Local Data Exchange
for
Airport Surface Trajectory-Based Operations

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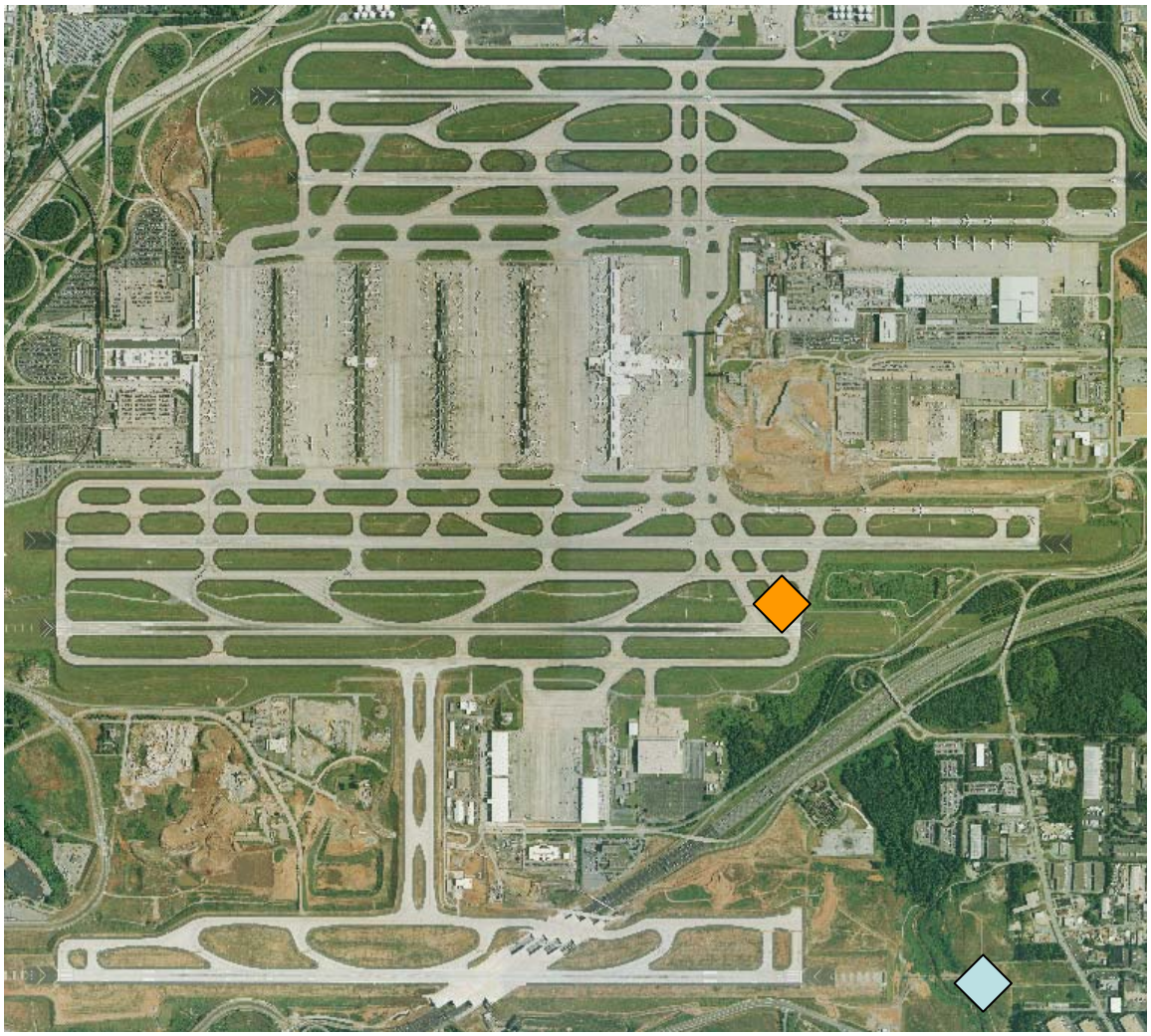
Presentation Outline

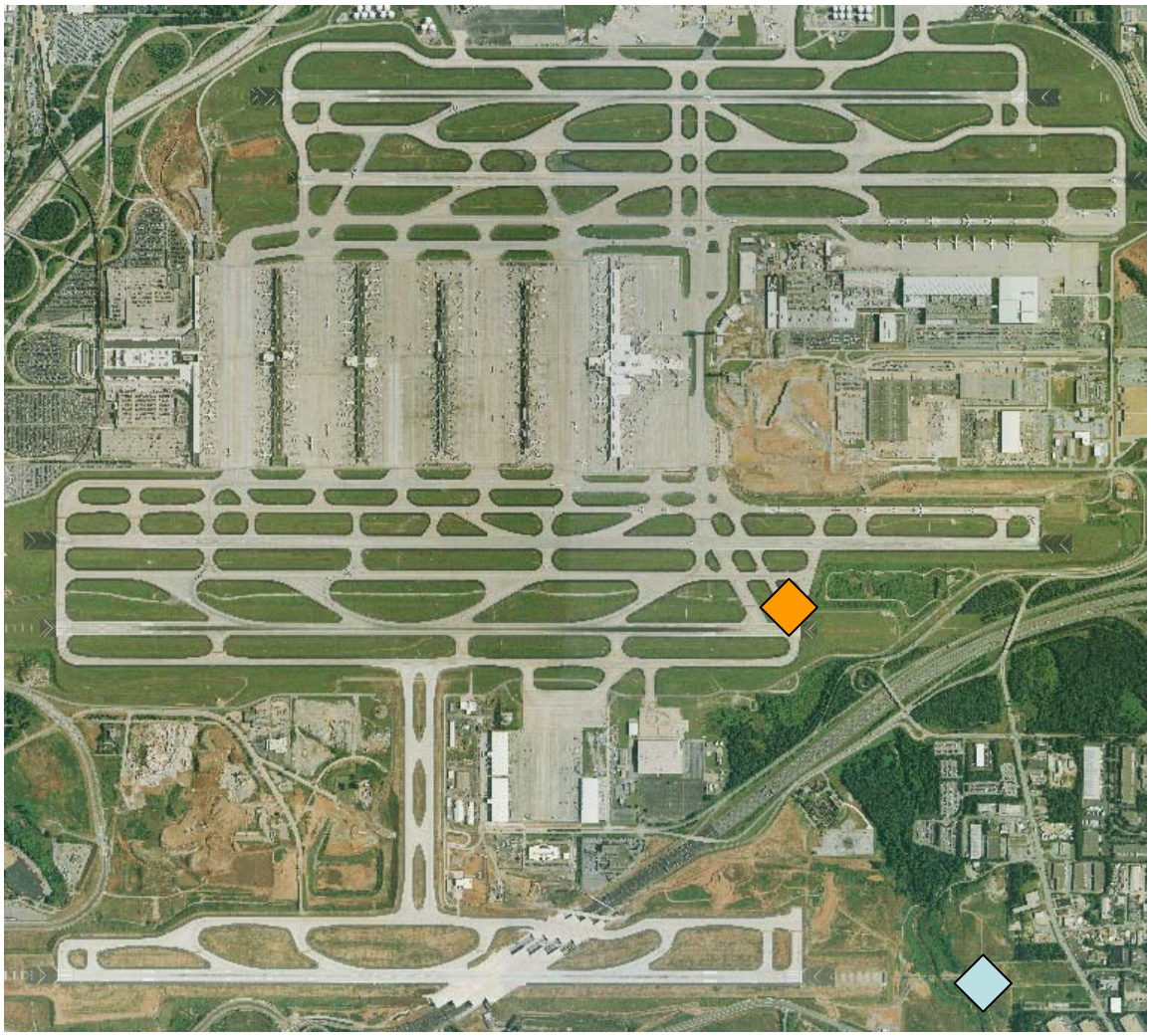
- Surface Trajectory Based Operations Overview
- The Need for Data
- Activity Decomposition of Airport Traffic Services
- Local Data Exchange Examples
- Conclusions and Future Work

Today's Airport Operations



- Airport Surface Traffic Controlled through Incremental Clearances
- Verbal Instructions Required for Each Step
- Ground Control: Verbal Capacity can be Limiting Constraint

Surface Trajectory Based Operations



- Pre-Planned Airport Surface Trajectories Allow Multiple Steps to be Cleared at Once
- Datalink Communication rather than Verbal
- No Verbal Capacity Constraint
- Safety Improvements

Comparison of Available Information

Airborne Flight Specification Data From Flight Operator to ATC	**Airport Surface Flight Specification Data From Flight Operator to ATC**
Origin (Airport) and Destination (Airport) Specified by Flight Operator	Origin and Destination not Specified Origin: Parking Gate (Departure) or Runway Exit (Arrival) Destination: Runway (Departure) or Parking Gate (Arrival)
Planned Altitude and Speed Specified by Flight Operator	No Need for Altitude Specification Speed not Specified Flight Readiness not Specified
Requested Route of Flight Specified by Flight Operator	No Information Provided If a Minimum Runway Length is Required, No Standard Communication until Flight is Taxiing

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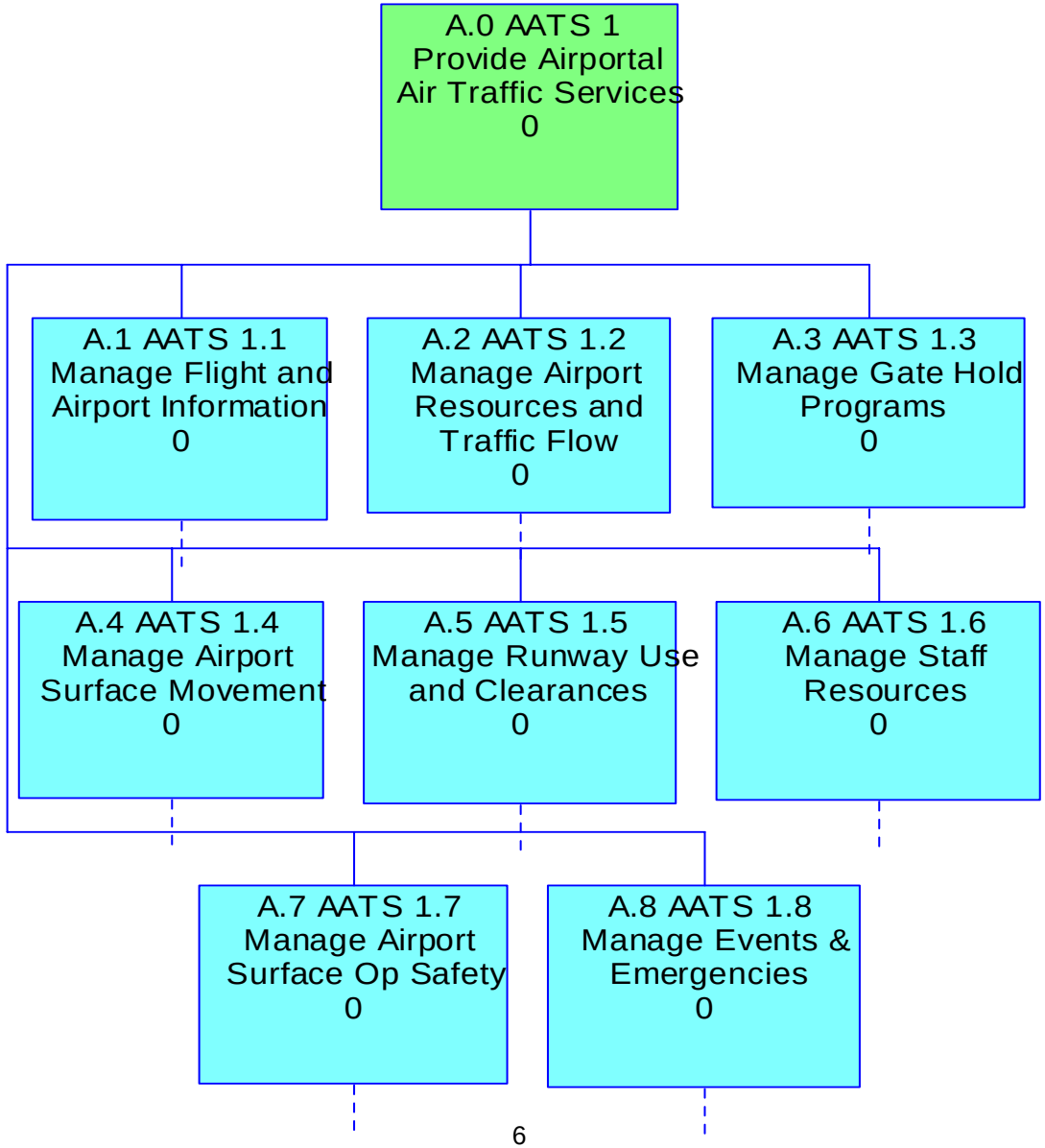
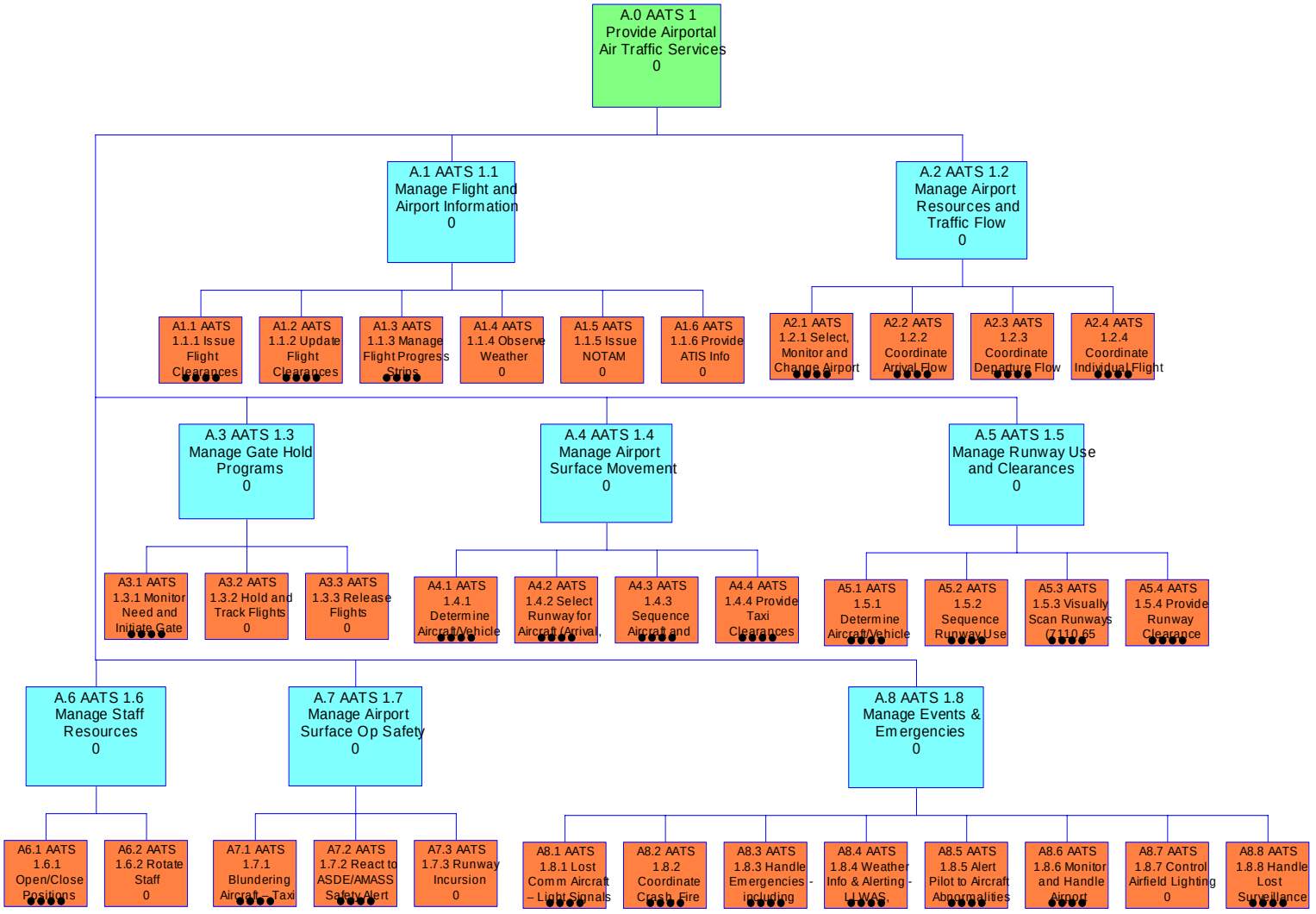
Airport Traffic Services Activity Decomposition



Airport Traffic Services Activity Decomposition

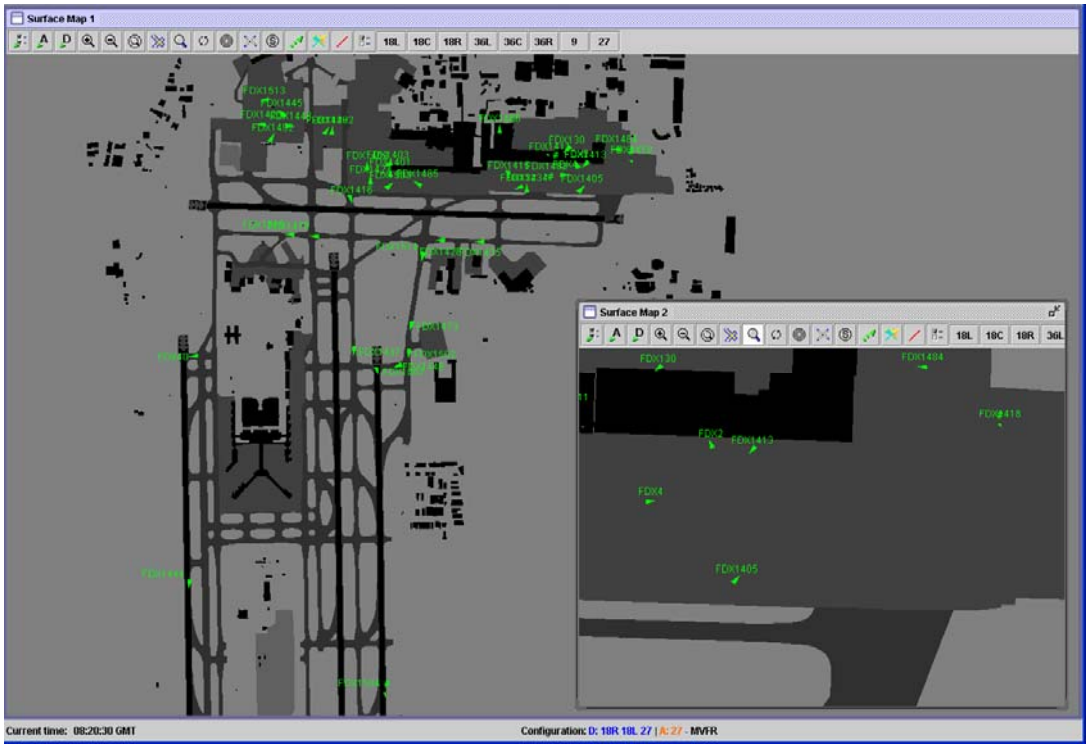


Activity References

Name	Leaf	Standards
AATS 1 Provide Airportal Air Traffic Services	F	
AATS 1.1 Manage Flight and Airport Information	F	
AATS 1.1.1 Issue Flight Clearances	T	7110.65 2-10-3, 2-2, 2-3, 4-2, 4-3, 4-4, 7210.3 10-4-2
AATS 1.1.2 Update Flight Clearances	T	7110.65 2-10-3, 2-2, 2-3, 4-2, 4-3, 4-4, 7210.3 10-4-2
AATS 1.1.3 Manage Flight Progress Strips	T	7110.65 2-3-3, 7210.3 10-1-8
AATS 1.1.4 Observe Weather	T	7110.65 2-6-6
AATS 1.1.5 Issue NOTAM	T	7110.65 2-1-9
AATS 1.1.6 Provide ATIS Info	T	7110.65 2.9, 7210.3 10-4-1
AATS 1.2 Manage Airport Resources and Traffic Flow	F	
AATS 1.2.1 Select, Monitor and Change Airport Configuration	T	7110.65 3.5, 7210.3 10-1-6
AATS 1.2.2 Coordinate Arrival Flow Restrictions	T	7210.3 10-7, 17-6-9
AATS 1.2.3 Coordinate Departure Flow Restrictions	T	7210.3 17-6-9
AATS 1.2.4 Coordinate Individual Flight Manual Release Times	T	7110.65 4-3-4, 7210.3 17-6-13
AATS 1.3 Manage Gate Hold Programs	F	
AATS 1.3.1 Monitor Need and Initiate Gate Hold Programs	T	7110.65 3-9-2, 7210.3 10-4-3
AATS 1.3.2 Hold and Track Flights	T	7110.65 3-9-2, 7210.3 10-4-3
AATS 1.3.3 Release Flights	T	7110.65 3-9-2, 7210.3 10-4-3
AATS 1.4 Manage Airport Surface Movement	F	
AATS 1.4.1 Determine Aircraft/Vehicle Position for Taxi	T	7110.65 3-1-7, 3-6-2
AATS 1.4.2 Select Runway for Aircraft (Arrival, Departure)	T	7110.65 3.5
AATS 1.4.3 Sequence Aircraft and Vehicles	T	7110.65 3.7
AATS 1.4.4 Provide Taxi Clearances	T	7110.65 3.7
AATS 1.5 Manage Runway Use and Clearances	F	
AATS 1.5.1 Determine Aircraft/Vehicle Position for Runway Use	T	7110.65 3-1-7, 3-10-7
AATS 1.5.2 Sequence Runway Use (Arrivals, Departures, Crossing Aircraft, Vehicles)	T	7110.65 3.8
AATS 1.5.3 Visually Scan Runways (7110.65 Section 3-1-12).	T	7110.65 3-1-12, 3-1-5
AATS 1.5.4 Provide Runway Clearance (Cross, TIPH, Take-Off, Land, Exit Runway, Taxi on R	T	7110.65 3-1-3
AATS 1.6 Manage Staff Resources	F	
AATS 1.6.1 Open/Close Positions	T	7210.3 4-6
AATS 1.6.2 Rotate Staff	T	7210.3 4-6
AATS 1.7 Manage Airport Surface Op Safety	F	
AATS 1.7.1 Blundering Aircraft – Taxi Out-of-Conformance	T	7210.3 2-1-20
AATS 1.7.2 React to ASDE/AMASS Safety Alert	T	7110.65 3-6-4, 7210.3 11-9-3
AATS 1.7.3 Runway Incursion	T	721-.3 2-1-20
AATS 1.8 Manage Events & Emergencies		
AATS 1.8.1 Lost Comm Aircraft – Light Signals	T	7110.65 3-2-1
AATS 1.8.2 Coordinate Crash, Fire Rescue	T	7110.65 10-1
AATS 1.8.3 Handle Emergencies - including security issue	T	7110.65 10-1, 10-2
AATS 1.8.4 Weather Info & Alerting - LLWAS, Microburst	T	7110.65 2-6, 3-1-8
AATS 1.8.5 Alert Pilot to Aircraft Abnormalities	T	7110.65 3-1-10
AATS 1.8.6 Monitor and Handle Airport Condition Issues (Rwy Closure, Braking Action, Debris	T	7110.65 3-3
AATS 1.8.7 Control Airfield Lighting	T	7110.65 3.4
AATS 1.8.8 Handle Lost Surveillance (due to aircraft malfunction, etc.)	T	

Local Sharing of Surface Data

- Flight Operator -> ATC
  - Parking Gate Assignment/Spot
  - Scheduled Push-back Time
  - Pre-push-back Status
  - Acceptable CDRs
  - Local Slot Substitutions
  - Gate/Ramp Conflict Resolution



- ATC -> Flight Operator
  - Assigned Off Times
  - Predicted On and In Times
  - Runway Assignments
  - Taxi Route Clearance
  - Surface Trajectory
  - Traffic Management Initiatives
  - Gate/Ramp Conflict Alert

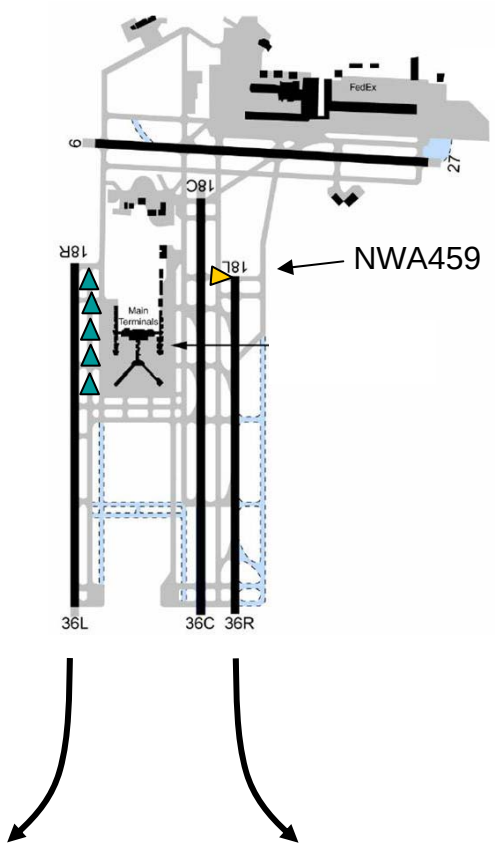
Parking Gate/Airfield Destination Data

- Air Carriers (and Military?)
  - Specify Parking Gate by Name/Designation via Local Data Exchange
  - Concept: Maintain Synchronized Database of Parking Gate Names and Locations
    - Shared by the ATC system and the Flight Operators

- Business Aviation and General Aviation
  - Even Greater Challenges Exist to Obtain Data
  - Possible Approaches:
    - Database of Based Aircraft with Location
    - File Airfield Destination by FBO
    - File Airfield Destination by Latitude/Longitude Coordinate
    - Controller Requests and Enters Airfield Destination upon Arrival

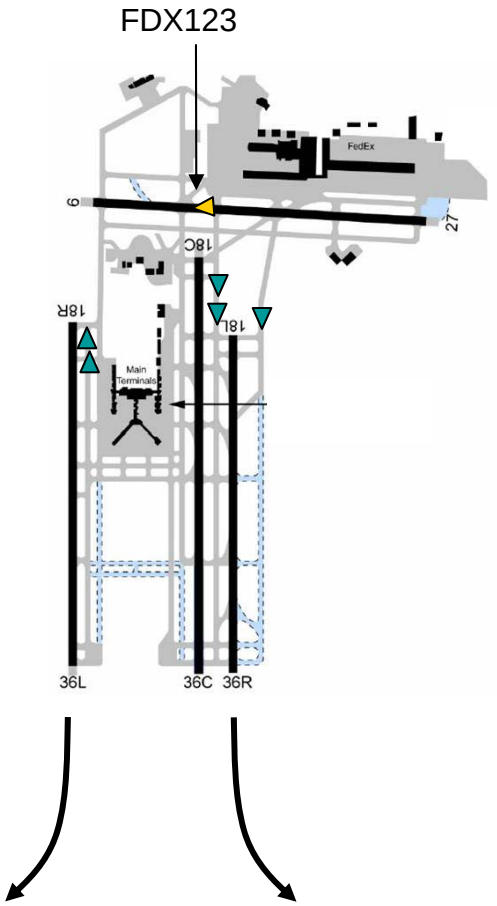
Local Sharing of Surface Data – Scenario

- By Identifying Available Coded Departure Routes, Alternate Runways can be Assigned
  - MEM Using Runways 18L, 18R and 27 for Departure
  - NWA459 MEM -> MSP
    - Fueled and Flight Planned to be Able to Accept Three CDRs
    - Two West-bound, One East-bound
  - When NWA459 Pushes Back and Calls for Taxi, Ground Controller already has Many West-bound Flights Queued on 18R
  - Ground Controller Notices on Tower Automation System Display that NWA459 Can Accept an East-bound CDR
  - Ground Controller Issues Taxi Clearance to 18L for NWA459
  - NWA459 Reaches 18L and is Cleared for Immediate Departure



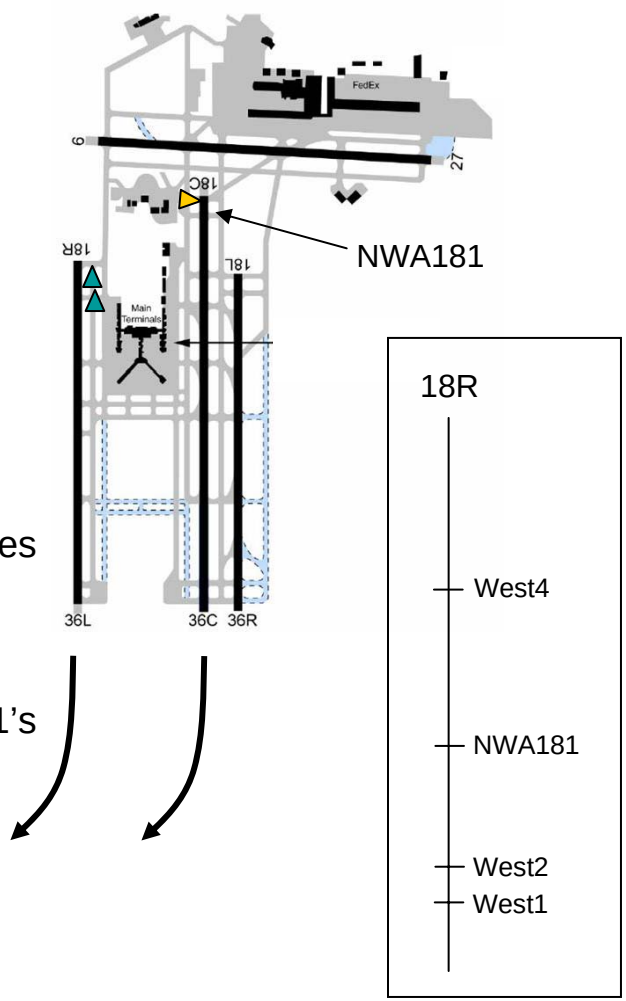
Airport Situational Awareness - Scenario

- Through Airport Surface Situational Awareness and Data Sharing, ATC and Flight Operators can Collaboratively Address Irregular Operations
  - FDX123 inbound to MEM is delayed and arrives at the beginning of the outbound launch
  - When FDX123 enters the terminal area, the potential conflict with departure traffic causes the TRACON to initiate a ‘Gate Conflict’ request to the FedEx Ramp Tower
    - Allows the FedEx Ramp Tower to indicate that the flight should be brought in to the Ramp, or held out of the way of Departures
  - Through the use of a surface planning tool, the FedEx Ramp Tower checks the scheduled departure flights at the predicted time of arrival of FDX123
    - A gap in scheduled departures from the gates on the west side of the Ramp will allow the arrival flight to be accepted.
    - The FedEx Ramp Tower indicates that the flight will be accepted into the Ramp.
  - The TRACON sees the acceptance of FDX123, and noting the gate/spot assignment, assigns the flight to land on runway 27 for a short taxi into the gate



Management of Runway Assignments - Scenario

- Using Additional Awareness from Local Data Exchange, Non-Standard Runways can be Assigned
  - MEM Using Runways 18L, 18R and 27 for Departure
  - NWA181 MEM -> LAX
  - West-bound departure on East side of Terminal
  - When NWA181 Pushes Back and Calls for Taxi, Ground Controller already has two West-bound Flights on 18R
  - Ground Controller Notices on SDSS Display that No Additional West-bound Flights will Push-Back for 10 minutes
  - Ground Controller Issues Taxi Clearance to 18C for NWA181
  - Two West-bound Flights Depart from 18R During NWA181's Taxi
  - NWA181 Reaches 18C and is Cleared for Immediate Departure



Conclusions

- Surface Trajectory Based Operations Can Alleviate Significant Operational Challenges
  - And, Thus, May Provide Significant Benefits

- The FAA is Currently Establishing a Surface Trajectory Based Operations Test-Bed in Memphis, Tennessee
  - To Assess Benefits through Operational Evaluation
  - Many of the Data Exchange Examples Identified in this Analysis Could be Evaluated through the Use of this STBO Test-Bed

- Primary Needs to Support Surface Trajectory Based Operations:
  - Local Data Exchange Infrastructure Must be Established
  - FAA Tower Automation Systems Must be Enhanced

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