SWIM Industry
Collaboration
Workshop #4

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

SWIM Stakeholders
FAA SWIM Program
August 15, 2018
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
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TFMS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFM-I Field/Remote Site TR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFM Improvements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CATMT WP5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDI Development/Acquisition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARS Enhancements 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARS Sustainment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTS IE/IIE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Improvements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBRITE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

Before TBFM

Significant vectoring and holding

With TBFM

Better-organized flows with minimal vectoring and no holding
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
<env xmlns="urn:us:gov:dot:faa:atm:tfm:tbfmeteringpublication"
    xsi:schemaLocation="urn:us:gov:dot:faa:atm:tfm:tbfmeteringpublication">
    <tma msgId="11318609" msgTime="2018-08-08T14:05:24.107Z">
        <air_airType="AMD" aid="Dal439" dep="JFK" apt="PBI" tmaId="W05815">
            <eta>
                <mfx>EJX_AR</mfx>
                <eta_time>2018-08-08T14:53:20Z</eta_time>
            </eta>
        </air_airType>
    </tma>
</env>
```

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

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

3. Visualize estimated APREQ time data for AOC use
SWIM Data proves anecdotal evidence

**Early TBFM APREQ effect on Taxi Time**
Aerobahn Test Cities
(Experimental FAA TBFM Test Data: Jan 1, 2014 - Feb 17, 2015)

- Average Taxi Out Time (minutes)
  - > 15 mins before departure: 15.1
  - 15-0 mins before departure: 16.9
  - After Departure: 20.1
Current Process for Scheduling Departures into a TBFM Arrival Stream

ARTCC

Obtains release time from TBFM and informs ATCT

Assigns release time

Request

Release Time

TFMS

PIC

ATCT

Pushes back

Contacts GC

Call for Service

Requests release time

Complies with instructions

Issues taxi instructions

Receives release time

Receives release time

Amends taxi instructions to meet release time

Departs at release time

Release Time

P-Time
Pilot-initiated Early TBFM Scheduling Using Verbal EOBT

* Pushback happens at EOBT
**Notional Automated Process for Early TBFM Scheduling: Process Map**

1. **ARTCC**
   - Obtains release time from TBFM and informs ATCT

2. **TBFM**
   - Notifies ARTCC that flight with EOBT is about to push x minutes before EOBT
   - Assigns release time
   - Publishes release time

3. **TFMS**
   - Receives EOBT
   - Releases EOBT
   - Release Time

4. **Flight Operator**
   - Updates EOBT
   - Release Time
   - Receives EOBT

5. **PIC**
   - Receives release time

6. **ATCT**
   - Receives release time

---

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

---

12 SWIFT Case Study: Improving Customer Service through TBFM Pre-Scheduling 8/15/18 DELTA AIR LINES, INC.
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**

### FAA Environment

**FAA Systems**

- TFMS
- TBFM

**FAA Actors**

- ARTCC
- ATCT/Ground Control

**FAA Environment Diagram**

- Request Release Time
- Release Time
- SWIM Gateway (NEMS)
- EOBT
- TBFM Wheels-Up Time
- A/G Voice

### Airline Environment

**Airline Systems**

- Flight Situational Display
- Surface Management Systems
- Flight Planning Systems
- Operations Management Systems

**Airline Actors**

- AOC
- Pilot

**Airline Environment Diagram**

- A/G Voice
- Request Release Time
- Release Time, Taxi Instructions
- Call For Release
- EOBT

- Aircraft
- Integrated crew times
- PAX connecting times
- Station Data
- Flight movements
- Integrated TMI/EDCT
- Flow management
- Post Ops Analysis Tools
## Live TBFM Data in Turn Management Tool

![TBFM Data Table](image)

### SWIFT Case Study: Improving Customer Service through TBFM Pre-Scheduling

8/15/18

DELTA AIR LINES, INC.
What’s Next?
### FAA Automation Roadmap

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TFMS</td>
<td>TFM I Field/Remote Site TR</td>
<td>TFM Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
</tr>
<tr>
<td>TBFM</td>
<td>TFM Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
<tr>
<td>HADDS</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECG</td>
<td>TFM Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
<tr>
<td>URET</td>
<td>TBMF Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
<tr>
<td>HOST</td>
<td>TBMF Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
<tr>
<td>DSR</td>
<td>TBMF Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
<tr>
<td>ERAM</td>
<td>TFM Improvements</td>
<td>CATMT WP4</td>
<td>CATMT WP5</td>
<td>SDI Development/Acquisition</td>
<td>TBFM WP3</td>
<td>TBFM WP4</td>
<td>ECG Sustainment</td>
<td>ERAM Enhancements 2</td>
<td>ERAM Sustainment 2</td>
<td>ERAM Enhancements 3</td>
<td>ERAM Sustainment 3</td>
<td>ERAM Enhancements 4</td>
<td>ERAM Sustainment 4</td>
<td>TBMF Tech Refresh</td>
<td></td>
</tr>
</tbody>
</table>

---

**SWIFT Case Study: Improving Customer Service through TBFM Pre-Scheduling**

8/15/18

---

**DELTA AIR LINES, INC.**
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

TFMS & TBFM “double delay”

Pilot
- Push back from gate
- Return to gate
- Fly DCA-LGA

Dispatch
- File Flight Plan
- Inform Pilot of TFMS MIT delay
- Assign TBFM reroute

Ground Crew
- Ready aircraft for filed route
- Add fuel for TBFM route
- Clear flight for departure

Traffic Manager
- Assign TFMS MIT delay
- Assign TBFM reroute

ATC Ground Control
- Clear flight for departure

Tools
- TFMS
- A/G Voice
- TBFM
- TFMS
- A/G Voice
- Fuel Truck
- A/G Voice
- Fuel Truck
- A/G Voice

TFMS & TBFM: "double delay" process involves steps like push back from gate, return to gate, fly DCA-LGA, file flight plan, inform pilot of TFMS MIT delay, assign TBFM reroute, ready aircraft for filed route, add fuel for TBFM route, clear flight for departure, assign TFMS MIT delay, assign TBFM reroute, and clear flight for departure.
Taxi-out, Return to gate
Alternative Vignettes

Two-Part Solution:
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

---

**What information is lacking?**

- ALT 1: Gate acceptance rates
- ALT 2: Release times

**How can information help?**

- ALT 1: Early Notification RBV constraining alert
- ALT 2: Better re-route decision making

**What is the business case?**

- What business operations are affected?
- What is the operational improvement impact?
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.

Objective
Demonstrate how SWIM data can be leveraged to optimize airline operations

Approach
- **Delta Use Case**
  - RBV arrivals in LGA
  - Taxi Out / Return to Gate
- **Leveraging SWIM**
  - Derive critical metrics for new operational insight and enhanced business rules

Value
Bridge the gap between airline operations and the FAA through leveraging SWIM data

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
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
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.
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

<table>
<thead>
<tr>
<th></th>
<th>Avg.</th>
<th>STDEV</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi Out Delay (min)</td>
<td>-5.5</td>
<td>3.7</td>
<td>-6</td>
</tr>
<tr>
<td>Airborne Delay (min)</td>
<td>9.7</td>
<td>9.7</td>
<td>9</td>
</tr>
<tr>
<td>Taxi In Delay (min)</td>
<td>-1.6</td>
<td>2.8</td>
<td>-3</td>
</tr>
</tbody>
</table>

FL# “123” bound for “XYZ”

Delays for all FL# “111” departing “AAA” bound for “XYZ”
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

**SOLUTION**

**METHODOLOGY**

- TBFM
- TFMS
- SFDPS
- STDDS

**BENEFITS**

- Potential to anticipate taxi out/return to gate due to RBV congestion using real time SWIM data

**Ex. BUSINESS RULES**

- Plan as scheduled
- Consider increasing fuel load
- Considering filing reroute

**SWIM data to provide foundational data for predictive analytics for airlines**

- Flight Information
- Flow Information
- Flight Position
- Flight Metering times
- Flight Release times
- Rwy & Fix Acceptance Rates
- Metering status

- # of aircraft scheduled over RBV / 15 minutes
- Miles in Trail
- Increment saturation post scheduled time
Metrics derived from SWIM data to drive business rules & provide new insight

**Monitoring traffic flight counts:**

<table>
<thead>
<tr>
<th>X # of RBV scheduled aircraft / 15 minutes</th>
<th>Y Miles in Trail</th>
<th>Z # of 15 min Increments saturated post scheduled time</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; X</td>
<td>No MIT</td>
<td>≤ Z saturated slots</td>
</tr>
<tr>
<td>&gt; X</td>
<td>&gt; Y</td>
<td>≥ Z saturated slots</td>
</tr>
</tbody>
</table>

- **Plan as scheduled**
- **Consider increasing fuel load**
- **Consider filing reroute**

**Advanced data analytics:**

Flying time from the TRACON outer fix to wheels down > X minutes

Begin planning for possible upcoming TMIs
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 additional 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

*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 understanding 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.

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.

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.
**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)
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
Implementation Sites by Configuration

[Map showing implementation sites with configuration A (27 sites) and configuration B (62 sites), and legend for sites labeled under configuration A and configuration B.]
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)
Flight Operator Data via SWIM to TFDM

- TFDM is intending to receive Flight Operator Data via TFMDaData 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

Data Quality is Key to Having Reliable Schedule and Metering Results
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 include 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/Subcribe)**
  – 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

Aeronautical Common Service (ACS) - Authoritative Source

Obstacles
- Obstacle Definitions

NASR
- NASR Data (airports, NAVAIDS)

eNASR
- Special Activity Airspace (SAA) Definitions

SAMS/MADE
- SAA Schedules

FNS
- NOTAMs

ACS Web Feature Service
ACS Data Query Service
ACS Data Subscription
ACS Web Map Service
ACS Web Map Tile Service
ACS Airspace Conflict Detection
ACS Post Operational Metrics
ACS Geodetic Computation
ACS NOTAM JMS Topic
ACS SUA JMS Topic

AIMM S2 System

Integrated AI
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:

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

**Build 1 Key Milestones:**
- System Requirements Review (SRR) – Completed September 2016
- Preliminary Design Review (PDR) – Completed January 2017
- Critical Design Review (CDR) – Completed June 2017
- Development Test Start (DT) - October 2018
- Operational Test Start (OT) – April 2019
- Initial Operating Capability (IOC) at PHX – January 2020 (APB)
- Build 1 Independent Operational Assessment (IOA) – March 2020 (APB)
- In-Service Decision (ISD) – July 2020 (APB)

**Build 2 Key Milestones:**
- System Requirements Review (SRR) – Completed January 2018
- Preliminary Design Review (PDR) – Completed April 2018
- Critical Design Review (CDR) – August 2018 (APB)
- Development test (DT) Start - September 2019
- Initial Operating Capability (IOC) at CLT – March 2021 (APB)
- Build 2 Independent Operational Assessment (IOA) – May 2021 (APB)
- In-Service Decision (ISD) – August 2021 (APB)

**Key:**
- = dependency

**# FAA IOCs:**
- FY16: 4
- FY17: 10
- FY18: 11
- FY19: 11
- FY20: 12
- FY21: 11
- FY22: 11
- FY23: 11
- FY24: 19
- FY25:
- FY26:
- FY27/28:
## TFDM Waterfall Detail (1 of 4)

### Risk Adjusted Dates

<table>
<thead>
<tr>
<th>Site #</th>
<th>ATCT Name</th>
<th>Tower ID</th>
<th>Config.</th>
<th>Functionality Deployed</th>
<th>IOC Risk Adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phoenix Sky Harbor International Airport (Build 1 key site)</td>
<td>PHX</td>
<td>A</td>
<td>Build 1</td>
<td>Jan-20</td>
</tr>
<tr>
<td>1</td>
<td>Phoenix Sky Harbor International Airport</td>
<td>PHX</td>
<td>A</td>
<td>Build 2 Retrofit (includes Build 1 functions)</td>
<td>Aug-21</td>
</tr>
<tr>
<td>2</td>
<td>Cleveland Hopkins International Airport</td>
<td>CLE</td>
<td>B</td>
<td>Build 1</td>
<td>Jul-20</td>
</tr>
<tr>
<td>3</td>
<td>Phoenix–Mesa Gateway Airport</td>
<td>IWA</td>
<td>B</td>
<td>Build 1</td>
<td>Aug-20</td>
</tr>
<tr>
<td>4</td>
<td>Raleigh–Durham International Airport</td>
<td>RDU</td>
<td>B</td>
<td>Build 1</td>
<td>Sep-20</td>
</tr>
<tr>
<td>5</td>
<td>Indianapolis International Airport</td>
<td>IND</td>
<td>B</td>
<td>Build 1</td>
<td>Oct-20</td>
</tr>
<tr>
<td>6</td>
<td>Los Angeles International Airport</td>
<td>LAX</td>
<td>A</td>
<td>Build 1</td>
<td>Nov-20</td>
</tr>
<tr>
<td>7</td>
<td>Charlotte Douglas International Airport (Build 2 Key Site)</td>
<td>CLT</td>
<td>A</td>
<td>Build 2 SW (includes Build 1 functions)</td>
<td>Mar-21</td>
</tr>
<tr>
<td>8</td>
<td>Philadelphia International Airport</td>
<td>PHL</td>
<td>A</td>
<td>Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Apr-21</td>
</tr>
<tr>
<td>8</td>
<td>Philadelphia International Airport</td>
<td>PHL</td>
<td>A</td>
<td>Adapt Build 2 (includes functions for DSP Replacement)</td>
<td>Apr-22</td>
</tr>
<tr>
<td>9</td>
<td>Newark Liberty International Airport</td>
<td>EWR</td>
<td>A</td>
<td>Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface</td>
<td>May-21</td>
</tr>
<tr>
<td>9</td>
<td>Newark Liberty International Airport</td>
<td>EWR</td>
<td>A</td>
<td>Adapt Build 2 (DSP Replacement)</td>
<td>Apr-22</td>
</tr>
<tr>
<td>9</td>
<td>Newark Liberty International Airport</td>
<td>EWR</td>
<td>A</td>
<td>Implement Surface Metering</td>
<td>Jan-23</td>
</tr>
<tr>
<td>10</td>
<td>John F. Kennedy International Airport</td>
<td>JFK</td>
<td>A</td>
<td>Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Jun-21</td>
</tr>
<tr>
<td>10</td>
<td>John F. Kennedy International Airport</td>
<td>JFK</td>
<td>A</td>
<td>Adapt Build 2 (DSP Replacement)</td>
<td>Apr-22</td>
</tr>
<tr>
<td>10</td>
<td>John F. Kennedy International Airport</td>
<td>JFK</td>
<td>A</td>
<td>Implement Surface Metering</td>
<td>Feb-23</td>
</tr>
<tr>
<td>11</td>
<td>LaGuardia Airport</td>
<td>LGA</td>
<td>A</td>
<td>Full TFDM SW. Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Jul-21</td>
</tr>
<tr>
<td>11</td>
<td>LaGuardia Airport</td>
<td>LGA</td>
<td>A</td>
<td>Adapt Build 2 - DSP Replacement</td>
<td>Apr-22</td>
</tr>
<tr>
<td>11</td>
<td>LaGuardia Airport</td>
<td>LGA</td>
<td>A</td>
<td>Implement Surface Metering</td>
<td>Mar-23</td>
</tr>
<tr>
<td>12</td>
<td>Phoenix Deer Valley Airport</td>
<td>DVT</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Aug-21</td>
</tr>
<tr>
<td>13</td>
<td>Dayton International Airport</td>
<td>DAY</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Sep-21</td>
</tr>
<tr>
<td>14</td>
<td>San Francisco International Airport</td>
<td>SFO</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Sep-21</td>
</tr>
<tr>
<td>15</td>
<td>Sacramento International Airport</td>
<td>SMF</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Oct-21</td>
</tr>
<tr>
<td>Site #</td>
<td>ATCT Name</td>
<td>Tower ID</td>
<td>Config.</td>
<td>Functionality Deployed</td>
<td>IOC Risk Adj</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>-----------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>16</td>
<td>George Bush Intercontinental Airport</td>
<td>IAH</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Nov-21</td>
</tr>
<tr>
<td>17</td>
<td>Hartsfield–Jackson Atlanta International Airport</td>
<td>ATL</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Jan-22</td>
</tr>
<tr>
<td>18</td>
<td>Teterboro Airport</td>
<td>TEB</td>
<td>B+</td>
<td>Full TFDM SW, Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Feb-22</td>
</tr>
<tr>
<td>19</td>
<td>Teterboro Airport</td>
<td>TEB</td>
<td>B+</td>
<td>Adapt Build 2 (DSP Replacement)</td>
<td>Apr-22</td>
</tr>
<tr>
<td>19</td>
<td>Westchester County Airport</td>
<td>HPN</td>
<td>B+</td>
<td>Full TFDM SW, Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Mar-22</td>
</tr>
<tr>
<td>19</td>
<td>Westchester County Airport</td>
<td>HPN</td>
<td>B+</td>
<td>Adapt Build 2 (DSP Replacement)</td>
<td>Apr-22</td>
</tr>
<tr>
<td>20</td>
<td>Scottsdale Airport</td>
<td>SDL</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Apr-22</td>
</tr>
<tr>
<td>21</td>
<td>Long Island MacArthur Airport</td>
<td>ISP</td>
<td>B+</td>
<td>Full TFDM SW, Enable Build 1 func. + FDIO/DSP Interface</td>
<td>Apr-22</td>
</tr>
<tr>
<td>22</td>
<td>Norman Y. Mineta San Jose International Airport</td>
<td>SJC</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jun-22</td>
</tr>
<tr>
<td>23</td>
<td>John Glenn Columbus International Airport</td>
<td>CMH</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jul-22</td>
</tr>
<tr>
<td>24</td>
<td>William P. Hobby Airport</td>
<td>HOU</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Aug-22</td>
</tr>
<tr>
<td>25</td>
<td>Prescott Municipal Airport</td>
<td>PRC</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Sep-22</td>
</tr>
<tr>
<td>26</td>
<td>Chicago O'Hare International Airport</td>
<td>ORD</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Oct-22</td>
</tr>
<tr>
<td>27</td>
<td>McCarran International Airport</td>
<td>LAS</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Nov-22</td>
</tr>
<tr>
<td>28</td>
<td>Oakland International Airport</td>
<td>OAK</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jan-23</td>
</tr>
<tr>
<td>29</td>
<td>Tampa International Airport</td>
<td>TPA</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Feb-23</td>
</tr>
<tr>
<td>30</td>
<td>San Diego International Airport</td>
<td>SAN</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Mar-23</td>
</tr>
<tr>
<td>31</td>
<td>Orlando International Airport</td>
<td>MCO</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Apr-23</td>
</tr>
<tr>
<td>32</td>
<td>Denver International Airport</td>
<td>DEN</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>May-23</td>
</tr>
<tr>
<td>33</td>
<td>Chicago Midway International Airport</td>
<td>MDW</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Jun-23</td>
</tr>
<tr>
<td>34</td>
<td>Miami International Airport</td>
<td>MIA</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jul-23</td>
</tr>
<tr>
<td>35</td>
<td>Dallas/Fort Worth International Airport (3 ATCTs)</td>
<td>DFW</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Aug-23</td>
</tr>
<tr>
<td>36</td>
<td>Logan International Airport</td>
<td>BOS</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Sep-23</td>
</tr>
<tr>
<td>37</td>
<td>Fort Lauderdale Executive Airport</td>
<td>FXE</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Oct-23</td>
</tr>
<tr>
<td>38</td>
<td>Minneapolis–Saint Paul International Airport</td>
<td>MSP</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Nov-23</td>
</tr>
</tbody>
</table>
## TFDM Waterfall Detail (3 of 4)

### Risk Adjusted Dates

<table>
<thead>
<tr>
<th>Site #</th>
<th>ATCT Name</th>
<th>Tower ID</th>
<th>Config</th>
<th>Functionality Deployed</th>
<th>IOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>Cincinnati/Northern Kentucky Airport</td>
<td>CVG</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jan-24</td>
</tr>
<tr>
<td>40</td>
<td>Washington Dulles International Airport</td>
<td>JAD</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Feb-24</td>
</tr>
<tr>
<td>41</td>
<td>Salt Lake City International Airport</td>
<td>SLC</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Mar-24</td>
</tr>
<tr>
<td>42</td>
<td>Detroit Metropolitan Wayne County Airport</td>
<td>DTW</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Apr-24</td>
</tr>
<tr>
<td>43</td>
<td>Fort Lauderdale–Hollywood International Airport</td>
<td>FLL</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>May-24</td>
</tr>
<tr>
<td>44</td>
<td>Jacksonville International Airport</td>
<td>JAX</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jun-24</td>
</tr>
<tr>
<td>46</td>
<td>Dallas Love Field</td>
<td>DAL</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Aug-24</td>
</tr>
<tr>
<td>47</td>
<td>Nashville International Airport</td>
<td>BNA</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Sep-24</td>
</tr>
<tr>
<td>48</td>
<td>Louisville International Airport</td>
<td>SDF</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Oct-24</td>
</tr>
<tr>
<td>49</td>
<td>Seattle–Tacoma International Airport</td>
<td>SEA</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Oct-24</td>
</tr>
<tr>
<td>50</td>
<td>Ronald Reagan Washington National Airport</td>
<td>DCA</td>
<td>A</td>
<td>Full TFDM SW, Adapt Build 1 and 2</td>
<td>Dec-24</td>
</tr>
<tr>
<td>51</td>
<td>T. F. Green Airport</td>
<td>PVD</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jan-25</td>
</tr>
<tr>
<td>52</td>
<td>Charleston International Airport</td>
<td>CHS</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Feb-25</td>
</tr>
<tr>
<td>53</td>
<td>Eppley Airfield</td>
<td>OMA</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Mar-25</td>
</tr>
<tr>
<td>54</td>
<td>Memphis International Airport</td>
<td>MEM</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Apr-25</td>
</tr>
<tr>
<td>55</td>
<td>Richmond International Airport</td>
<td>RIC</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>May-25</td>
</tr>
<tr>
<td>56</td>
<td>San Antonio International Airport</td>
<td>SAT</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jun-25</td>
</tr>
<tr>
<td>57</td>
<td>Bradley International Airport</td>
<td>BDL</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jul-25</td>
</tr>
<tr>
<td>58</td>
<td>Birmingham–Shuttlesworth International Airport</td>
<td>BHM</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Aug-25</td>
</tr>
<tr>
<td>59</td>
<td>Lincoln Airport</td>
<td>LNK</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Sep-25</td>
</tr>
<tr>
<td>60</td>
<td>Joint Base Andrews</td>
<td>ADW</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Oct-25</td>
</tr>
<tr>
<td>61</td>
<td>Buffalo Niagara International Airport</td>
<td>BUF</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Dec-25</td>
</tr>
<tr>
<td>62</td>
<td>Palm Beach International Airport</td>
<td>PBI</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Jan-26</td>
</tr>
<tr>
<td>63</td>
<td>Montgomery Regional Airport</td>
<td>MGM</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Feb-26</td>
</tr>
<tr>
<td>64</td>
<td>Portland International Airport</td>
<td>PDX</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Mar-26</td>
</tr>
<tr>
<td>65</td>
<td>Pittsburgh International Airport</td>
<td>PIT</td>
<td>B</td>
<td>Full TFDM SW, Adapt Build 1</td>
<td>Apr-26</td>
</tr>
</tbody>
</table>
## TFDM Waterfall Detail (4 of 4)

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