and ATC.
- Flights are often planned to unnecessarily circumnavigate SAA or are rerouted after departure to avoid SAA.
- Last minute SAA changes cause safety concerns for flight crews who must make quick unplanned trajectory changes
- This creates unnecessary delays, increases fuel use, and creates uncertainty that impacts safety, gate assignments, passenger connections, crew schedules, aircraft rotations and planning.

Future State

- SAA data will be shared with ATC and Airspace Users via SWIM
- SAA data will be formatted for filtering and sorting, enabling airspace users and ATC to readily determine impacts
- Airspace users and ATC will have the same current data
- AUs and ATC will be able to quickly and accurately determine the status, timing and impacts of SAA during planning and after departure
- Routing decisions will be made earlier, with fewer negative impacts
- As changes occur, updates will be shared giving FOCs and flight crews early notification of status changes
- This will facilitate improved accuracy of flight planning, flight operations, airspace management and coordination
- Flight crews will be faced with less uncertainty, improving safety
- Planning and collaboration between AUs and ATC will improve.
- Gate usage, fleet management, resource management, fuel planning and customer experience will benefit.

Metrics

Air Traffic Control:

- Safe flight operations
- Maximum airspace usage
- Minimum impacts from SAA
- Effective traffic management initiatives
- Effective delay management
- Effective collaboration with AUs

AU Flight Ops:

- Efficient and effective planning
- Efficient and effective flights
- Efficient delay management
- Minimum fuel consumption
- Increased predictability
- On time arrivals
- Effective gate utilization, flight and ground crew scheduling, and fleet management
- Regulatory Compliance
- Improved customer experience

Flight Crews:

- Improved safety risk management
- Regulatory Compliance
- Efficient routings
- Minimum fuel consumption
- On-time operations
- Improved customer experience

Benefits

Using SWIM to share SFDPS SAA data with airspace users and ATC will facilitate greater efficiency and reduced workload by making SAA data that is current, accurate and sortable available to stakeholders. This will enable AUs and ATC to readily determine impacts to flights and create mitigations that are timely and efficient, resulting in:

- Improved aircraft routes
- Fewer delays
- Shorter flights
- Improved fuel efficiency
- Increased predictability
- More on-time arrivals
- Improved resource management
- Improved TFM system collaboration
- Improved safety
- Improved customer experience

SFDPS Airspace Use Case Preview

- **Feedback received:**
  - SAA messages provide information already available from AIM
  - Other messages from SFDPS Airspace may be of more interest to be highlighted in a Use Case
- **Action Taken:**
  - Draft copy of the SFDPS Airspace document provided to Focus Group Participants on 7/27
  - Request for input on which messages are of highest interest to be provided by 8/10

SFDPS Airspace Messages

- **Sector Assignment Status**
  - Used to communicate current sector and Terminal Radar Approach Control (TRACON) configurations. A sector or TRACON may either be closed or open. If the sector or TRACON is open, it is composed of one or more Fixed Airspace Volumes (FAV).
- **Route Status**
  - Used to communicate whether some adapted departure and/or arrival routes are active or not. A route status is indicated by the route name followed by either “ON” or “OFF.”
- **Special Activities Airspace**
  - Provides the real-time status and schedules for the SAA.
- **Altimeter Setting**
  - Used to communicate altimeter reference data for a particular station, generally an airport. The altimeter reference data includes the data reporting time (35a), the reporting station (13.3), and the altimeter setting (34a).
- **Adapted Route Status Reconstitution**
  - Sent when a client first connects to a HADDS or when a client reconnects to a HADDS due to a disruption in communication.
- **Altimeter Status Reconstitution**
  - Sent when a client first connects to a HADDS or when a client reconnects to a HADDS due to a disruption in communication.
- **Sector Assignment Reconstitution**
  - Sent when a client first connects to a HADDS or when a client reconnects to a HADDS due to a disruption in communication.

Next Steps

- **Awaiting feedback on:**
  - TBFM Ops Context
  - SFDPS Flight Use Case
- **Finalizing Completed Documentation**
  - Publication of Ops Context and Use Case documentation onto NSRR

Terminal Flight Data Manager (TFDM) SWIM Data Publications Primer

Eric Van Brunt (Leidos)
- TFDM System Architect

TFDM Functional Site Configurations

- **Configuration B (Partial Set of TFDM Capabilities)**
  - Electronic Flight Data
    - Ingestion and Management of Flight Data Information from FAA NAS Systems
    - Electronic Flight Strips in ATCT
  - Airport Resource Mgmt.
    - Airport Configurations
      - Runway Assignment
    - Airport Resource Closures
  - Traffic Flow Data Mgmt.
    - Enter and Process Traffic Management Initiatives
    - Integration with Time Based Flow Metering for Departure Metering
  - Surface Scheduling
    - Airport Level Demand Predictions
  - Metrics, Reporting, and Analysis

Configuration B provides Electronic Flight Data (EFD) with some selected surface scheduling, traffic flow data, airport resource management capability, and limited data exchange with Flight Operator System (FOS)

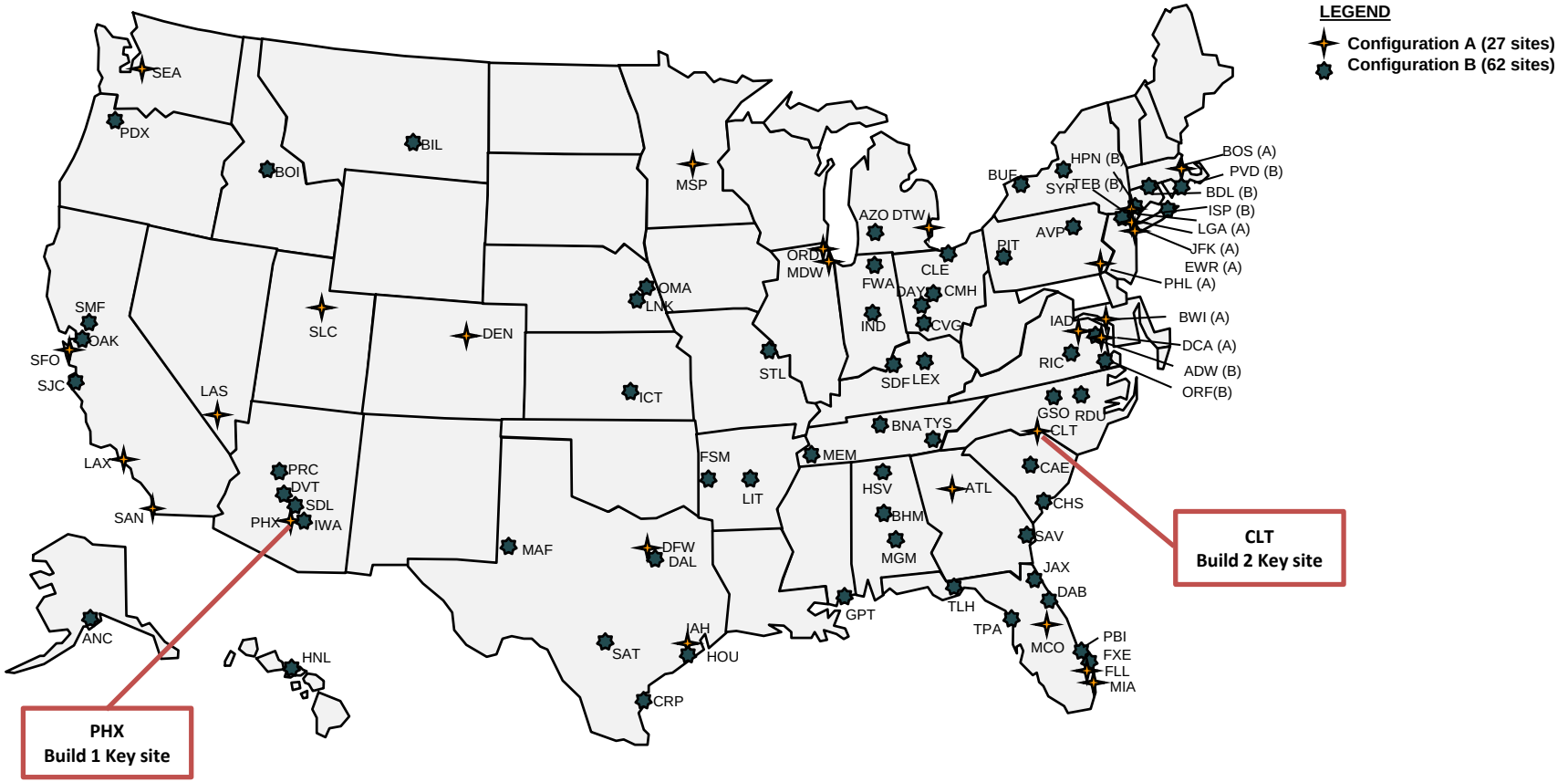
Black – Build 1
Red – Build 2

TFDM Functional Site Configurations

- **Configuration A (Full Set of TFDM Functions)**
  - Electronic Flight Data
    - Ingestion and Management of Flight Data Information from FAA NAS Systems
    - Electronic Flight Strips in ATCT
  - Airport Resource Mgmt.
    - Airport Configurations
      - Runway Assignments
    - Airport Resource Closures
  - Traffic Flow Data Mgmt.
    - Enter and Process Traffic Management Initiatives
    - Integration with Time Based Flow Metering for Departure Metering
  - Surface Scheduling
    - Predicted Runway and Spot Assignments, Taxi Times, Takeoff Time
    - Predict Resource Utilization in Active Movement/Non-Movement Areas
  - Surface Metering
    - Ration By Schedule based Surface Metering Programs
  - Metrics, Reporting, and Analysis

Black – Build 1
Red – Build 2

Implementation Sites by Configuration

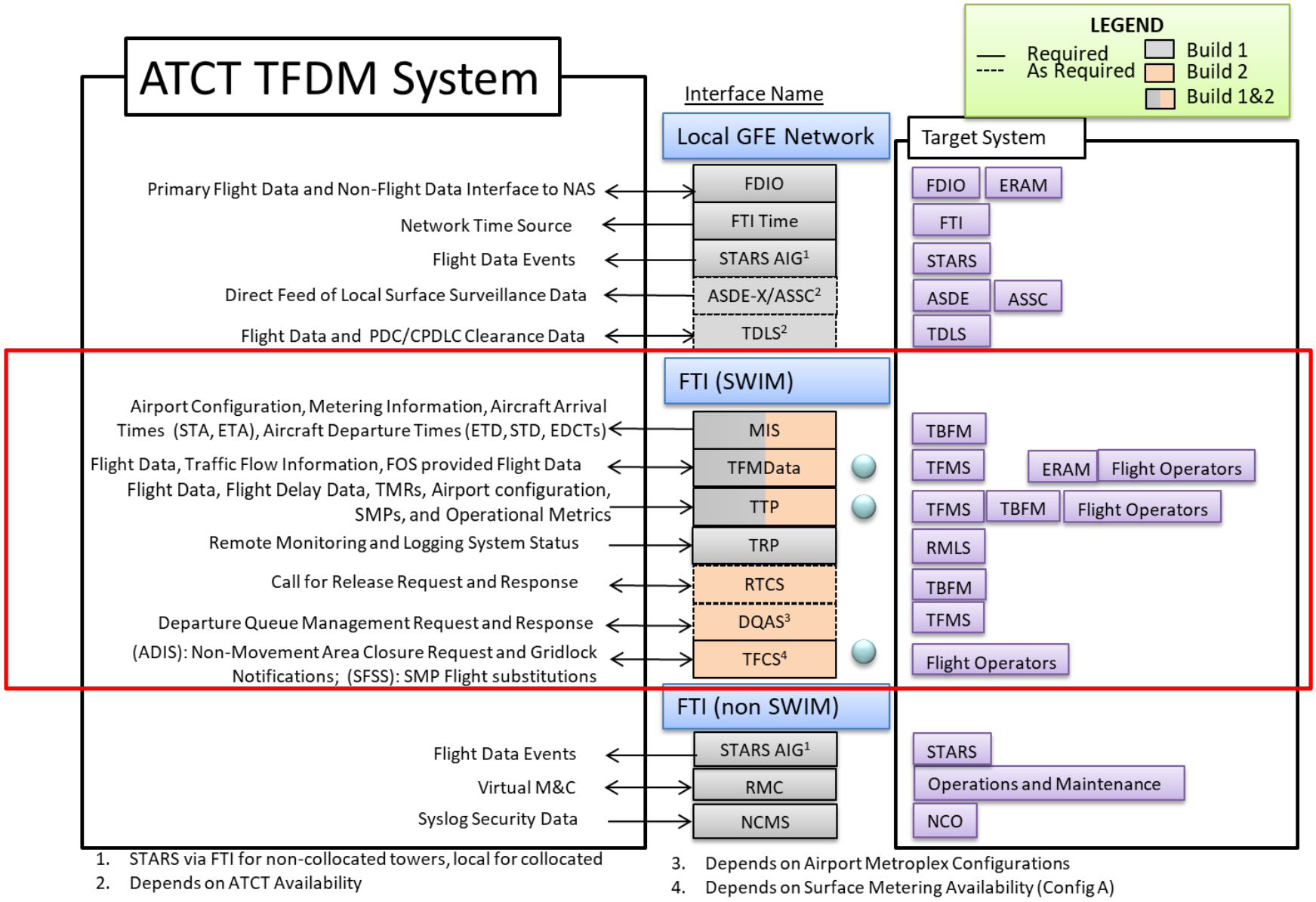


TFDM Benefits for Airline/Operator Users

- **Improved ATC Airport Tactical Awareness (Build 1) through SWIM Publication and consumption of TFDM Data**
  - Flight Data Information
    - Per Flight TFDM data for aircraft arriving/departing airport
    - Would include TFDM calculated predictions and state of flight at a TFDM enabled airport
  - Flight Delay Information
    - Per Flight details of flight delays
  - Airport Information
    - Runway Configuration, Arrival/Departure Rates, Closures, Notifications
  - Traffic Management Restrictions
    - Provides information about various restrictions and the flight affected by them (Airport Scope)
  - Operational Metrics
    - Key Performance Indications such as airport and runway throughput, departure and arrival rates and flight specific metrics such as Data Quality and Surface durations

TFDM Benefits for Airline/Operator Users

- **Establish FAA Surface Airport Collaboration (Build 2) Capabilities**
  - Airport Resource Management
    - Airport Operators can provide Non-movement Area Closure, Non-movement Area Gridlock Notification
  - Surface Metering Programs
    - Parameters, notifications, and information related to the Affirmed and Recommended Surface Metering Program for a TFDM airport. This information includes the list of affected flights.
    - Metered Surface Times (Target Movement Area Times)
    - Flight Substitution (Ability to request substitution)



1. STARS via FTI for non-collocated towers, local for collocated
2. Depends on ATCT Availability
3. Depends on Airport Metroplex Configurations
4. Depends on Surface Metering Availability (Config A)

Focus of this Presentation

Flight Operator Data via SWIM to TFDM

- **TFDM is intending to receive Flight Operator Data via TFMData publication. Data includes:**
  - Operator Flight Intent and Actual Block Times
    - Actual In/Off Block Times
      - Key to determining non-movement area activity
    - Initial and Earliest Off-Block Time
      - Heavily Utilized Input to Surface Scheduling and Metering
    - Gate Assignment
      - Determine Gate Conflicts and Tactical Awareness by ATC
    - Flight Cancellation

    - Intent(s) to Hold in the Movement and Non-Movement Area
      - Aids Surface Resource Gridlock Predictions
    - Intent for Deicing
      - Aids applicability to Surface Metering
    - Intended Arrival/Departure Spot
      - Aids Surface Resource – Alleyway Conflict Detection

TFDM Terminal Publication (TTP) Services Overview

- **TFDM Terminal Publication Service is a collection of TFDM related SWIM Services**
  - TFDM Systems at individual airports contribute/produce variety of TFDM related data for consumption
  - Has provisions for restricting sensitive data.

- **TTP Services Include:**
  - Flight Data
  - Flight Delay
  - Airport Information (AI)
  - Traffic Mgmt Restrictions (TMR)
  - Operational Metrics (OM)
  - Surface Metering Program (SMP)

TFDM TTP Flight Data

- **Overview**
  - The Flight Data service provides flight specific information for flights departing from and arriving at a TFDM enabled airport. Data includes detailed surface location information and predicted/actual times at those locations.
- **Intended Service Users**
  - FAA Systems
  - Any commercial air carrier, airport operator, ramp operator, Collaborative Decision Making (CDM) participants, or private user of the NAS.
- **Availability:**
  - From All TFDM Sites
- **Data Exchange (Publish/Subscribe)**
  - Add/Update/Delete Flight Messages
    - FIXM based messages that includes flight specific flight data (ACID, Departure/Arrival Airport, Departure/Arrival Fixes, Stand Locations, Block Times, Take-Off Times, Landing Times, Movement Area Times, Runway Queue Times, ATC Flight state, Operational flight State, Runway Assignments)

TFDM TTP Flight Delay

- **Overview**
  - The Flight Delay service provides flight specific delay information for flights departing a TFDM enabled airport. Data includes detailed information about the delay for the flight.
- **Intended Service Users**
  - FAA Systems
- **Availability:**
  - From All TFDM Sites
- **Data Exchange (Publish/Subscribe)**
  - Delay Flight Message
    - Flight Matching Data – ACID, CID, ERAMGufi, Arrival and Departure Airport, Initial Gate Time of Departure
    - Delay Information – Delay Start/End Time, Impacting Condition (Reason) , TMI Type, Facility Charge To, Remarks

TFDM TTP Airport Information

- **Overview**
  - The Airport Information service provides data about the TFDM enabled airport and includes runway configurations and associated departure and arrival rates as well as closures, notifications and runway departure delay information.
  - Note: There is no flight specific information included
- **Intended Service Users**
  - FAA Systems
  - Any commercial air carrier, airport operator, ramp operator, Collaborative Decision Making (CDM) participants, or private user of the NAS.
- **Availability:**
  - From All TFDM Sites
- **Data Exchange (Publish/Subscribe)**
  - Airport Information Messages include
    - Current and Scheduled Airport Configurations – Includes time of effectiveness, airport and runway arrival/departure rates
    - Runway, Taxiway, Surface Element, and Non-Movement Area Closure Data – lists of closures
    - Notifications – Rate Change, Configuration Changes, ramp Closure/Open
    - Delay Data – Airport and Runway Delays

TFDM TTP Traffic Management Restrictions

- **Overview**
  - The Traffic Management Restrictions service provides information about various restrictions and the flights affected by them. Restrictions include Miles in Trail, Minutes in Trail, Departure Stops and APREQs. This can included locally (at the specific TFDM airport) entered Traffic Management Restrictions not reflected in Traffic Flow Management Systems.
- **Intended Service Users**
  - FAA Systems
  - Any commercial air carrier, airport operator, ramp operator, Collaborative Decision Making (CDM) participants, or private user of the NAS.
- **Availability:**
  - From All TFDM Sites
- **Data Exchange (Publish/Subscribe)**
  - Restriction Messages contain list of flights affected for Approval Requests (APREQ), Miles in Trail, Minutes in Trail, Departure Stops – Build 1
    - Flights in list contain flight matching data plus Earliest Off Block Time and Approval Request Release Times.

TFDM TTP Operational Metrics

- **Overview**
  - The Operational Metrics service provides Key Performance Indicators (KPIs) for the airport such as its airport and runway throughput, departure and arrival rates, and flight specific metrics such as Data Quality points and surface durations.
- **Intended Service Users**
  - FAA Systems
  - Collaborative Decision Making (CDM) participants
- **Availability:**
  - From All TFDM Sites
- **Data Exchange (Publish/Subscribe)**
  - Operational Metrics published on 16 KPIs which include the following subset:
    - Flight Data Quality (per Flight)
    - Metering Read Time Compliance (per Airport and per Flight)
    - Metering Time Compliance (per Airport and per Flight)
    - Metering Hold Data (per Airport and per Flight)
    - Actual vs Predicted Flight Times (per Flight)
    - Stability of Metering Times Data (per Flight)
    - Phase of Taxi Operations (per Flight)
    - Calculated Fuel Burn KPI (per Airport)

Operational Metrics for flights are produced on takeoff or arrival at gate

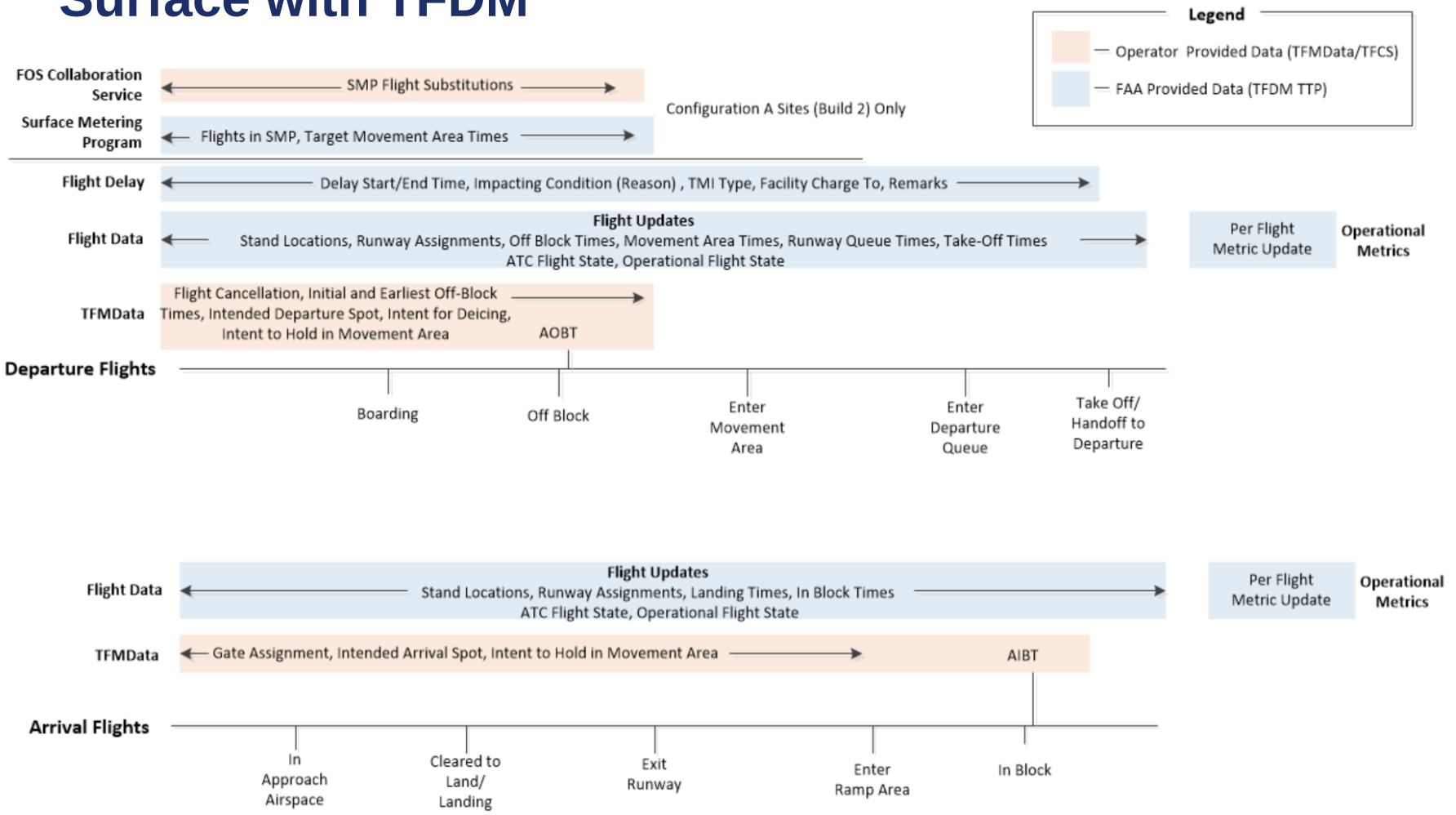
TFDM TTP Surface Metering Program

- **Overview:**
  - The Surface Metering Program service provides parameters, notifications, and information related to the Affirmed and Recommended Surface Metering Programs for a TFDM airport. This information includes the list of affected flights.
- **Intended Service Users:**
  - FAA Systems
  - Collaborative Decision Making (CDM) participants.
- **Availability:**
  - From TFDM Configuration A Sites Only (post Build 2 deployment)
- **Data Exchange (Publish/Subscribe):**
  - TFDM SMP Data Message
    - This message is used to communicate the SMPs themselves (w/associated flight lists), and the recommended SMPs (w/associated flight lists).
  - TFDM SMP Flight List Update
    - This message is used to communicate an update to the flight list of an SMP.

TFDM FOS Collaboration Service (TFCS)

- **Overview:**
  - The TFDM FOS Collaboration Services handles requests submitted by the Flight Operator System group of users. Functionality categorized into Airport Data requests and Surface Metering Program (SMP) Flight Substitution Requests
- **Intended Service Users:**
  - Any commercial air carrier, airport operator, ramp operator, or Collaborative Decision Making (CDM) participant.
- **Availability:**
  - From TFDM Configuration A Sites Only (post Build 2 deployment)
- **Data Exchange (Request/Reply):**
  - Airport Data Information
    - Allows FOS users to create, update, activate, deactivate or remove Non-Movement Area Closures
    - Allows FOS users to create, update, or remove Predicted and Actual Gridlock in Non-Movement Areas.
  - SMP Flight Substitution
    - Allows FOS users with flights affected by an SMP to swap which flights are using their departure slots.

High Level Overview of Per Flight Data Exchanges for Surface with TFDM



Availability of TFDM Data

- **Integration and Test Activity Data**
  - ATD-2 (NASA) Activities in CLT produce a TFDM TTP compliant set of data that can be integrated.
    - Available now via SWIM
  - TFDM Testing at FAA WJHTC Labs will produce limited amounts of TTP data for integration
    - Dependent on Systems Executing Test Data
    - Requires access to FAA Test NESG
- **Operational Data Access**
  - As each TFDM system (airport) becomes operational (IOC), the TTP data will be publishing for that airport.

Question & Answer Session…

Producer Focus:
Aeronautical Information Management Modernization

Aeronautical Common Service (ACS)

By: AIMM Program Office

To: SWIM Industry-FAA Team (SWIFT)

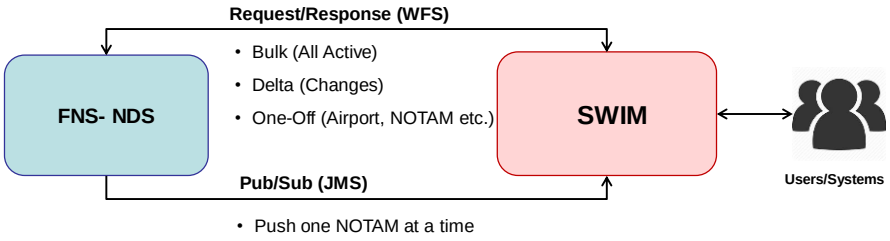
Date: August 15, 2018

Overview

- **Aeronautical data products distributed with different formats & channels**
  - Non-standard and lack of integration
- **Goal is to standardize data formats and make them available via SWIM**
  - WFS and WSN through SWIM
  - Leverage SWIM Cloud Distribution Service (JMS Topics)
- **Consolidate and streamline all Aeronautical data products under Aeronautical Common Services (ACS) platform**
  - Eliminate silos & non-standard distribution mechanisms
  - Enable integration of static and dynamic data
  - Improved data quality & availability
- **Plan**
  - Improve operational reliability of all AI data services
  - AIMM S2 (ACS) - Consolidate all AI data providing both integrated and standalone services via SWIM
  - AIMM S3 increases NAS efficiency and safety access by improving quality of NAS constraint data and enabling near-real-time data processing

NOTAM Quality

- **FNS NDS is operational over SWIM providing two services**
  - Request/Response (Web Feature Service) & Publish/Subscribe (JMS)
- **Current operational issues with FNS NDS**
  - Pub/Sub service experiencing message loss
    - Request/Response service does not have this issue
  - Request/Response service experiences outage during NEMS maintenance
    - Current configuration of NDS at the DR site cannot support SWIM
- **Pub/Sub Message Loss**
  - Message loss due to AIXM schema compliance and validation
  - All issues have been addressed and software in testing
- **Support multiple NEMS nodes to eliminate outage during maintenance**
  - Technical solution has been designed, Solution in development
- **Both these issues will be addressed and deployed within AIMM S2 release schedule**
  - CTB available early calendar 2019
  - ACS FOC fall 2019



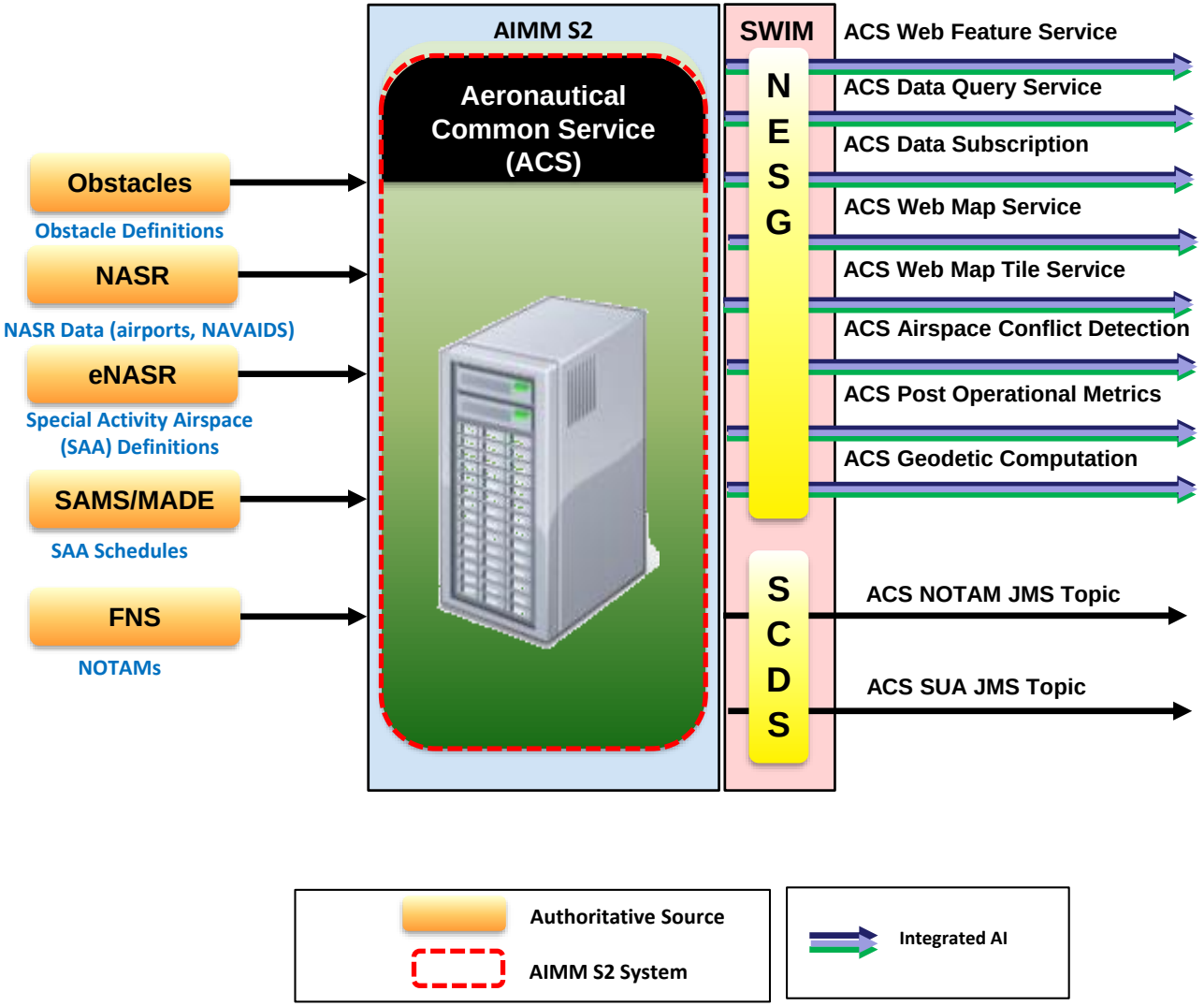
AIMM Segment 2 / ACS

- **Aeronautical Common Services (ACS) will:** FOC planned for Fall 2019
  - Enable transition from aeronautical products to aeronautical data.
  - Provide foundational enterprise level infrastructure platform leveraging SWIM, internationally recognized exchange standards, and web services to deliver aeronautical information across the NAS with native functionality to process, transform, filter, and publish tailored aeronautical information as services to end use applications
  - Add fully integrated data feed via OGC-compliant web services for tailored data queries
  - Improve distribution of SAA, NOTAM, and relevant aeronautical reference information
- **Consumer Test Bed (CTB):** Connected to R&D NEMS
  - Deploy value-added services and data to external stakeholders (e.g. airlines, 3rd party vendors) enabling improved flight planning, decision making, and mapping capabilities
  - Allow stakeholders
    - to develop and test interfaces to receive aeronautical information via ACS
    - to identify the aeronautical data they want
    - to identify and test bandwidth requirements for selected data dissemination
  - Establish a feedback process for consumers while in the CTB for bugs, enhancements, and customization
  - Available early calendar year 2019

AIMM Segment 2 / ACS (cont'd)

1. **Ingestion**
   - Digital data ingestion reduces voice-transcription errors and speeds data transfer from source to destination
   - Authoritative Data Sources
2. **Integration**
   - Data will be validated and transformed from legacy formats to Aeronautical Information Exchange Model (AIXM)
   - Data will be integrated in order to increase usability (e.g., data queries) and understanding
3. **Dissemination**
   - Single point of access to AI via a two-way data exchange using SWIM-compliant web services
   - Other common services (e.g., NOTAMs and SUA through SWIM SCDS – JMS topics)

ACS Integrated Data Feed



AIMM Segment 3

AIMM S3 increases NAS efficiency and safety access by improving the quality of NAS constraint data and enabling near-real-time data processing. It provides:

- Integrated aeronautical data services within the NAS
- Combined airspace tool
- Additional aeronautical information authoritative sources
- Infrastructure enhancements
- Standard Operating Procedure/Letter of Agreement (SOP/LOA) constraints, procedures, and obstacles data.

This service will provide consistent data to enhance internal and external (e.g. DoD, airlines, general aviation) customer operational objectives and help them realize future benefits:

Activity	Example
Flight Planning	Using geo-carved SAA and NOTAM data to improve trajectory planning *Benefit: Increase efficiency of the NAS through enabling trajectory negotiations*
Real-Time NAS Operations	Notifying stakeholders of a Navigational Aid (NAVAID) outage via a NOTAM *Benefit: Increase safety and situational awareness (common operational picture)*
Traffic Flow Management	Taking into account predicted SAA status when considering Traffic Flow Management Initiatives *Benefit: Enhance airspace utilization*
Post-Event Analysis	Analyzing use of airspace *Benefit: Facilitates improved decision making*

Summary & Next Meeting

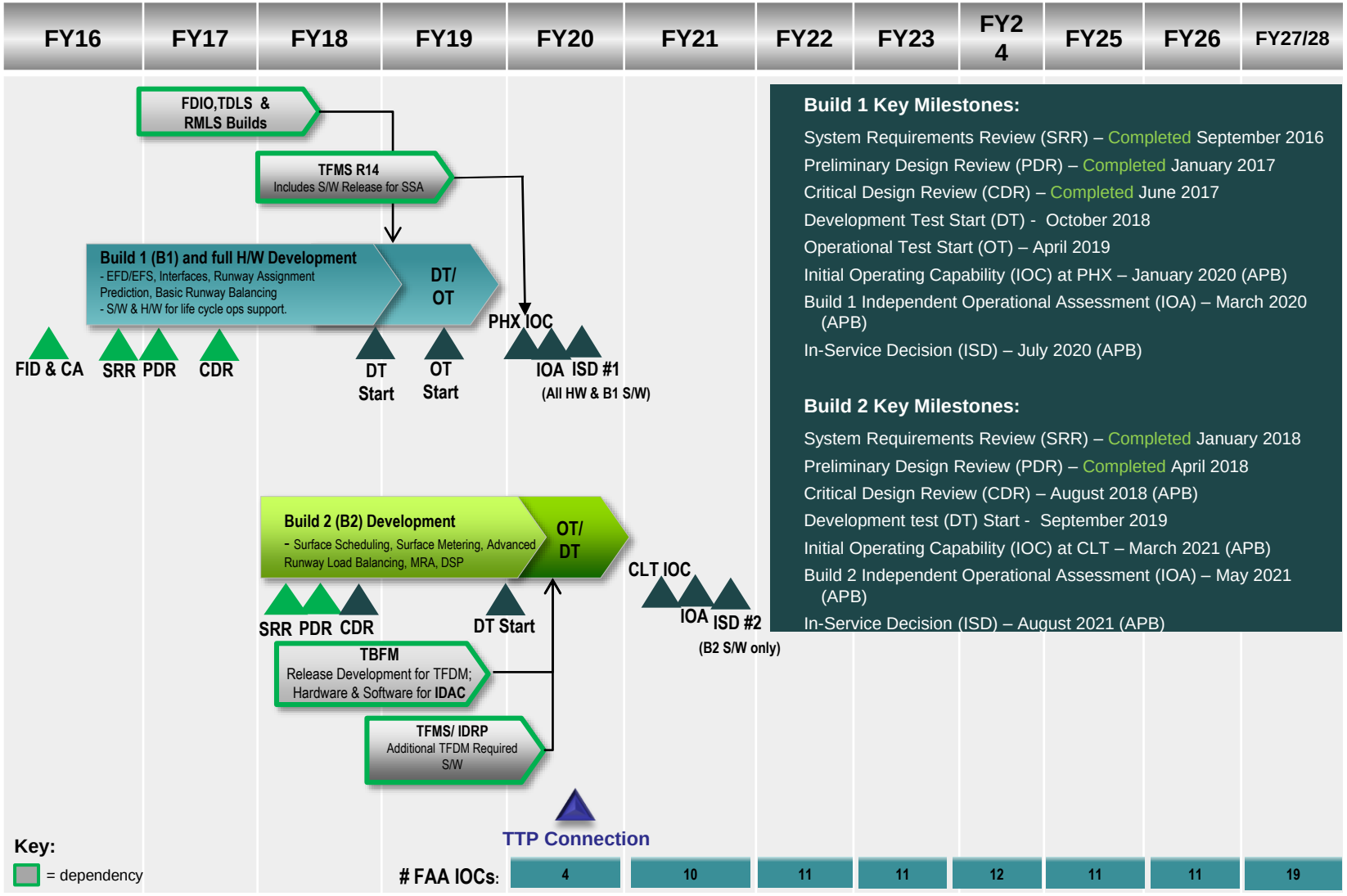
- **Summary of the day**

- **Topics for next meeting:**
  - Case Studies:
    - Southwest Airlines
    - Delta Airlines
  - Operational Metrics Deep Dive
  - SWIM Data in Action: Sample Tool Demonstration (NOD)
  - Global SWIM Strategy: FAA Perspective

- **Next meeting: November 2018 in Washington DC**

Back Up

TFDM Development & Implementation Timeline



TFDM Waterfall Detail (1 of 4)

Risk Adjusted Dates

Site #	ATCT Name	Tower ID	Config.	Functionality Deployed	IOC Risk Adj
1	**Phoenix Sky Harbor International Airport (Build 1 key site)**	PHX	A	Build 1	Jan-20
1	Phoenix Sky Harbor International Airport	PHX	A	Build 2 Retrofit (includes Build 1 functions)	Aug-21
2	Cleveland Hopkins International Airport	CLE	B	Build 1	Jul-20
3	Phoenix–Mesa Gateway Airport	IWA	B	Build 1	Aug-20
4	Raleigh–Durham International Airport	RDU	B	Build 1	Sep-20
5	Indianapolis International Airport	IND	B	Build 1	Oct-20
6	Los Angeles International Airport	LAX	A	Build 1	Nov-20
7	**Charlotte Douglas International Airport (Build 2 Key Site)**	CLT	A	Build 2 SW (includes Build 1 functions)	Mar-21
8	Philadelphia International Airport	PHL	A	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface)	Apr-21
8	Philadelphia International Airport	PHL	A	Adapt Build 2 (includes functions for DSP Replacement)	Apr-22
9	Newark Liberty International Airport	EWR	A	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	May-21
9	Newark Liberty International Airport	EWR	A	Adapt Build 2 (DSP Replacement)	Apr-22
9	Newark Liberty International Airport	EWR	A	Implement Surface Metering	Jan-23
10	John F. Kennedy International Airport	JFK	A	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	Jun-21
10	John F. Kennedy International Airport	JFK	A	Adapt Build 2 (DSP Replacement)	Apr-22
10	John F. Kennedy International Airport	JFK	A	Implement Surface Metering	Feb-23
11	LaGuardia Airport	LGA	A	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	Jul-21
11	LaGuardia Airport	LGA	A	Adapt Build 2 - DSP Replacement	Apr-22
11	LaGuardia Airport	LGA	A	Implement Surface Metering	Mar-23
12	Phoenix Deer Valley Airport	DVT	B	Full TFDM SW, Adapt Build 1	Aug-21
13	Dayton International Airport	DAY	B	Full TFDM SW, Adapt Build 1	Sep-21
14	San Francisco International Airport	SFO	A	Full TFDM SW, Adapt Build 1 and 2	Sep-21
6	Los Angeles International Airport	LAX	A	Build 2 Retrofit (includes Build 1 functions)	Oct-21
15	Sacramento International Airport	SMF	B	Full TFDM SW, Adapt Build 1	Oct-21

TFDM Waterfall Detail (2 of 4)

Risk Adjusted Dates

Site #	ATCT Name	Tower ID	Config.	Functionality Deployed	IOC Risk Adj
16	George Bush Intercontinental Airport	IAH	A	Full TFDM SW, Adapt Build 1 and 2	Nov-21
17	Hartsfield–Jackson Atlanta International Airport	ATL	A	Full TFDM SW, Adapt Build 1 and 2	Jan-22
18	Teterboro Airport	TEB	B+	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	Feb-22
18	Teterboro Airport	TEB	B+	Adapt Build 2 (DSP Replacement)	Apr-22
19	Westchester County Airport	HPN	B+	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	Mar-22
19	Westchester County Airport	HPN	B+	Adapt Build 2 (DSP Replacement)	Apr-22
20	Scottsdale Airport	SDL	B	Full TFDM SW, Adapt Build 1	Apr-22
21	Long Island MacArthur Airport	ISP	B+	Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface	Apr-22
22	Norman Y. Mineta San Jose International Airport	SJC	B	Full TFDM SW, Adapt Build 1	Jun-22
23	John Glenn Columbus International Airport	CMH	B	Full TFDM SW, Adapt Build 1	Jul-22
24	William P. Hobby Airport	HOU	B	Full TFDM SW, Adapt Build 1	Aug-22
25	Prescott Municipal Airport	PRC	B	Full TFDM SW, Adapt Build 1	Sep-22
26	Chicago O'Hare International Airport	ORD	A	Full TFDM SW, Adapt Build 1 and 2	Oct-22
27	McCarran International Airport	LAS	A	Full TFDM SW, Adapt Build 1 and 2	Nov-22
28	Oakland International Airport	OAK	B	Full TFDM SW, Adapt Build 1	Jan-23
29	Tampa International Airport	TPA	B	Full TFDM SW, Adapt Build 1	Feb-23
30	San Diego International Airport	SAN	A	Full TFDM SW, Adapt Build 1 and 2	Mar-23
31	Orlando International Airport	MCO	A	Full TFDM SW, Adapt Build 1 and 2	Apr-23
32	Denver International Airport	DEN	A	Full TFDM SW, Adapt Build 1 and 2	May-23
33	Chicago Midway International Airport	MDW	A	Full TFDM SW, Adapt Build 1 and 2	Jun-23
34	Miami International Airport	MIA	A	Full TFDM SW, Adapt Build 1 and 2	Jul-23
35	Dallas/Fort Worth International Airport (3 ATCTs)	DFW	A	Full TFDM SW, Adapt Build 1 and 2	Aug-23
36	Logan International Airport	BOS	A	Full TFDM SW, Adapt Build 1 and 2	Sep-23
37	Fort Lauderdale Executive Airport	FXE	B	Full TFDM SW, Adapt Build 1	Oct-23
38	Minneapolis–Saint Paul International Airport	MSP	A	Full TFDM SW, Adapt Build 1 and 2	Nov-23

TFDM Waterfall Detail (3 of 4)

Risk Adjusted Dates

Site #	ATCT Name	Tower ID	Config.	Functionality Deployed	IOC Risk Adj
39	Cincinnati/Northern Kentucky International Airport	CVG	B	Full TFDM SW, Adapt Build 1	Jan-24
40	Washington Dulles International Airport	IAD	A	Full TFDM SW, Adapt Build 1 and 2	Feb-24
41	Salt Lake City International Airport	SLC	A	Full TFDM SW, Adapt Build 1 and 2	Mar-24
42	Detroit Metropolitan Wayne County Airport	DTW	A	Full TFDM SW, Adapt Build 1 and 2	Apr-24
43	Fort Lauderdale–Hollywood International Airport	FLL	A	Full TFDM SW, Adapt Build 1 and 2	May-24
44	Jacksonville International Airport	JAX	B	Full TFDM SW, Adapt Build 1	Jun-24
45	Baltimore/Washington International Thurgood Marshall Airport	BWI	A	Full TFDM SW, Adapt Build 1 and 2	Jul-24
46	Dallas Love Field	DAL	B	Full TFDM SW, Adapt Build 1	Aug-24
47	Nashville International Airport	BNA	B	Full TFDM SW, Adapt Build 1	Sep-24
48	Louisville International Airport	SDF	B	Full TFDM SW, Adapt Build 1	Oct-24
49	Seattle–Tacoma International Airport	SEA	A	Full TFDM SW, Adapt Build 1 and 2	Oct-24
50	Ronald Reagan Washington National Airport	DCA	A	Full TFDM SW, Adapt Build 1 and 2	Dec-24
51	T. F. Green Airport	PVD	B	Full TFDM SW, Adapt Build 1	Jan-25
52	Charleston International Airport	CHS	B	Full TFDM SW, Adapt Build 1	Feb-25
53	Eppley Airfield	OMA	B	Full TFDM SW, Adapt Build 1	Mar-25
54	Memphis International Airport	MEM	B	Full TFDM SW, Adapt Build 1	Apr-25
55	Richmond International Airport	RIC	B	Full TFDM SW, Adapt Build 1	May-25
56	San Antonio International Airport	SAT	B	Full TFDM SW, Adapt Build 1	Jun-25
57	Bradley International Airport	BDL	B	Full TFDM SW, Adapt Build 1	Jul-25
58	Birmingham–Shuttlesworth International Airport	BHM	B	Full TFDM SW, Adapt Build 1	Aug-25
59	Lincoln Airport	LNK	B	Full TFDM SW, Adapt Build 1	Sep-25
60	Joint Base Andrews	ADW	B	Full TFDM SW, Adapt Build 1	Oct-25
61	Buffalo Niagara International Airport	BUF	B	Full TFDM SW, Adapt Build 1	Dec-25
62	Palm Beach International Airport	PBI	B	Full TFDM SW, Adapt Build 1	Jan-26
63	Montgomery Regional Airport	MGM	B	Full TFDM SW, Adapt Build 1	Feb-26
64	Portland International Airport	PDX	B	Full TFDM SW, Adapt Build 1	Mar-26
65	Pittsburgh International Airport	PIT	B	Full TFDM SW, Adapt Build 1	Apr-26

TFDM Waterfall Detail (4 of 4)

Risk Adjusted Dates

Site #	ATCT Name	Tower ID	Config.	Functionality Deployed	IOC Risk Adj
66	St. Louis Lambert International Airport	STL	B	Full TFDM SW, Adapt Build 1	May-26
67	Wilkes-Barre/Scranton International Airport	AVP	B	Full TFDM SW, Adapt Build 1	Jul-26
68	Piedmont Triad International Airport	GSO	B	Full TFDM SW, Adapt Build 1	Aug-26
69	Gulfport–Biloxi International Airport	GPT	B	Full TFDM SW, Adapt Build 1	Sep-26
70	Syracuse Hancock International Airport	SYR	B	Full TFDM SW, Adapt Build 1	Oct-26
71	Norfolk International Airport	ORF	B	Full TFDM SW, Adapt Build 1	Nov-26
72	Clinton National Airport	LIT	B	Full TFDM SW, Adapt Build 1	Jan-27
73	Savannah/Hilton Head International Airport	SAV	B	Full TFDM SW, Adapt Build 1	Feb-27
74	Ted Stevens Anchorage International Airport	ANC	B	Full TFDM SW, Adapt Build 1	Mar-27
75	Boise Airport	BOI	B	Full TFDM SW, Adapt Build 1	Apr-27
76	McGhee Tyson Airport	TYS	B	Full TFDM SW, Adapt Build 1	May-27
77	Wichita Dwight D. Eisenhower National Airport	ICT	B	Full TFDM SW, Adapt Build 1	Jun-27
78	Billings Logan International Airport	BIL	B	Full TFDM SW, Adapt Build 1	Jul-27
79	Daytona Beach International Airport	DAB	B	Full TFDM SW, Adapt Build 1	Aug-27
80	Daniel K. Inouye (Honolulu) International Airport	HNL	B	Full TFDM SW, Adapt Build 1	Sep-27
81	Columbia Metropolitan Airport	CAE	B	Full TFDM SW, Adapt Build 1	Oct-27
82	Midland International Air and Space Port	MAF	B	Full TFDM SW, Adapt Build 1	Dec-27
83	Huntsville International Airport	HSV	B	Full TFDM SW, Adapt Build 1	Jan-28
84	Fort Smith Regional Airport	FSM	B	Full TFDM SW, Adapt Build 1	Feb-28
85	Fort Wayne International Airport	FWA	B	Full TFDM SW, Adapt Build 1	Mar-28
86	Blue Grass Airport	LEX	B	Full TFDM SW, Adapt Build 1	Apr-28
87	Kalamazoo/Battle Creek International Airport	AZO	B	Full TFDM SW, Adapt Build 1	May-28
88	Tallahassee International Airport	TLH	B	Full TFDM SW, Adapt Build 1	Jun-28
89	Corpus Christi International Airport	CRP	B	Full TFDM SW, Adapt Build 1	Jul-28