Future Surface Decision Support Overview

Airspace Technology Demonstration 2 (ATD-2) Industry Workshop

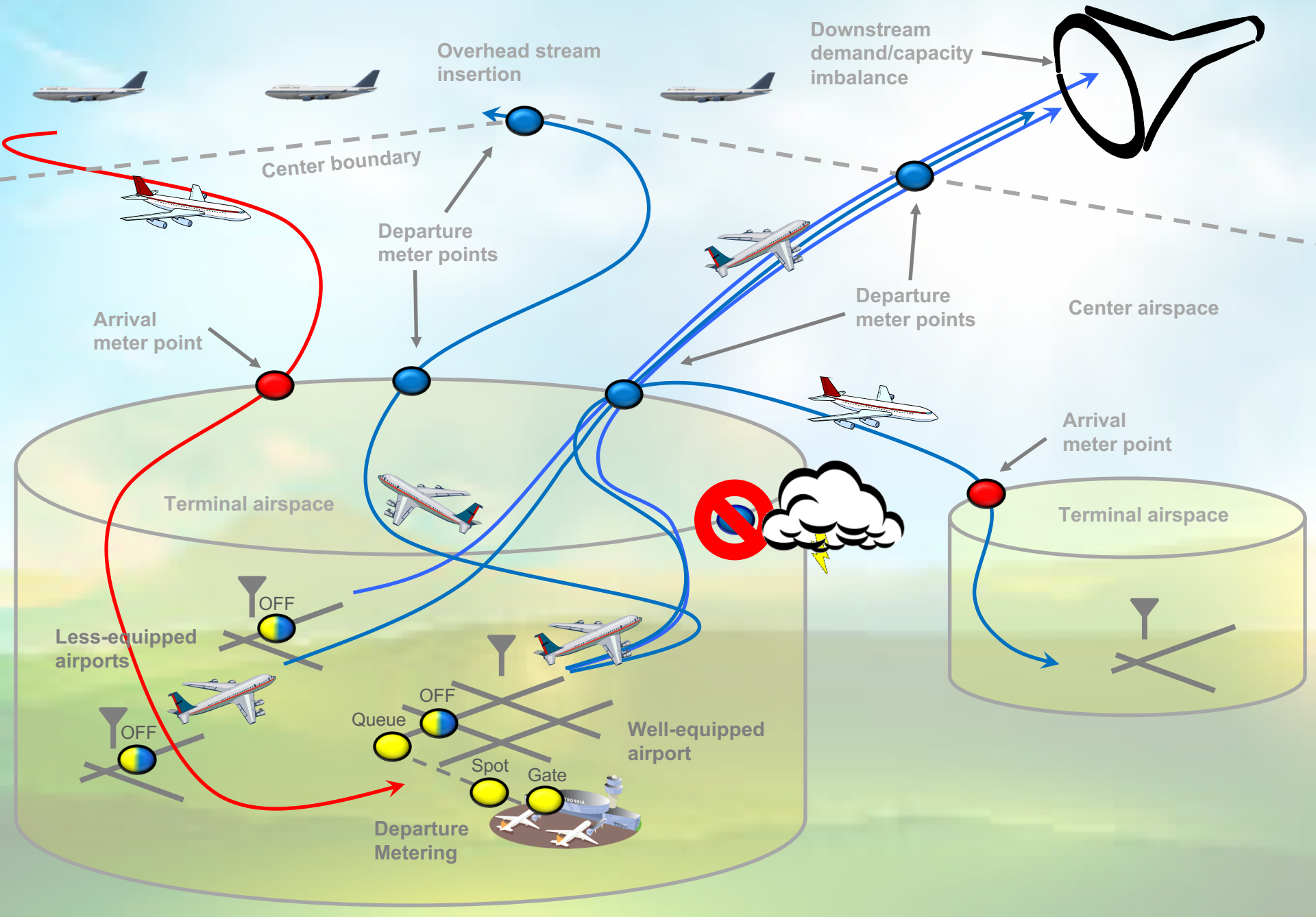
September 4, 2019

Isaac Robeson (NASA ATD-2)
Liang Chen (NASA ATD-2)
Yoon Jung (NASA ATD-2)

Agenda

- ATD-2 Overview
- Electronic Data Exchange
- Common Situational Awareness
- Surface Scheduling
- Departure Scheduling for Overhead Stream Insertion
- Surface Metering

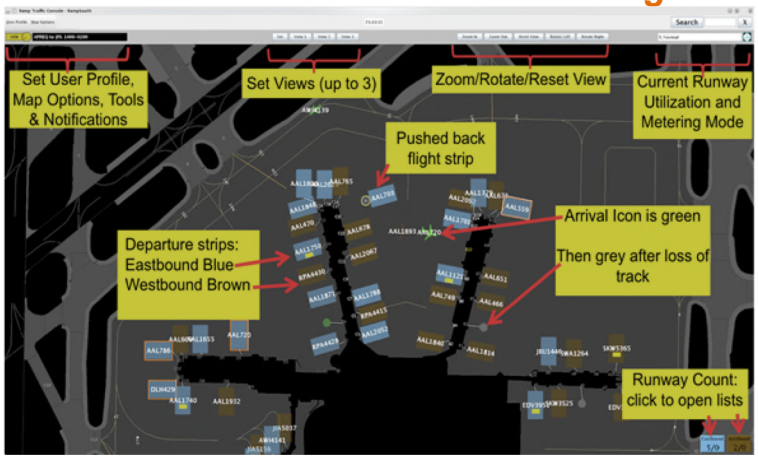
Operational Environment for the ATD-2 Concept



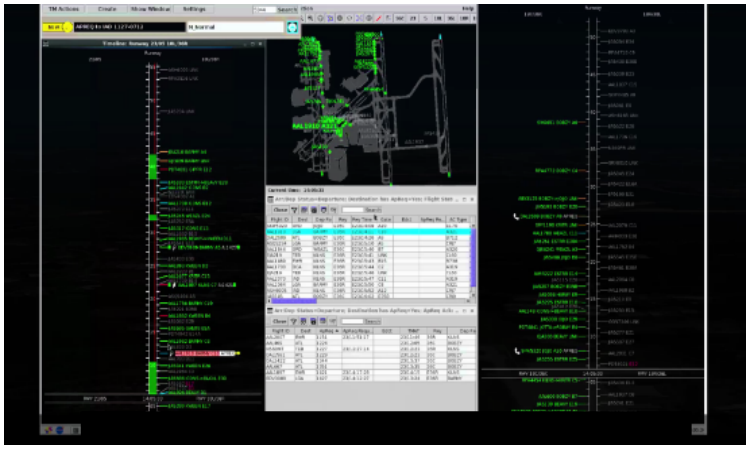
What is Airspace Technology Demonstration 2 (ATD-2)?

- NASA/FAA/Industry collaborative project that demonstrates the benefits of an integrated arrival, departure and surface (IADS) traffic flow decision making process while introducing new trajectory based operations (TBO) technologies and procedures
- Responds to a NextGen Advisory Committee (NAC) recommendation/need

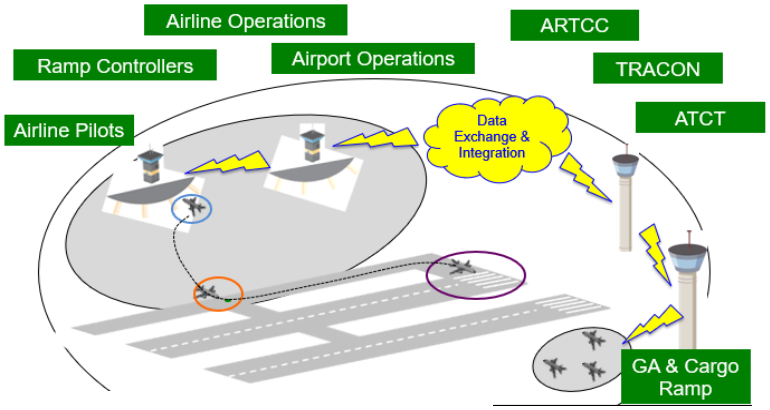
Collaborative Surface Metering



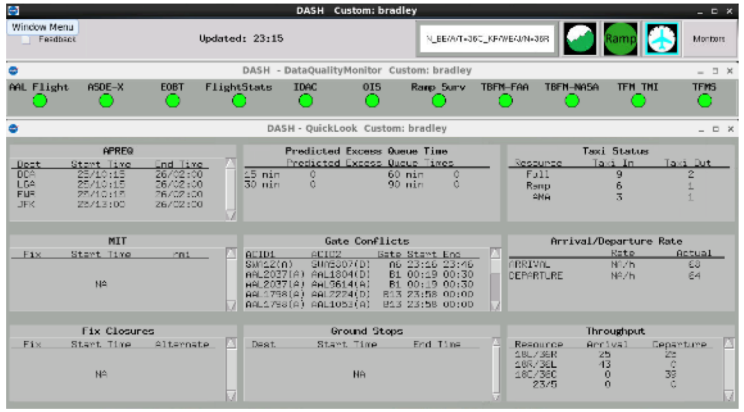
Overhead Stream Operational Integration



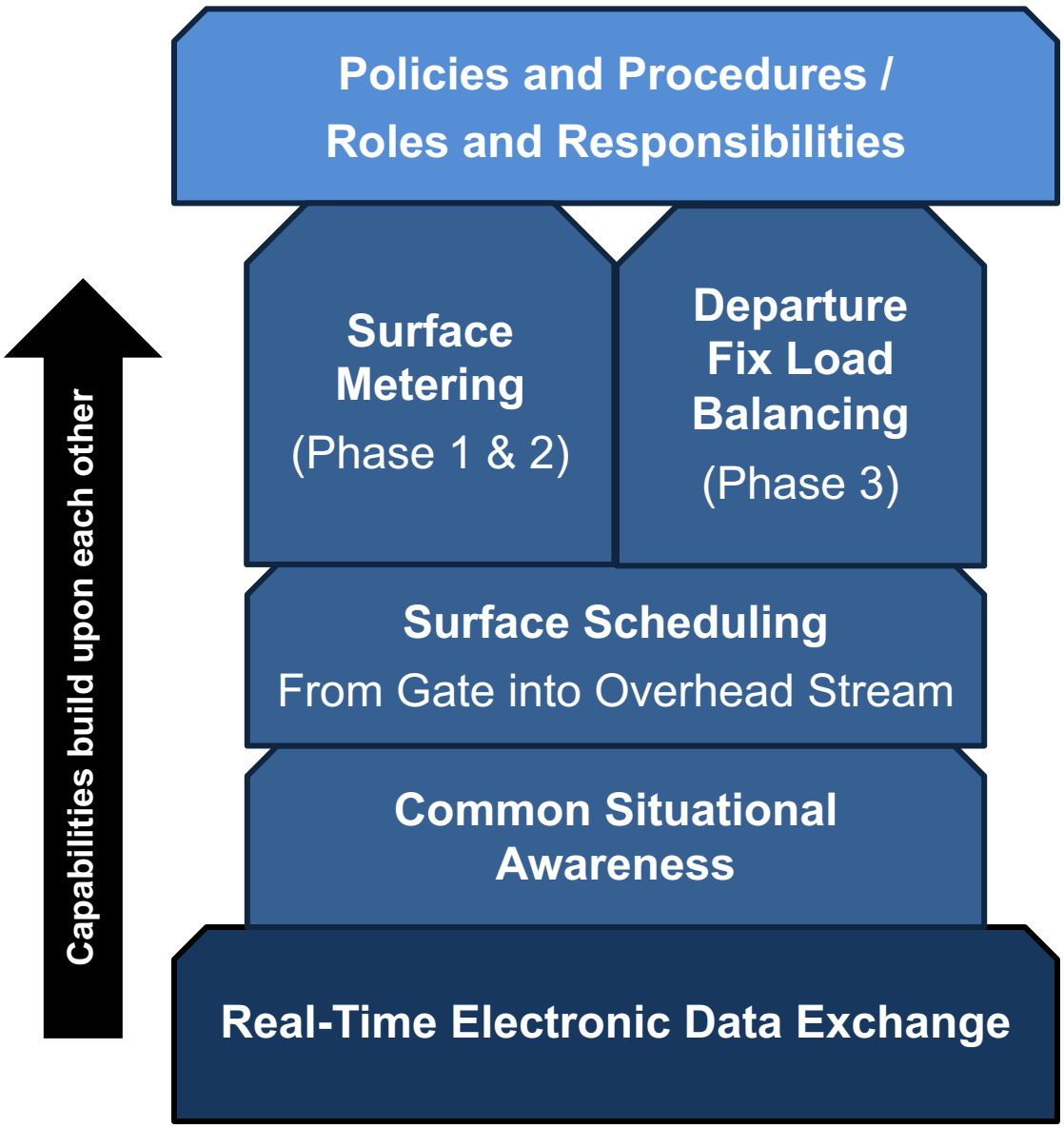
ATC/Operator Data Exchange and Integration



Initial Digital Transformation of Airport Surface



ATD-2 Capabilities



The capstone needed for each capability to work and provide benefits

Departure Fix Load Balancing: Use improved predictions and TOSs to balance demand across fixes

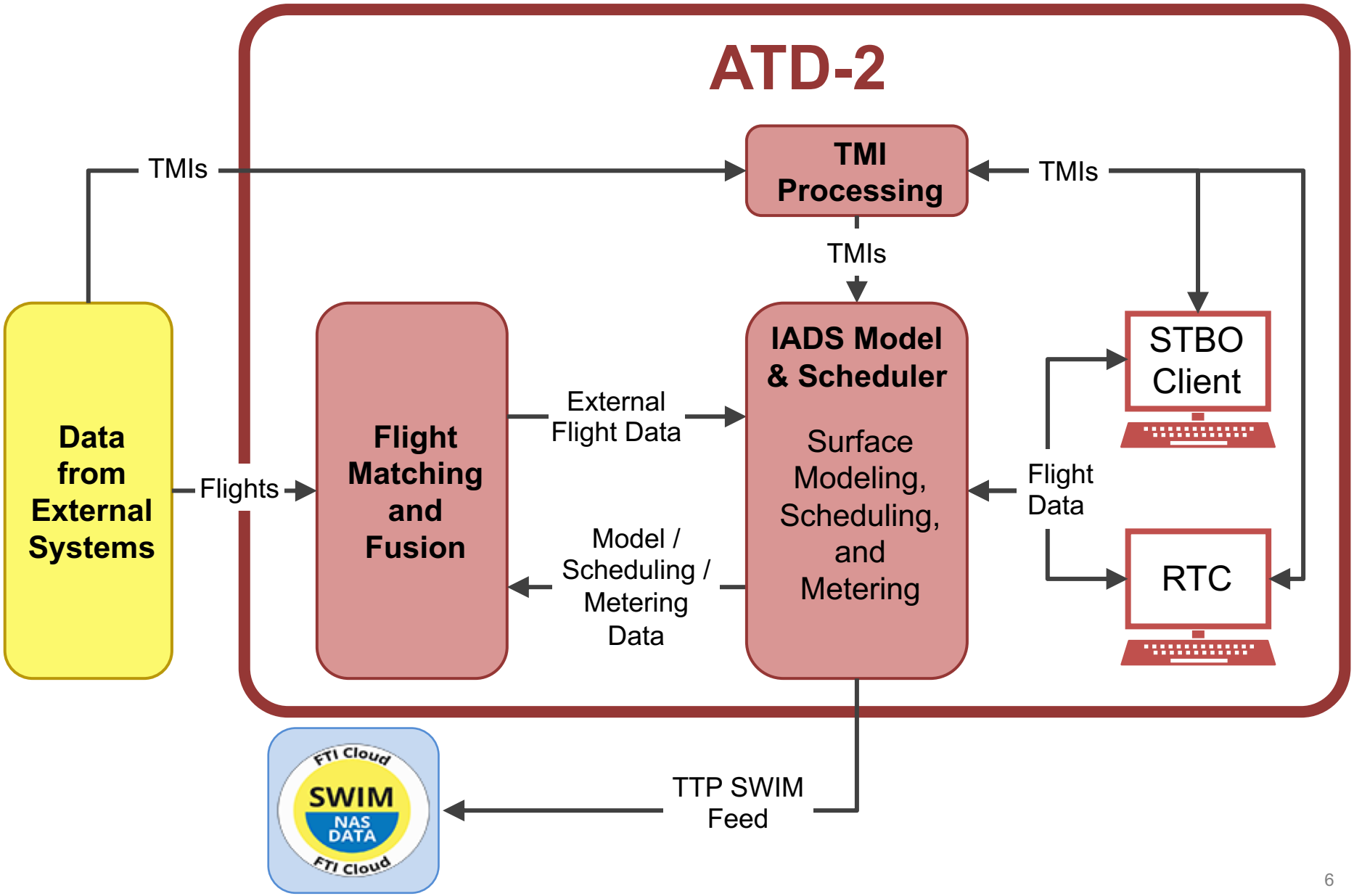
Surface Metering: Hold flights at the gate to reduce surface congestion and save fuel + emissions

Surface Scheduling: Predict when each flight will operate and determine how it will fit into the overhead stream

Common Situational Awareness: Shared view of flights, airport, airspace, and TMIs

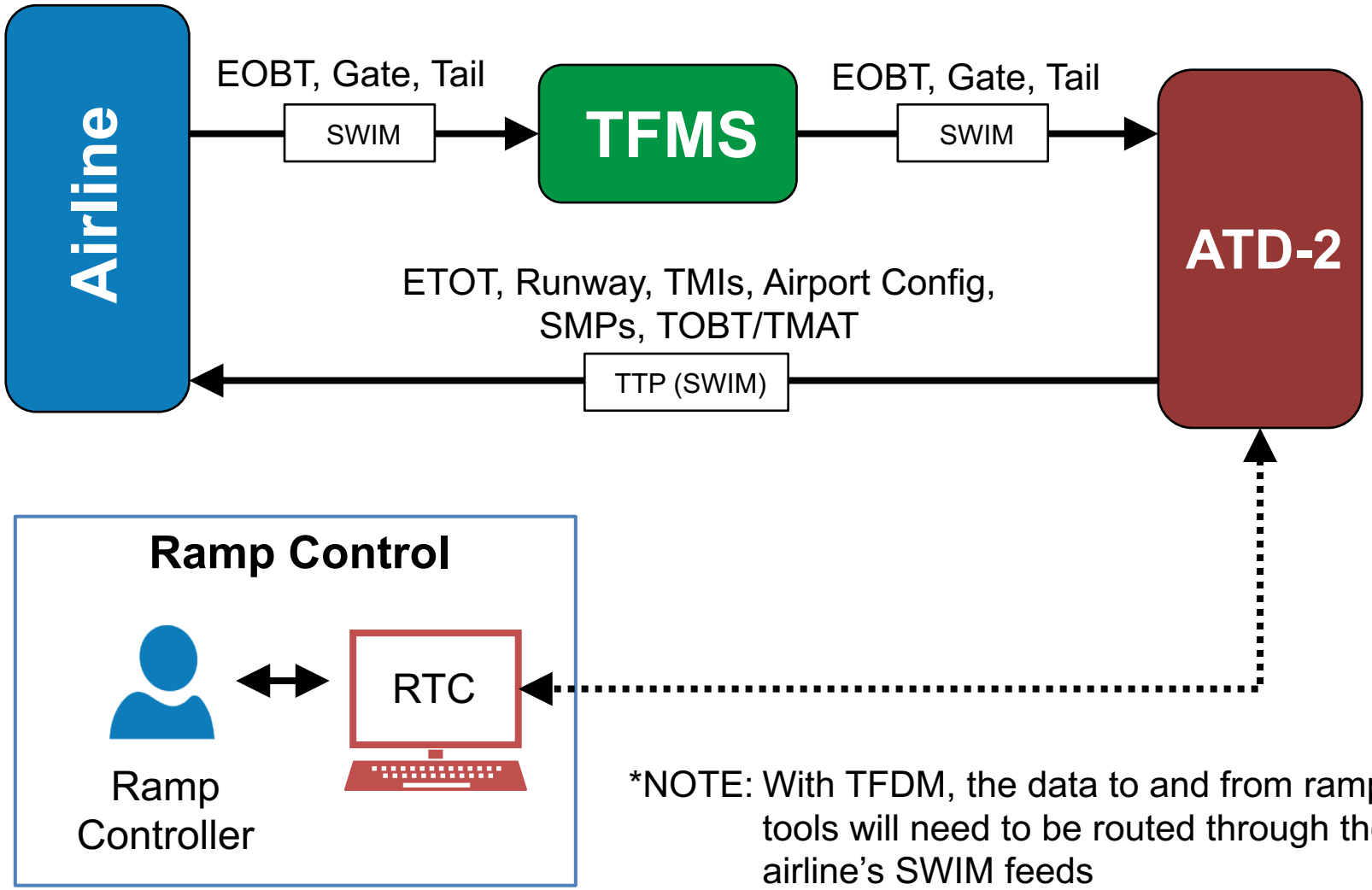
The foundation of all of the other ATD-2 capabilities

ATD-2 System Overview



Electronic Data Exchange

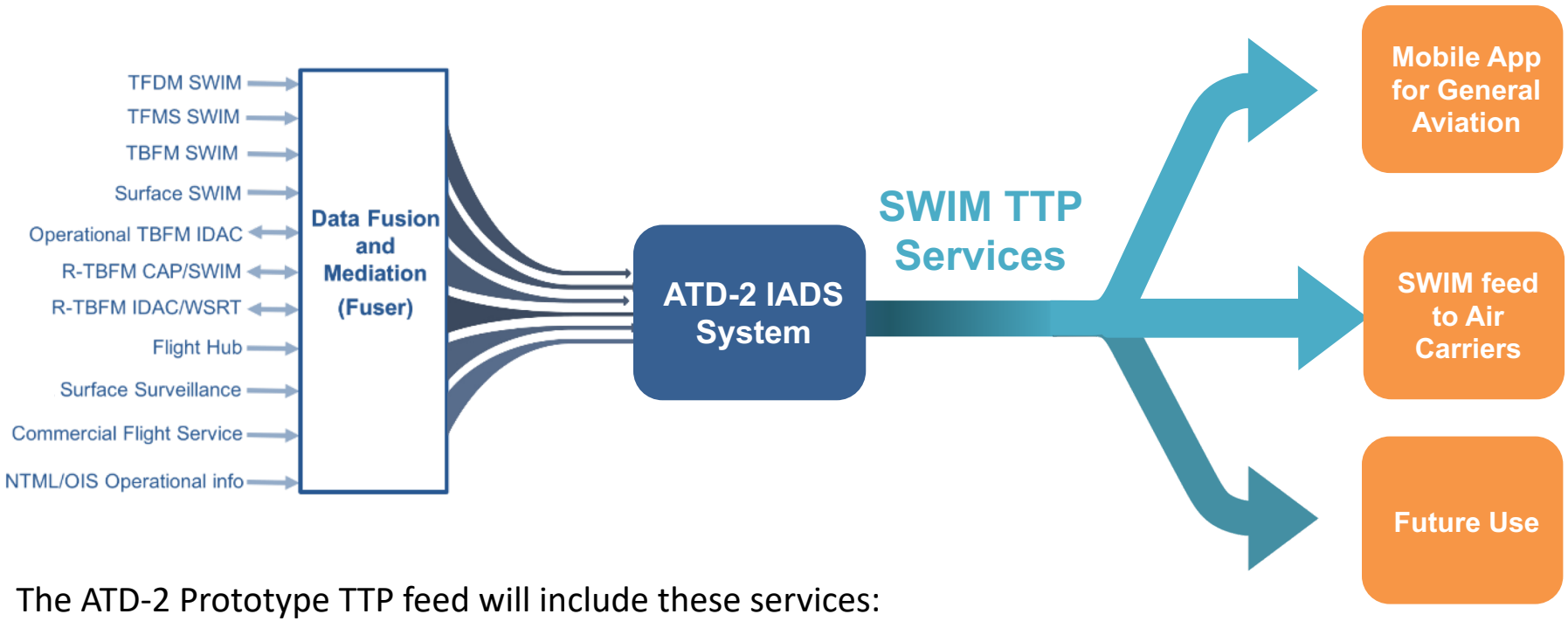
Electronic Data Exchange between ATCT and Airlines



*NOTE: With TFDM, the data to and from ramp tools will need to be routed through the airline's SWIM feeds

IADS Data Sharing via Prototype TTP

NASA and the FAA are collaborating to provide a prototype TFDM Terminal Publication (TTP) feed via SWIM R&D network as part of the ATD-2 Field Demonstration

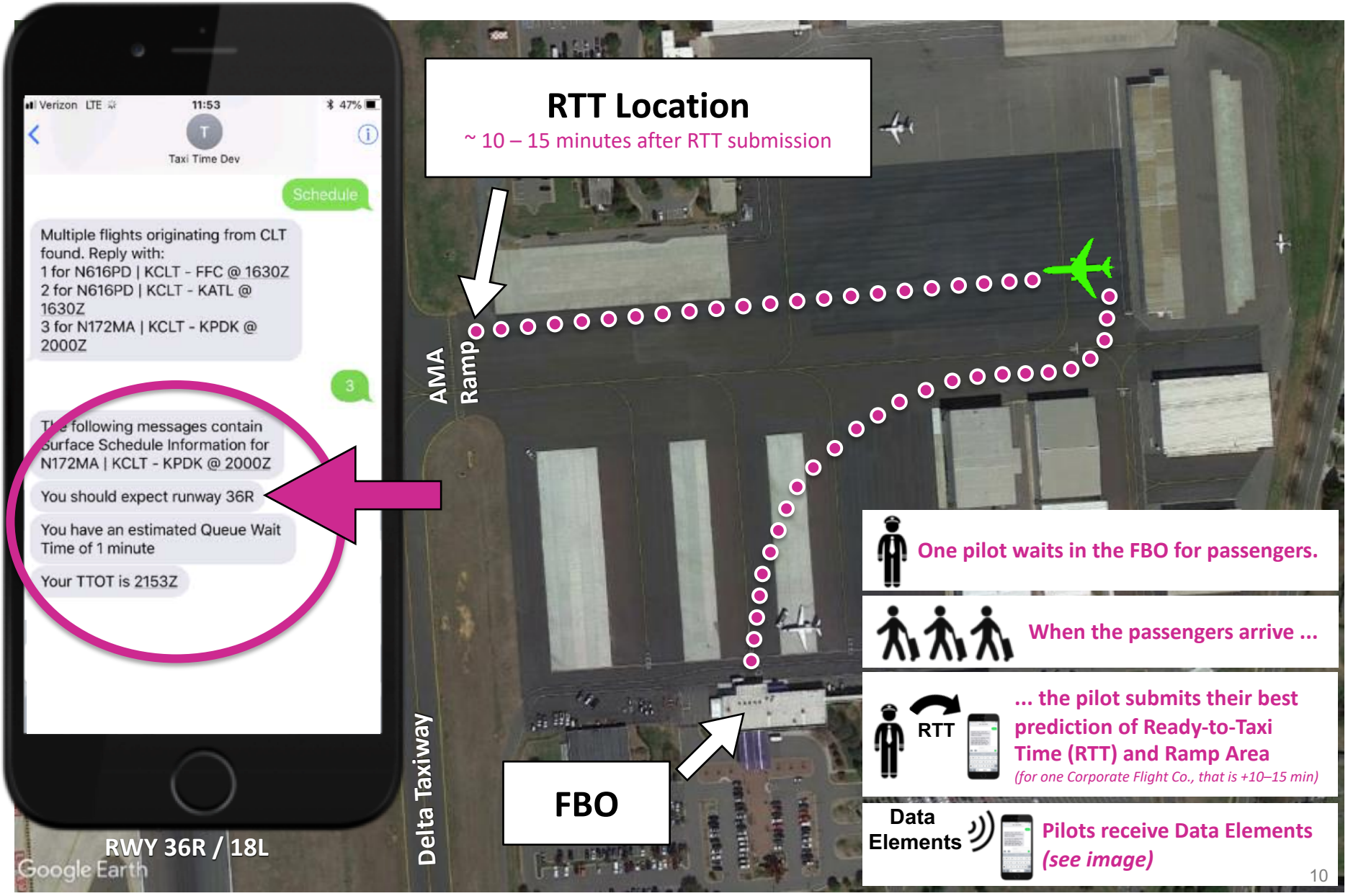


The ATD-2 Prototype TTP feed will include these services:

- Flight Data
- Airport Information
- Traffic Management Restrictions
- Flight Delay
- Operational Metrics

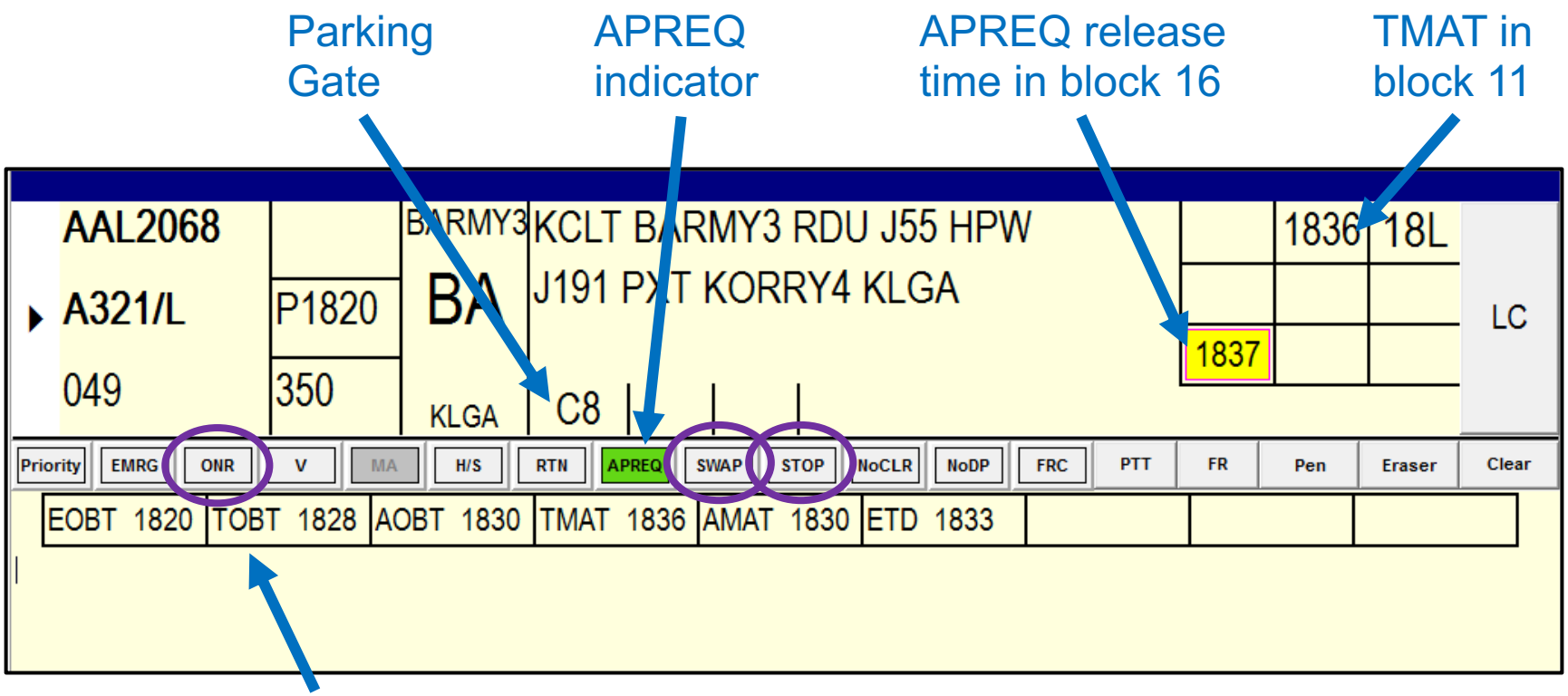
TTP is now available on SWIM R&D for CLT. You are welcome to onboard now!

Electronic Data Exchange with GA / BA
Mobile App Ready-to-Taxi Time Submission



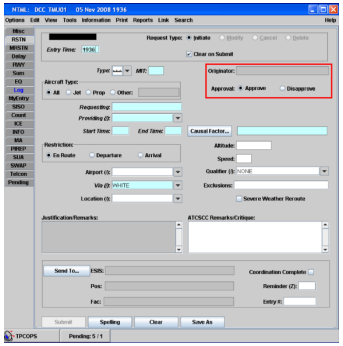
Electronic Data Exchange in the ATCT Cab
AEFS/ATD-2 Integration

- ATD-2 data elements are integrated into AEFS V5.5.0 Build 1 which was deployed to CLT on Thu 9/20/2018



Other data from ATD-2: ONR, SWAP, STOP

Electronic Data Exchange Of Traffic Management Initiatives (TMIs)



Current Restrictions

This page refreshes every minute. Last updated Fri, 23 Aug 2019 17:40:37 UTC

REQUESTING	PROVIDING	RESTRICTION	START TIME	STOP TIME
ZDC	CLT/ZTL	APREQ CLT,ZTL to DCA via BARMY,KILNS 1145-0100 ZDC:CLT,ZTL	08/23/2019 1145	08/24/2019 0100
ZDC	CLT/ZTL	APREQ CLT,ZTL to EWR via BARMY,KILNS 1015-0200 ZDC:CLT,ZTL	08/23/2019 1015	08/24/2019 0200
ZDC	CLT/ZTL	APREQ CLT,ZTL to JFK via BARMY,KILNS 1015-0200 ZDC:CLT,ZTL	08/23/2019 1015	08/24/2019 0200
ZDC	CLT/ZTL	APREQ CLT,ZTL to LGA via BARMY,KILNS 1015-0200 ZDC:CLT,ZTL	08/23/2019 1015	08/24/2019 0200
ZDC	CLT/ZTL	APREQ CLT,ZTL to PHL via BARMY,KILNS 1630-0030 ZDC:CLT,ZTL	08/23/2019 1630	08/24/2019 0030
ZJX	CLT/ZTL	CLT SOUTHBOUND 10MIT SINGLESTREAM 1720-2000 ZJX:ZTL,CLT	08/23/2019 1720	08/23/2019 2000

TFMS

NTML

OIS

Restrictions

ATD-2

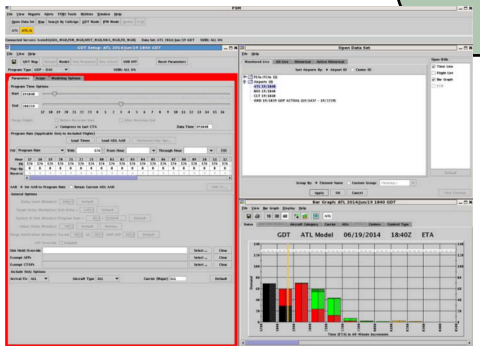
ATC Personnel

FSM

TfmData Flow

Restrictions, GSs, GDPs

SWIM

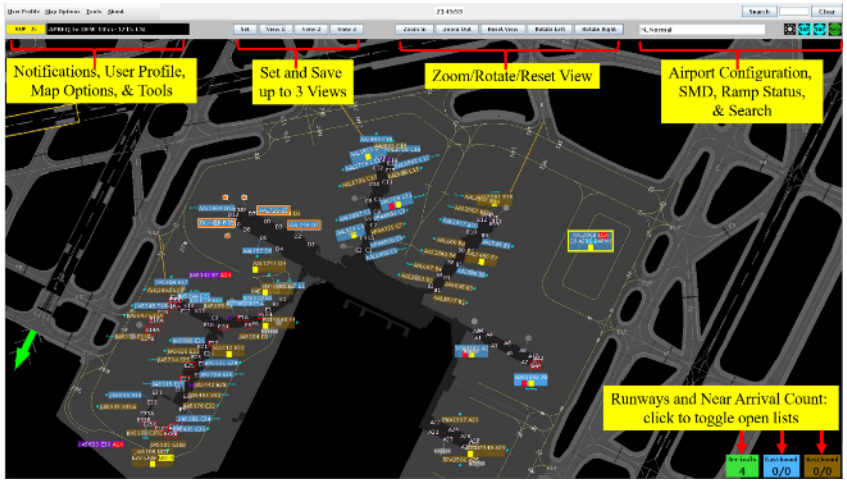




Common Situation Awareness

Common Situational Awareness between ATCT and Airlines

- A single system running with multiple users (i.e., Tower, Ramp, TRACON, Center) to interact with one another
- Users share the same data, exchange information, and make decisions collaboratively
- Inputs are from multiple sources, including FAA, Airlines, ATC, and Ramp

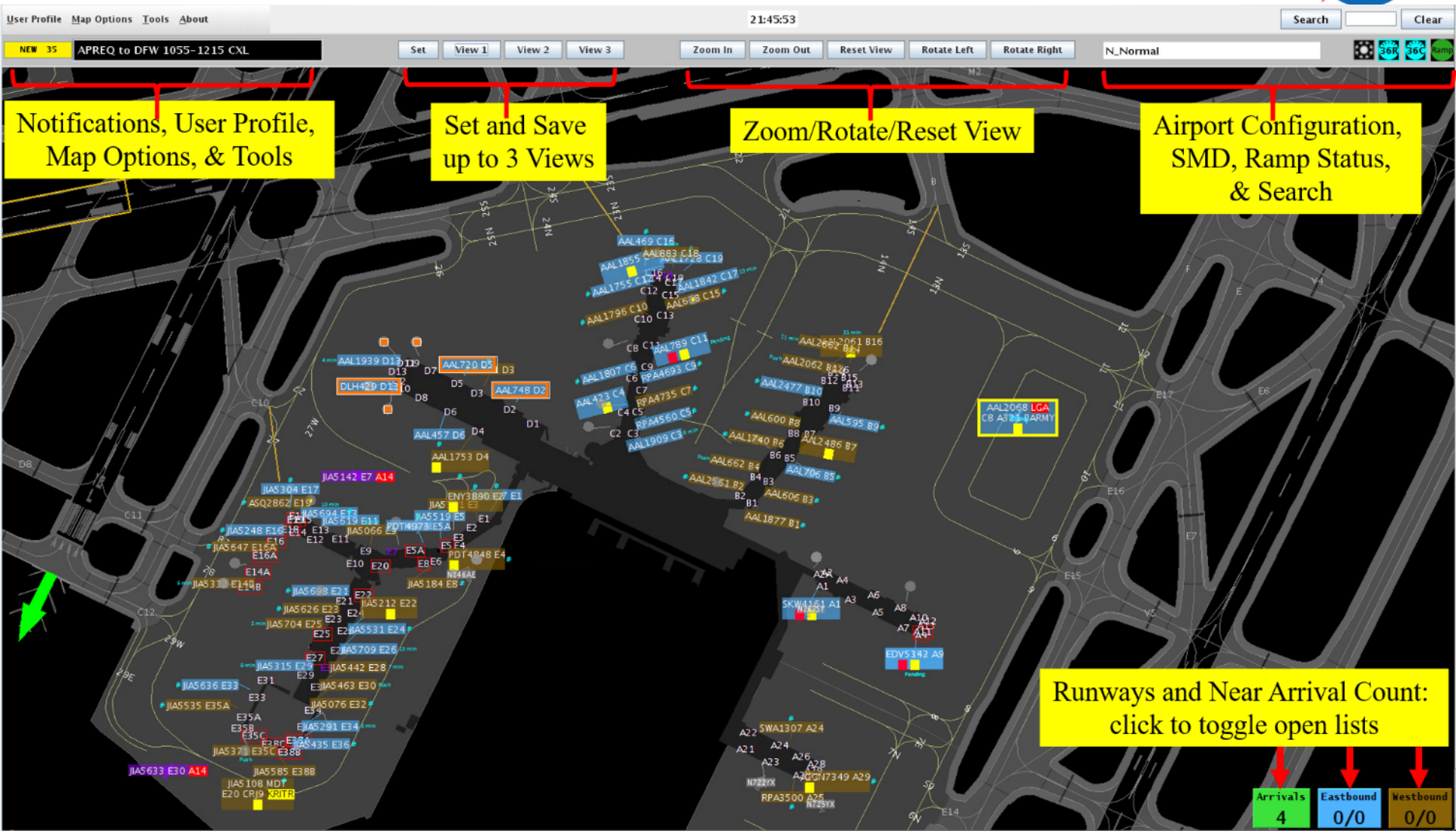


Ramp Traffic Console (RTC) and Ramp Manager Traffic Console (RMTC)



Surface Trajectory-Based Operation (STBO) Client - Tower, TRACON, and Center

Common Situational Awareness – Ramp View



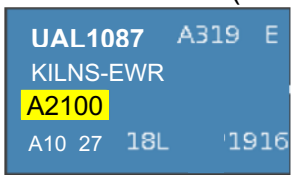
The ramp traffic console has many lessons learned woven into its Human Computer Interface

Common Situational Awareness – Ramp View

ATC to Operator

- Real-time traffic management initiatives
- Airport configuration coordination
- Runway intent information

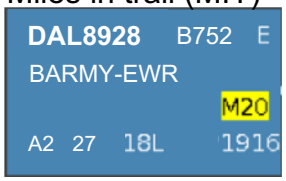
Call for release (APREQ)



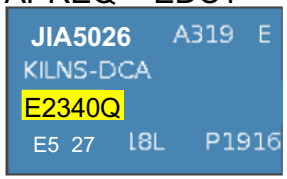
Ground delay (EDCT)



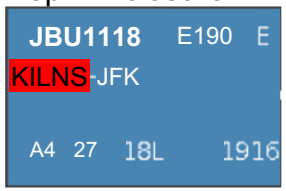
Miles in trail (MIT)



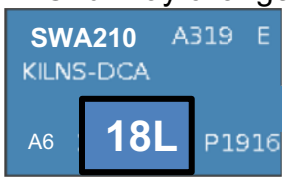
APREQ + EDCT



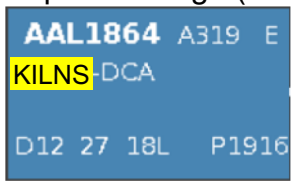
Dep Fix closure



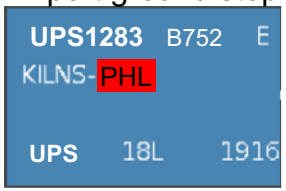
ATC runway change



Dep Fix change (CDR)



Airport ground stop



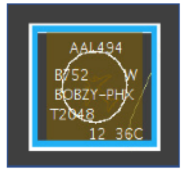
Ramp Tool Colors and Symbology



Arrivals are green



After pushback, engine symbol indicates spool up state



757 aircraft has blue and white border



Sector ownership



Westbound departures are brown, eastbound are blue



Hollow icon (if no surveillance)



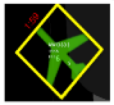
Super type aircraft has thick white border



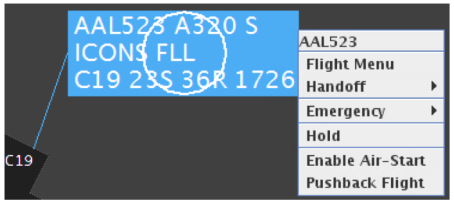
Heavy aircraft has orange and white border

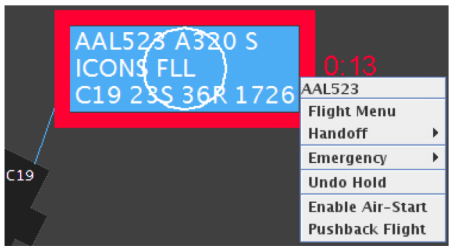


Priority flight has green border



A flight assigned to the hardstand has yellow border





Ramp control entries are ***key*** to accurate measures of benefit and good system performance

Surface Scheduling

Surface Modeling

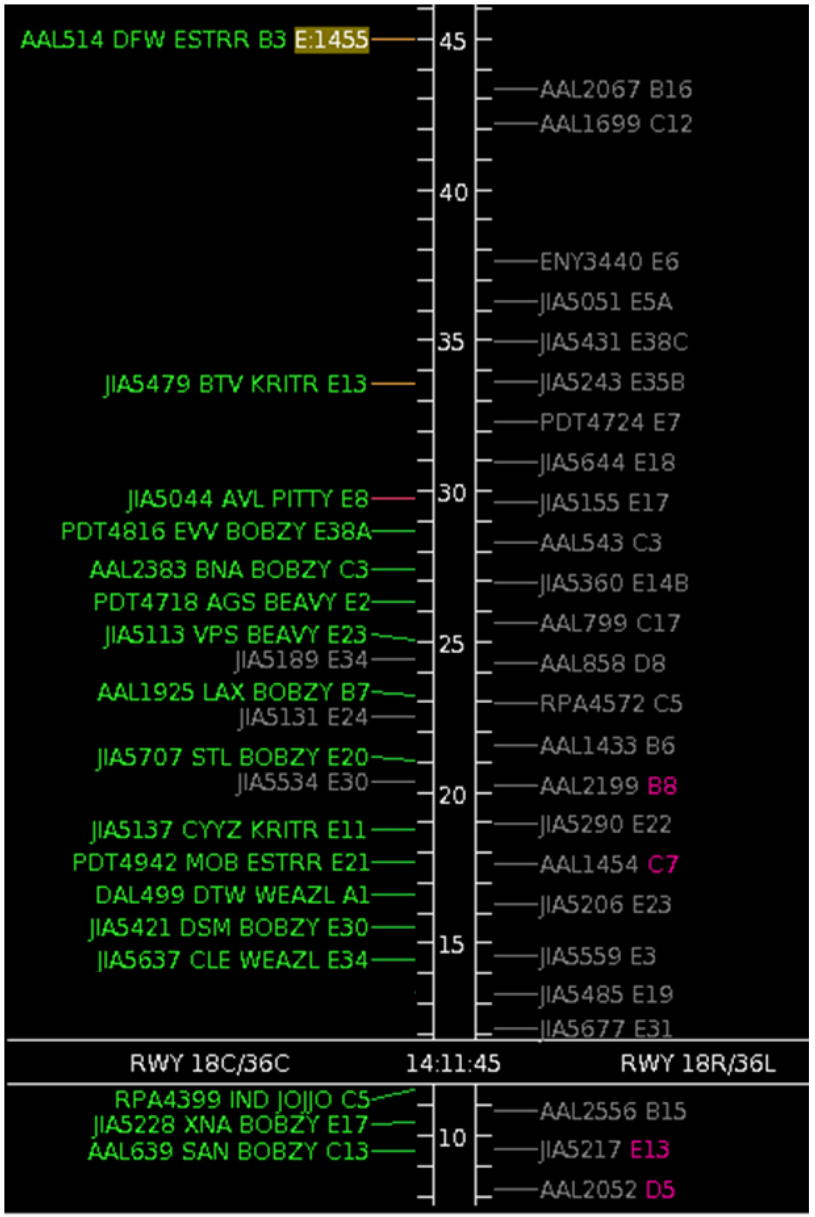
- Detects the flight's current state
- Predicts which resources a flight will use
  - Gate
  - Spot
  - Runway
  - Fix
- Predicts undelayed 4D trajectory
- Tracks aircraft line of flight and predicts gate conflicts



Surface Scheduling

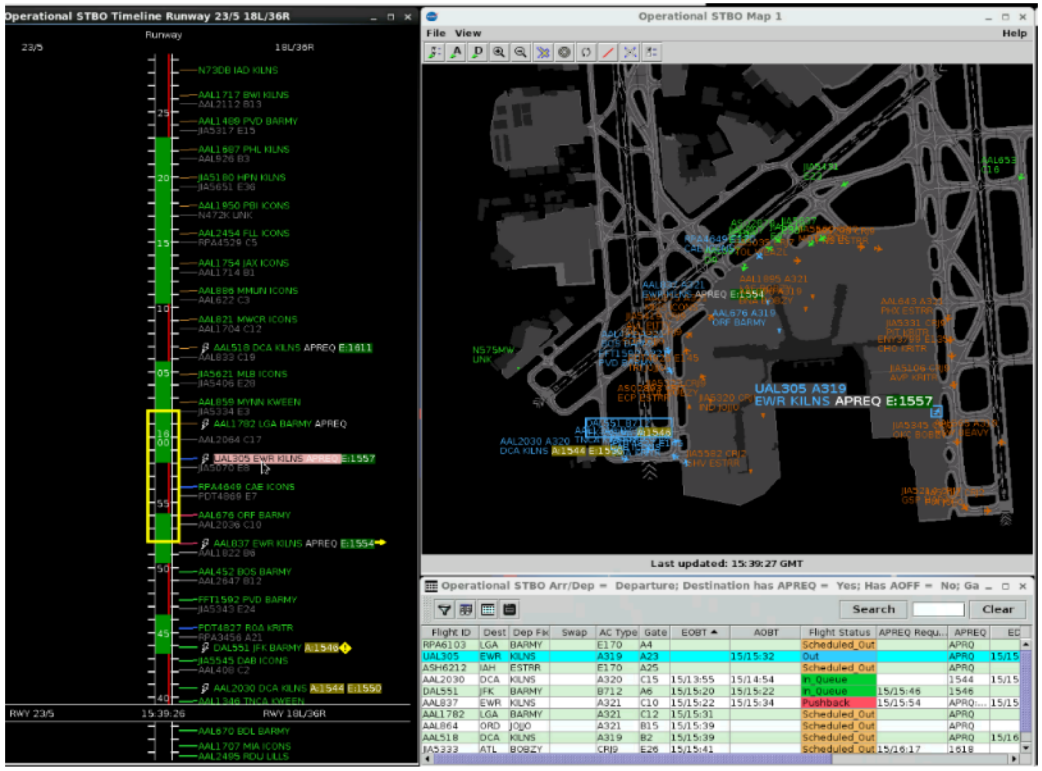
- Predicts when each flight will take off or land

- Considers
  - Current flight state
  - Undelayed 4D trajectory
  - Other flights arriving and departing from the same runway
  - Runway separation requirements
  - EDCTs
  - Release times
  - Ground stops and fix closures



Scheduling Flights into Overhead Stream

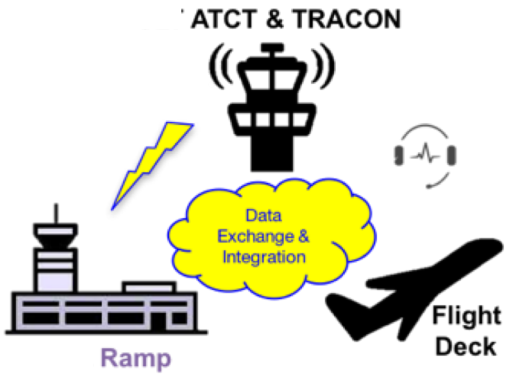
- ATD-2 allows ATCT TMC to electronically negotiate release time into the overhead stream using IDAC-style interface
- Displays green-space / red-space that shows available time slots for flight to take off
- Take off time prediction for flight shown relative to other flights on the same runway
- EDCT and local information displayed for the flight



Pre-Scheduling with EOBTs from CLT to ATL / ORD

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





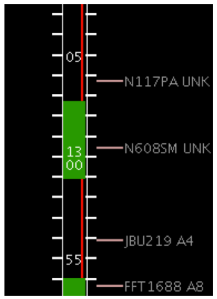
2. Center TMC approves or adjusts the time based on center constraints

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



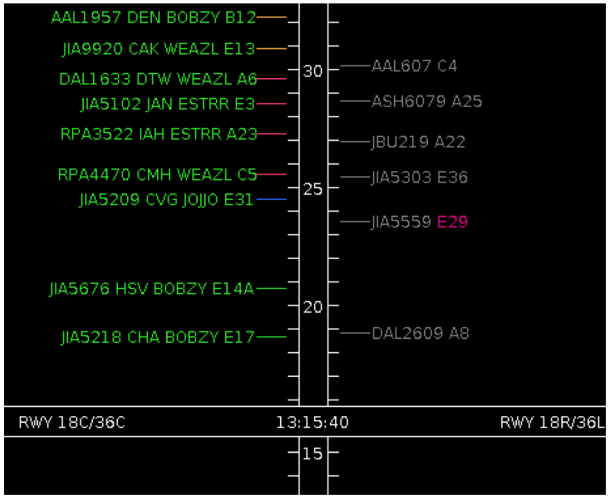
4. IDAC-style scheduling between TBFM and ATD-2 is used to re-schedule as necessary



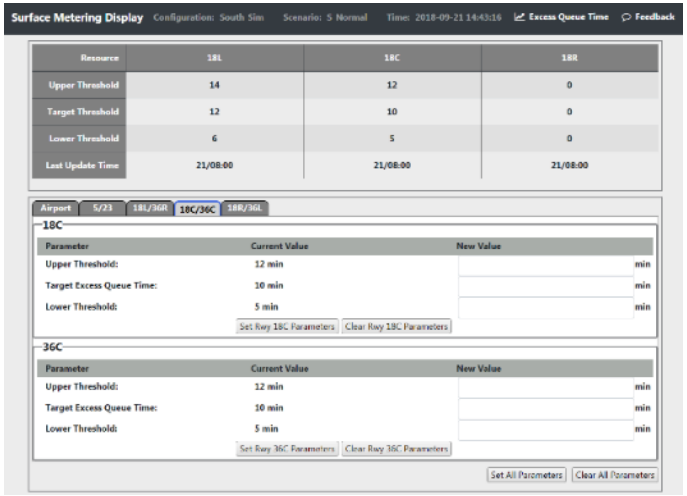
Surface Metering

Surface Metering – Process Flow

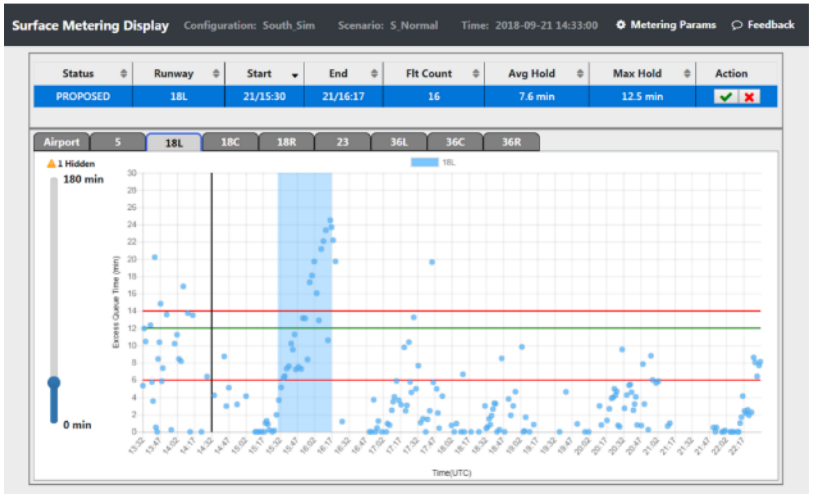
1 **ATD-2 generates demand and capacity predictions**



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**

