A Framework for the Development of ATM-Weather Integration

Building on the Original ATM-Weather Integration Concept Diagram

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Outline

• Background
  – Air Traffic Management (ATM)-Weather Integration Concept Diagram

• Motivation and Strategy

• A Framework for the Development of ATM-Weather Integration
  – Framework design considerations
  – Diagram
  – Operational Example

• Summary
Background—Initial ATM-Weather Integration Diagram

- The initial ATM-Weather Integration concept diagram was developed in 2010 and covered a narrow scope of functions and responsibility.
Motivation and Strategy

• Increased level of comprehension of ATM-Weather Integration since 2010

• However, still an incomplete understanding of many core ATM-Weather Integration functions and components

• A wider/system view is needed to facilitate broader understanding and continued evolution and discussion of ATM-Weather Integration

• Visual representations work well to generate discussion - “a picture’s worth a thousand words”
Creating a Framework for the Development of ATM-Weather Integration

Framework Design Considerations

• Echo the four ATM-Weather Integration functions in the 2010 diagram
• Focus on four-dimensional flight trajectory (4DT) – the impact of weather applied Gate-to-Gate
• Highlight the support to National Airspace System (NAS) operations
• Highlight key weather integration touch-points with external systems
• Include additional details necessary to facilitate the discussion and understanding of these cross-system interactions
ATM-Weather Integration Development Framework

Surveillance Information
Aeronautical Information
Flight Information

NAS Net-Centric Infrastructure

Weather Data
Common Service/Open Standards

Translation
- NAS constraint (airspace)
- Threshold event (airport)

4-D Trajectory
- Airspace
- Surface

Air Traffic Impact
Capacity
Demand

ATM Decision Support
- Airport Configuration
- TMIs

Virtual Flow of Information

Aeronautic Information
Flight Information

Primary Responsibility:
FAA Met
NWS
FAA ATM

Menu
- Time Frame ✓
- Wx Parameter ✓
- Altitude ✓
- Location ✓

Menu
- Time Frame ✓
- Wx Parameter ✓
- Altitude ✓
- Location ✓

Flow Planning/Flight Planning
- Pushback/Taxi/Takeoff
- Climb
- Cruise
- Descent/Final Approach
- Landing

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Alignment with Current ATM-Weather Integration Diagram

- **Weather Data Common Service/Open Standards**
  - **Weather Information**
  - **Translation**
    - NAS constraint (airspace)
    - Threshold event (airport)

- **4D Wx Cube**
  - **NWP**

- **Translation**
  - Conversion of NAS Constraints and Threshold Events into:
    - NAS Impacts
    - State Changes

- **ATM Impact Conversion**
- **ATM Decision Support**
  - DSTs use specific NAS impact to develop strategic/tactical TFM solutions

- **Air Traffic Impact**
  - Airspace
  - Surface

- **ERAM**
  - CATM-T TFDM TBFM
    - Airport Configuration
    - TMIs

- **NextGen 4D Wx Cube**

- **Data Collection**
  - Analysis
  - Forecasts
For DSTs to make the best possible recommendations they need information from several different sources — this information will be provided via one of the specified Common Services:

- **Flight Information**
  - E.g., Crew Qualifications, Aircraft Equipage and Performance

- **Aeronautical Information**
  - E.g., Special Activity Airspace, Airport Status, and ARR/DEP rates

- **Surveillance Information**
  - E.g., ASDE-X, ADS-B, Radar
ATM-Weather Integration and Operational Decision Making

- Operational view as it relates to the weather integration process
- Area of interest: Gate-to-gate vs. a slice of airspace or time
- Different decisions require different weather information
- Benefits of translated weather as a common service:
  - Common information provided to all subscribers (SAS/COP)
  - User subscriptions to targeted weather minimizes data size
Example of Weather Information Flow for Translation

- Common service data such as historical traffic, airspace alerts, and runway configuration thresholds could be used to further refine airspace constraints and airport threshold events.
- Aeronautical and Flight Information are not currently considered in Translation (dashed purple lines).
Example of Weather Information Flow for ATM Systems

- Level 3 and above systems will need Surveillance, Aeronautical, and Flight information to determine impact
- Additional information (i.e., crew and aircraft capabilities, TMI, and surveillance data) will help define both impacts and solutions
Terminal Airspace Reconfiguration Example

ATCSCC Traffic Management Specialist Point of View

Example Decision

• Will convective activity be a factor in the terminal airspace around Airport X or Metroplex Y today?

Required Information (ATM-Weather Integration Level)

• 4-8 hour translated weather constraint forecast for convection in the terminal area with probability of occurrence (Level 2).
• Flight-by-flight impact calculations for the aircraft scheduled to operate into and out of the affected airport during the weather-impacted hours (Level 3).
• If demand and capacity are imbalanced; alternative airspace configurations to counteract the forecast convective weather constraint, and updated airport capacities associated with recommended TMIIs (Level 4).
Terminal Airspace Reconfiguration Example cont.

Surveillance Information
Aeronautical Information
Flight Information

SWIM

CSS-Wx

4D-Wx Cube

NWP
- Airspace Constraints
- Airport Thresholds

4-D Trajectory
- Airspace
- Surface

Air Traffic Impact
Capacity ▲ Demand

Terminal Airspace Configuration DST

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- Rwy Config
- Crew Quals
- Aircraft Equipage
- TMIs

Controller/Sector area of interest
Gate-to-Gate area of interest

Gate
Pushback/Taxi/Takeoff
Climb

Flow Planning/Flight Planning

Cruise

Descent/Final Approach
Landing

ATCSCC ATM Specialist

TRACON TMC

Menu

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Summary

• We must understand how weather integration fits within the larger context of NextGen Enterprise Architecture

• The Devil is in the details!
  – How will additional Common Service data elements be applied to Translation, Impact, and Decision Support?
  – Single Translation source for surface threshold events?
  – Should a Weather Conflict Detection Service be developed?
  – Should a Weather Conflict Resolution Service be developed?

• Discussion and exploration must continue

• Utilizing weather information to determine ATM impact and subsequent problem resolution is a process that must be shared by the weather and ATM communities
Questions?