ATD-2 Update
for TBFM/TFDM Ops Teams

June 26, 2019

Agenda

- Overview
- Demo
- Q&A

ATD-2: Progress Indicator Chart

Technology Transfers

Stakeholder input, NASA Tech maturity, Analysis, Benefits, Costs

16/7/365 Operation of ATD-2 IADS system in field

Demo Readiness Reviews

Periodic ATD-2 IADS system releases result in operational capability increases

Full ATD-2 Capability

ATD-2 IADS system installation

Joint NASA/FAA Site Selection & Existing NASA/FAA Tech Capabilities

Phase 3 Terminal IADS demo begins

Phase 2 Fused IADS demo begins

Phase 1 Baseline IADS demo begins

We are here!

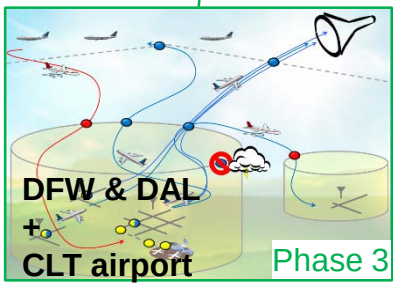
Percent of Full ATD-2 IADS System Capability

100
80
60
40
20
0

2014 2015 2016 2017 2018 2019 2020

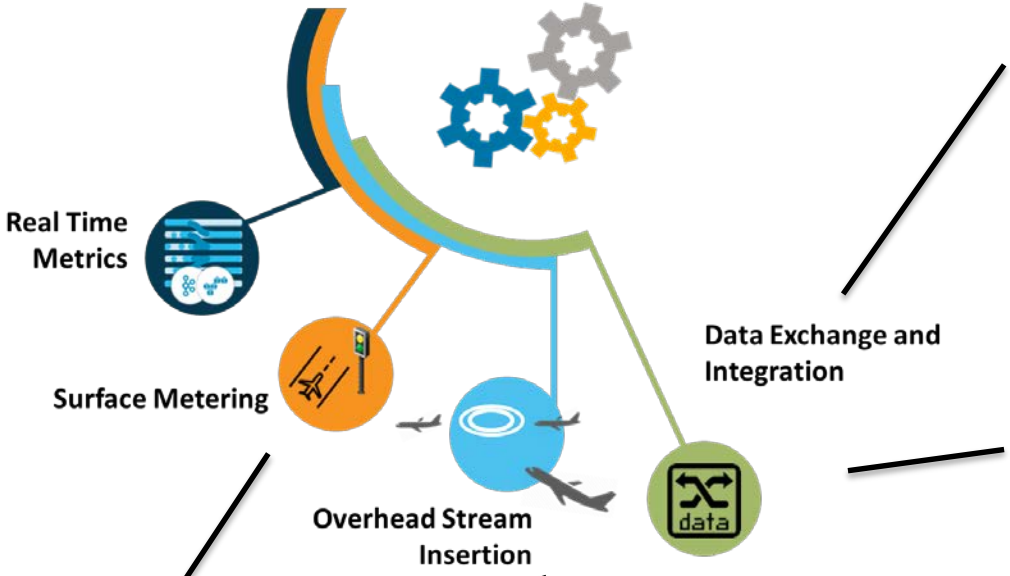
Fiscal Year

Field Demo structured in 3 year-long phases with increasing IADS system capabilities.



Recap of New Capabilities for Phase 2

Integrated Arrival, Departure, Surface (IADS) System v4.0
deployed: September 11th ✓



5. Ingest data from TTP-connected Mobile App data into IADS scheduling system (enables General Aviation operators to fully participate in ATD-2 Field Demo)
start date: late-October ✓

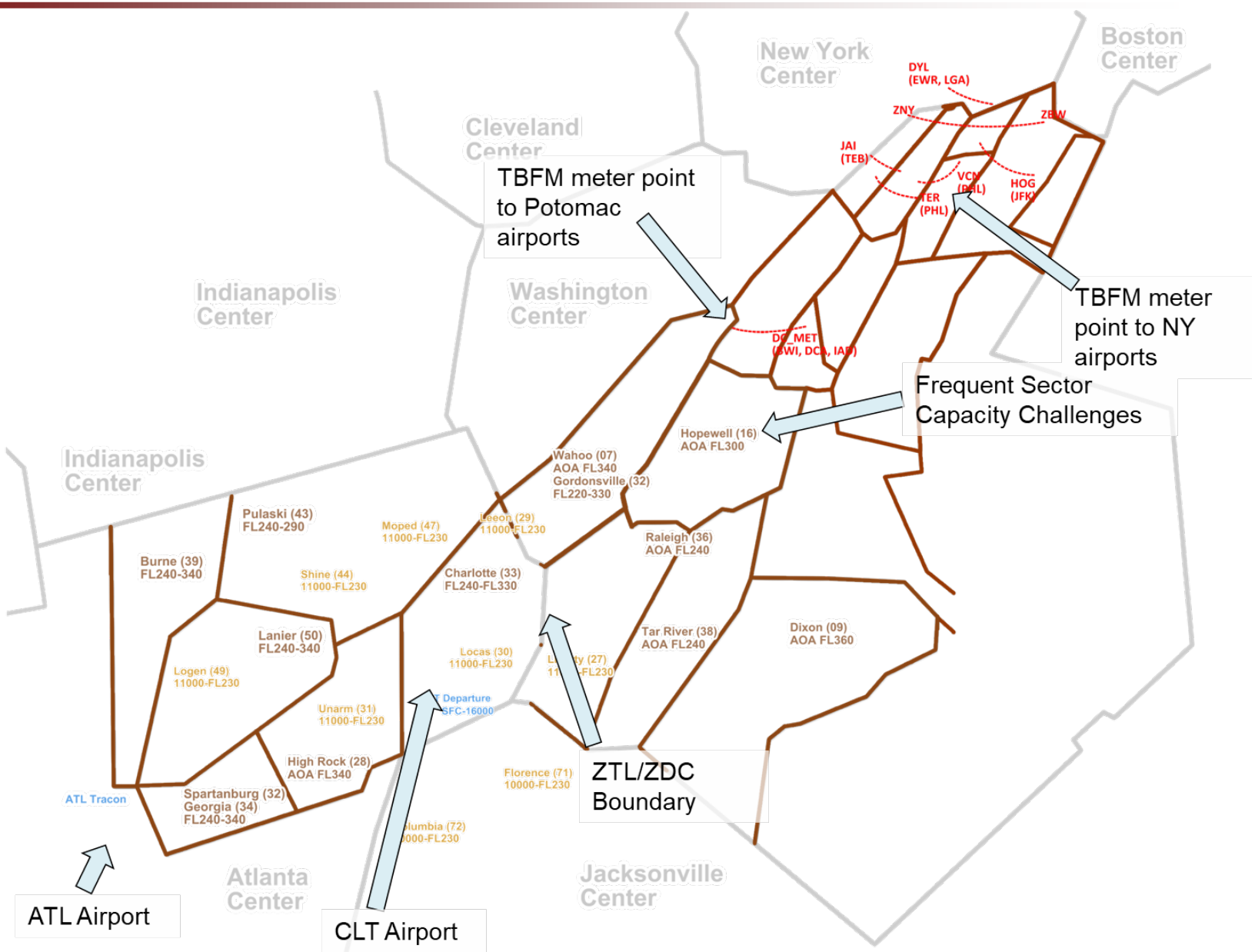
4. Deliver IADS data as TFDM Terminal Publication (TTP) service via FAA's SWIM system (enables all flight operators to participate in ATD-2 Field Demo)
start date: July 6th ✓

1. Extend time horizon to strategic range (enables more options for operators and passengers).
start date: October 10th ✓

2. Interface with Atlanta Center arrival metering TBFM system (enables evaluation of pre-scheduling concept)
start date: October 1st ✓

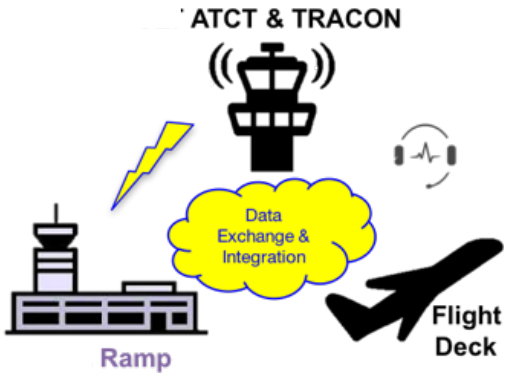
3. Interface with Tower controller electronic flight strips. (enables more precise management of controlled takeoff times)
start date: September 20th ✓

Overhead Stream From CLT into Busy NEC



Pre-Scheduling with EOBTs from CLT to ATL (Started Oct 2018)

1. At an adaptable time prior to departure (e.g. 20 min) the ATD-2 system uses the EOBT, taxi time estimate and a buffer to electronically submit a release time request to TBFM

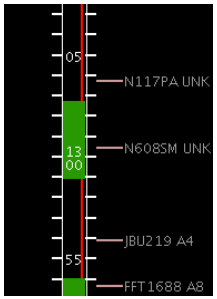


2. Center TMC approves or adjusts the time based on center constraints

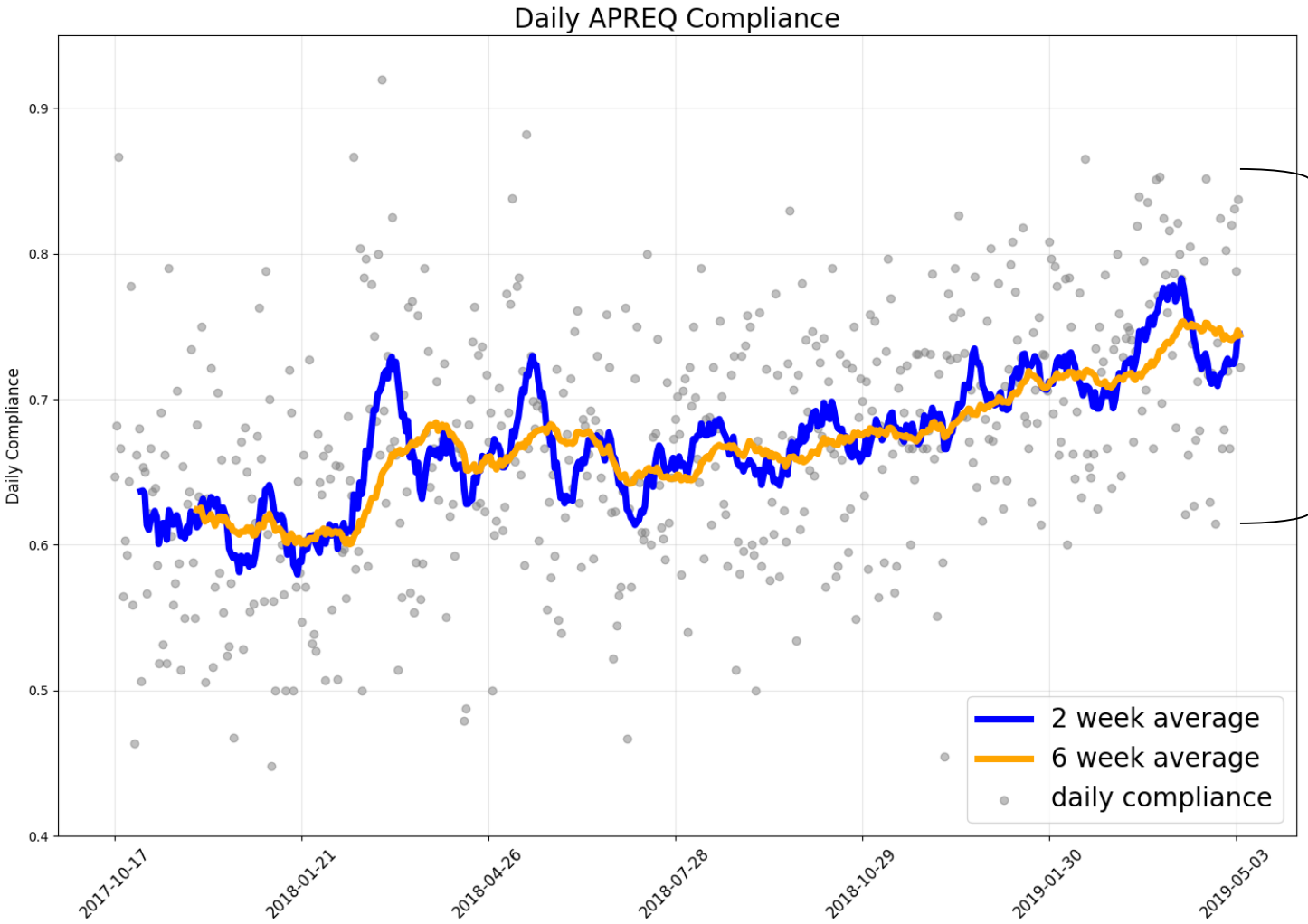
3. ATCT and Ramp utilize the now visible APREQ time on their strips and pushback advisories

The data is made available on the TTP SWIM feed so that Operators can get it to their pilots

4. IDAC-style scheduling between TBFM and ATD-2 is used to re-schedule as necessary



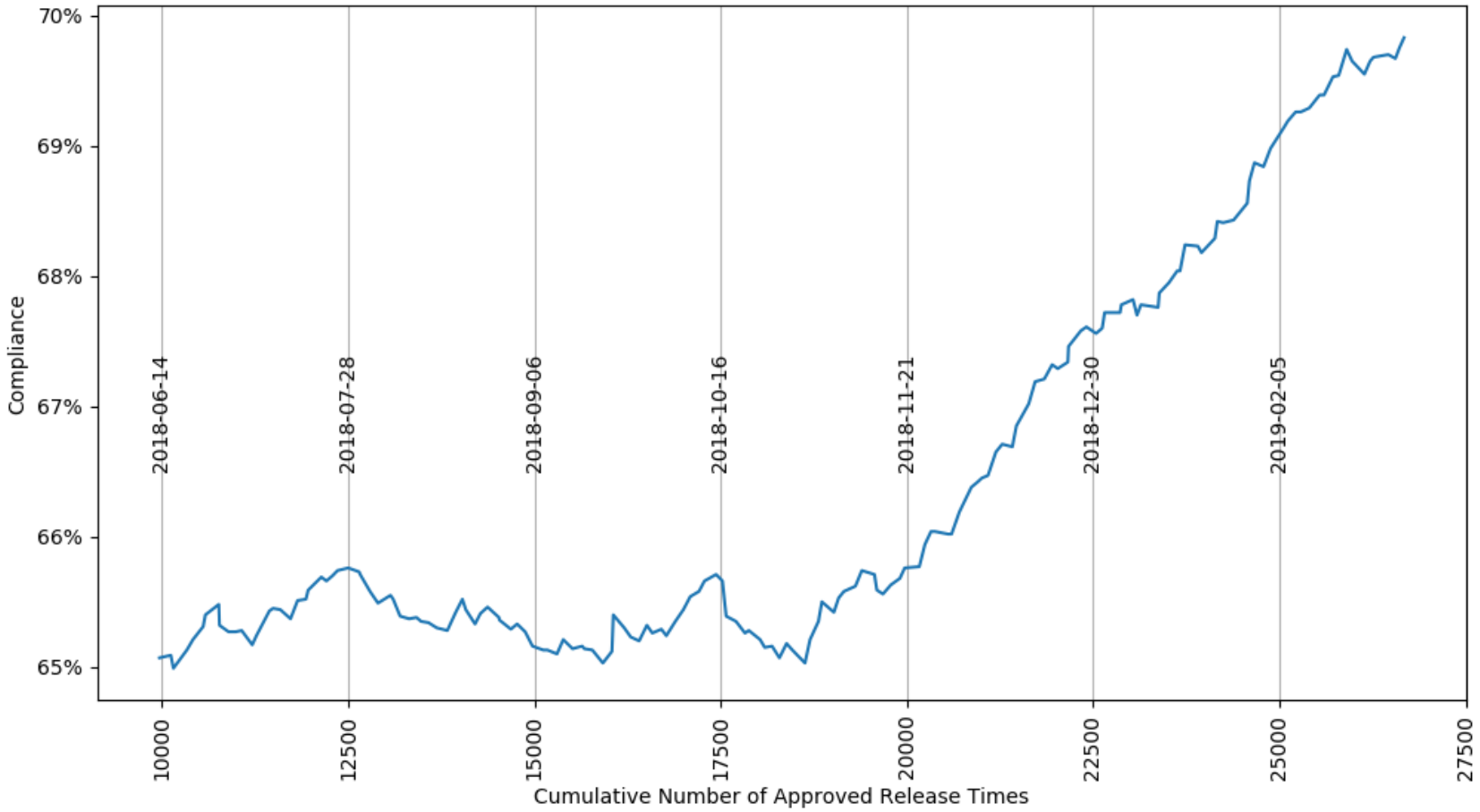
CLT APREQ Daily Compliance (Compliance Improvement Since ATD-2 Start)



In addition to overall improved compliance into TBM systems, the predictability is ***increasing***

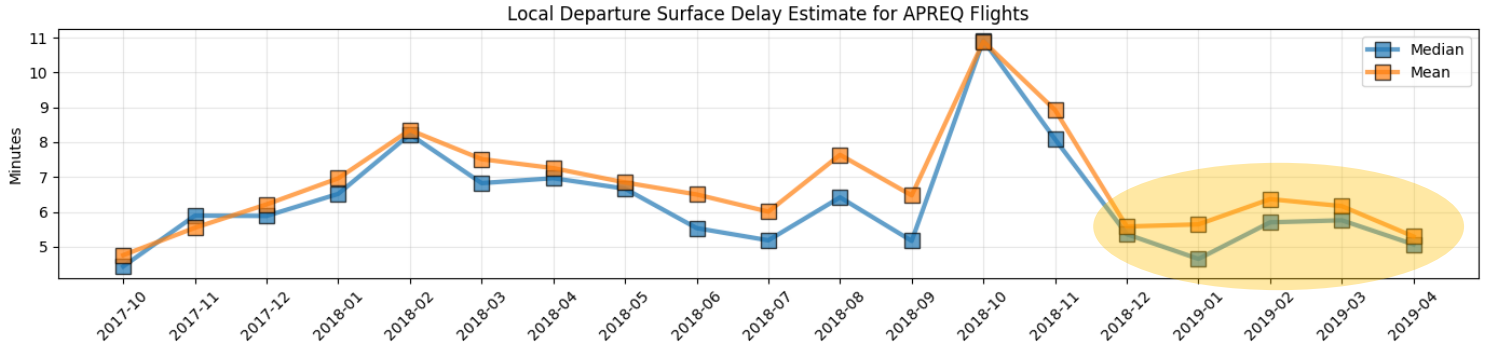
Steady increase of APREQ compliance over the life of the project.
Reduced variation in compliance leading to improved predictability.

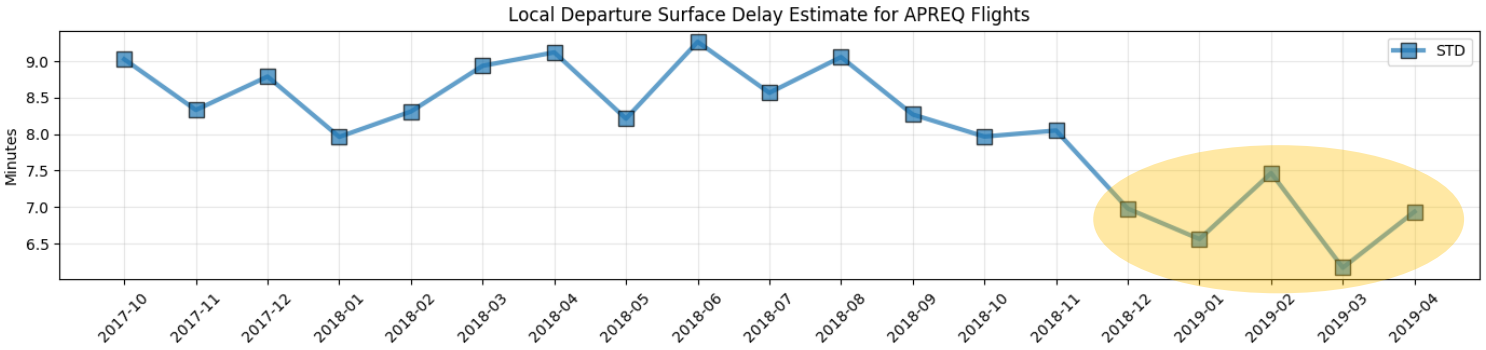
APREQ Compliance 10K Rolling Window

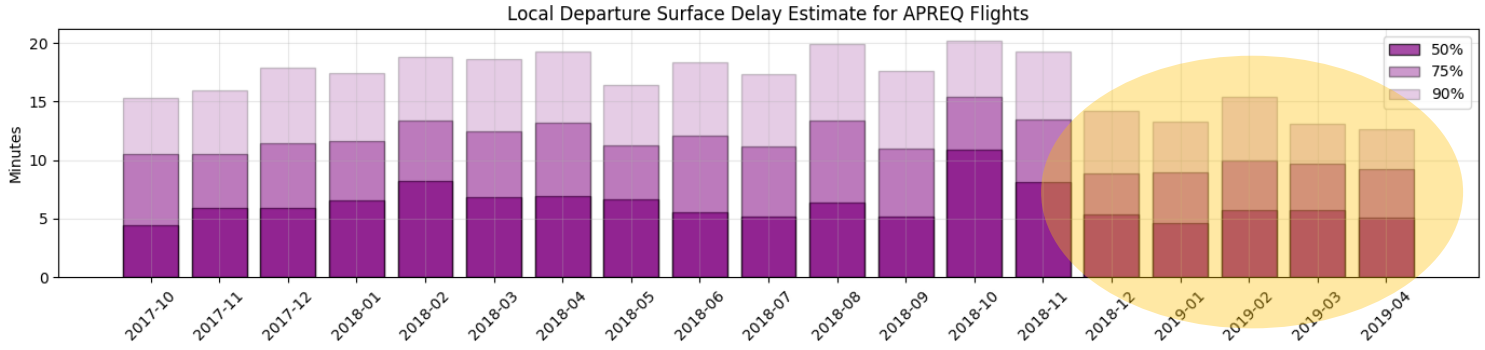


The most substantial APREQ compliance improvements started with Phase 2 capability (AEFS integration, ZTL IDAC, pre-scheduling and scheduler updates).

APREQ Delay For Pre-Scheduled Flights into KATL Have Been More Predictable For the Last Five Months

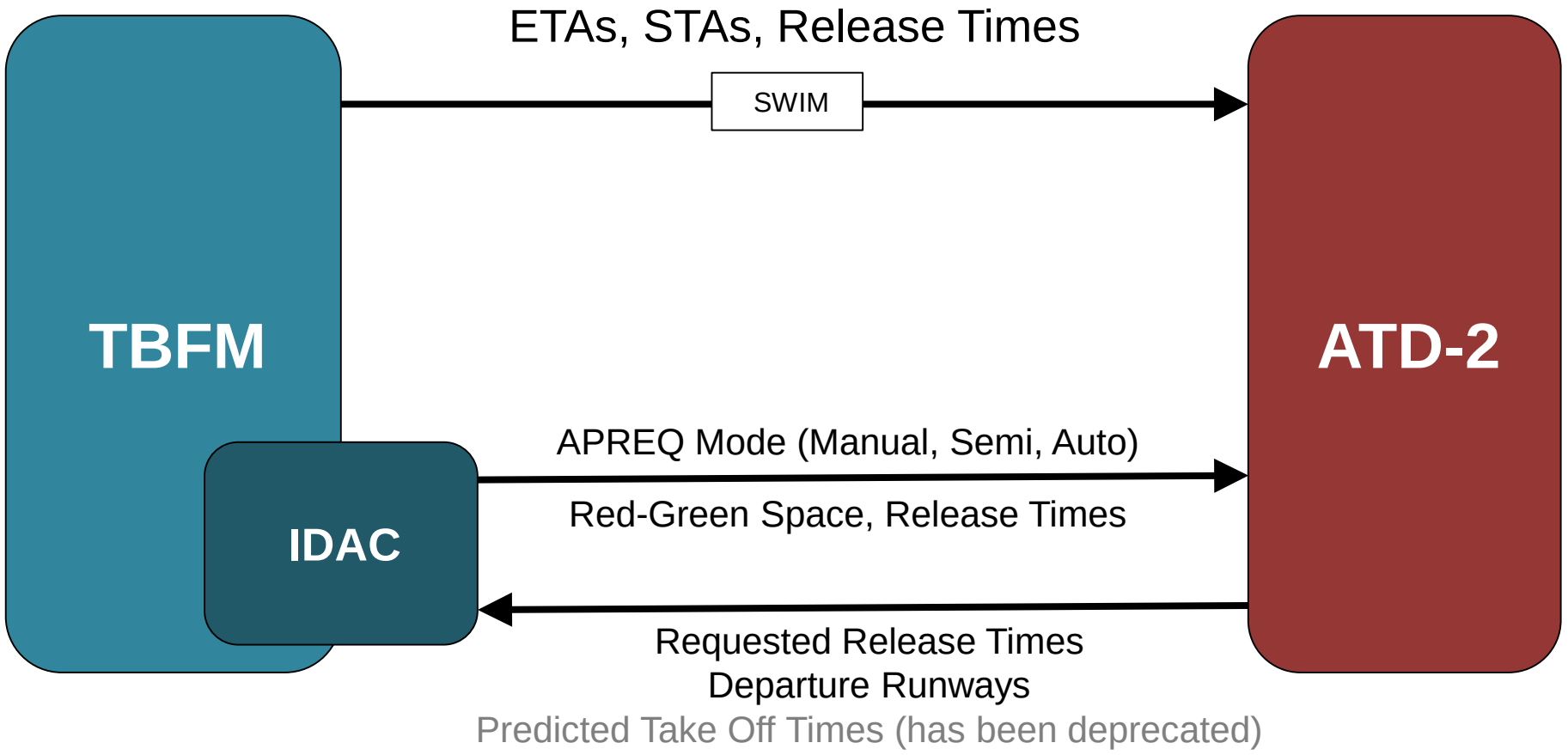






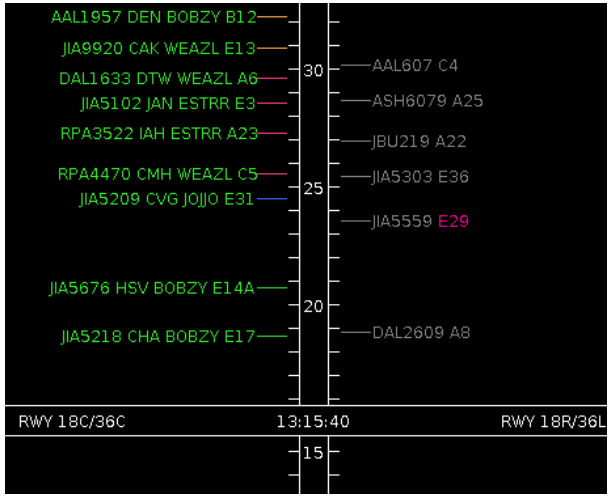
Substantial Improvements in predictability of delay for the last 5 months

Data Exchange between ATD-2 and TBFM

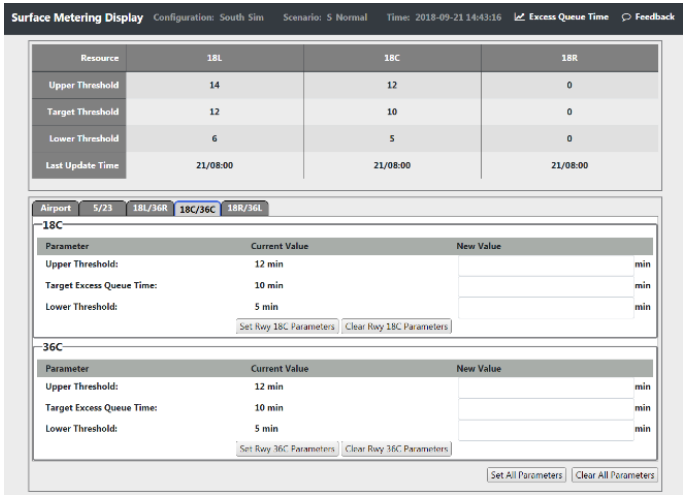


Surface Metering – Process Flow

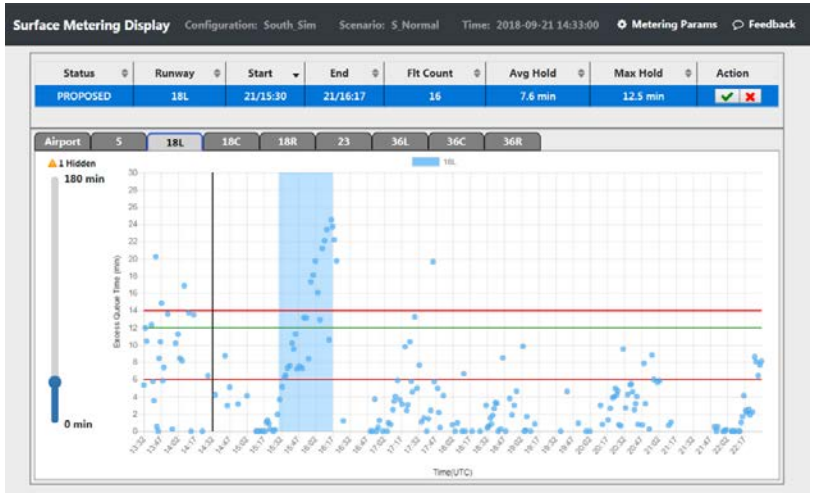
1 **ATD-2 generates demand and capacity predictions**



2 **TMC enables metering capability and sets metering parameters in collaboration with ramp manager**



3 **ATD-2 recommends and TMC affirms SMPs.**



4 **Ramp controllers honor metering hold advisories**

TOBT Advisory

TMAT Advisory

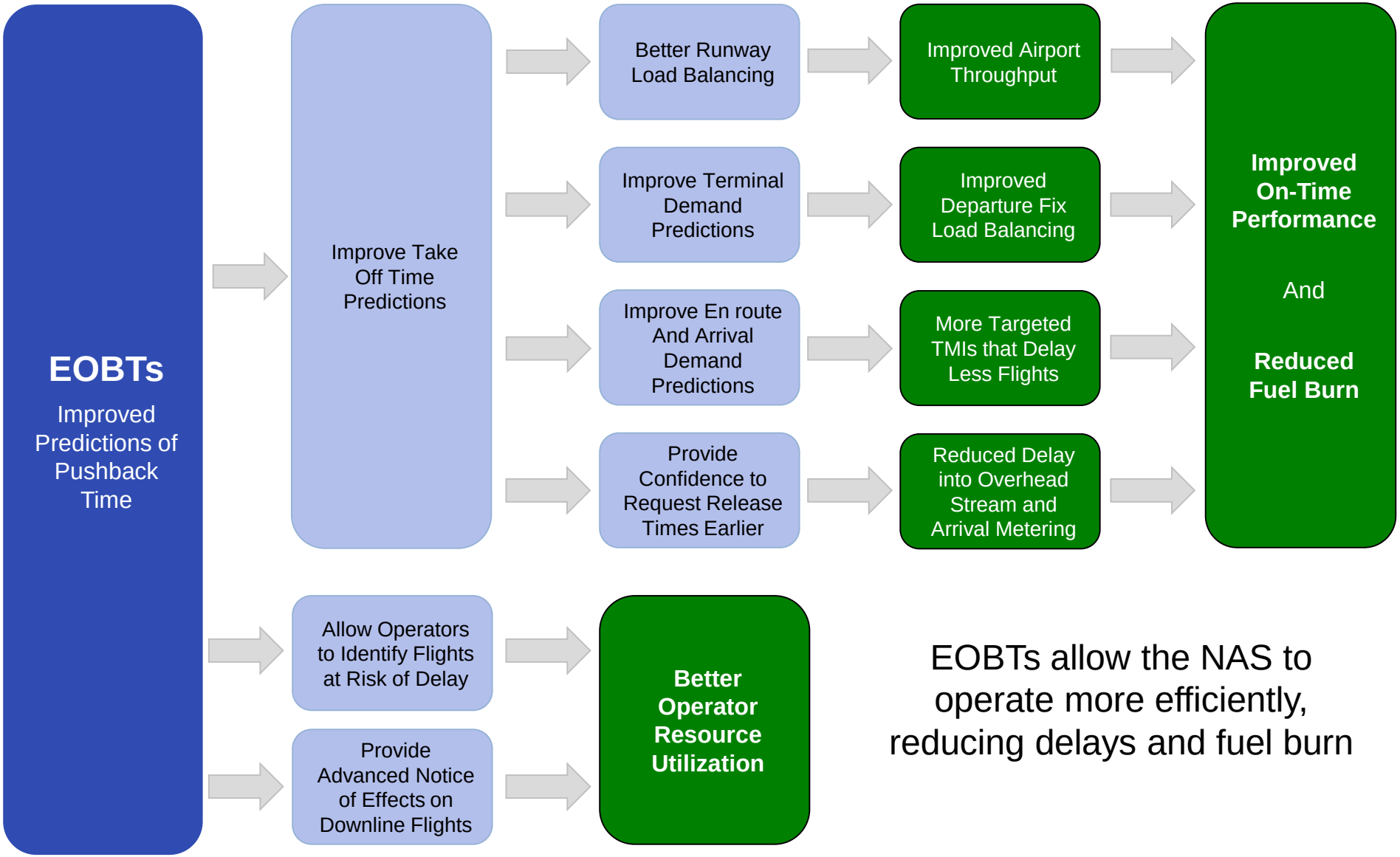
ATD-2 Surface Metering and TBFM

- Prior to a release time being assigned,
  - ATD-2 identifies the flight as being a part of an APREQ restriction
  - ATD-2 computes an Earliest Feasible Takeoff Time (EFTT) that includes additional buffer (EFTT Buffer) to account for estimated pushback time uncertainty
    - 1 minute for flights with EOBT
    - 4 minutes for flights without EOBT

- Once a release time has been assigned,
  - ATD-2 assigns a TOBT and TMAT so as to get the flight to the runway shortly before the start of the release time window
  - CTD Buffer = 5 minutes

- ATD-2 calibrated EFTT and CTD buffers through engagement with CLT ATCT and data analysis of release time compliance
  - TFDM's CTD buffer serves the roll of both the EFTT and CTD buffers in ATD-2

Benefits of Estimated Off Block Times for ATC and Operators



EOBTs allow the NAS to operate more efficiently, reducing delays and fuel burn

Analysis and Feedback on EOBTs

- NASA has analyzed EOBTs provided through SWIM for over two years and provided input/feedback to Operators
  - Some Operators have evolved their EOBT generation several times
  - Other Operators are submitting legacy times (LGTD/LTIMEs) on the new SWIM interface. However, these Operators are working toward more advanced EOBTs.
  - NASA does not share Operator specific performance data with the community. This honors the relationship with Operators and encourages engagement and progress.

- Quantifying EOBTs quality is a non-trivial task
  - Analysis of both absolute and actual error at various look ahead time windows
  - Proper selection of flights to exclude from this analysis (controlled flights, return to gate, etc.)
  - Sources of 'truth data' for actual OUT. EOBT is really more akin to 'pilot call in'

- An 'upper bound' of accuracy for EOBTs does exist in the NAS today
  - The absolute best EOBTs today leverage passenger ticket scan and baggage information. This data does not become available until about 30 minutes prior to departure.
  - Predicting EOBT is akin to predicting when your computer will fail given the many components on the aircraft that could fail, passenger issues, crew staffing issues, etc.

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Questions?