Quantifying Aviation Weather Forecast Benefits in a Common Framework

Presented to: Friends of Aviation Weather Forum
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FAA’s Acquisition Management Process

The FAA’s Investment Planning and Analysis Office works closely with the program offices to ensure a defensible business case moves forward.

**METRICS** are identified, developed, and transformed into **benefits**. A large number of acquisition programs go through the investment analysis process, e.g., weather programs - ITWS, WARP and other programs such as CATMT, TMA/TBFM, ERAM, Data Comm and ADS-B.

**FAA LIFECYCLE MANAGEMENT PROCESS**

- **MISSION** Analysis
  - Service Gap Analysis
  - Concept & Requirements Definition

- **ANALYSIS**
  - Initial Investment Analysis
  - Final Investment Analysis

- **INVESTMENT**
  - Concept & Requirements Definition

- **SOLUTION IMPLEMENTATION**

**Disposal**

**Legend**
1. Concept & Requirements Definition Readiness Decision
2. Investment Analysis Readiness Decision
3. Initial Investment Decision
4. Final Investment Decision
5. In-Service Decision

Corporate Planning
Research for Service Analysis
Service-Level Analysis

New Service Needs
Metrics – Conversion to Benefits

• Several NAS Programs claim user benefits (delay savings, flight efficiency) from enhanced capabilities
  – Many of these programs acquire benefits from weather forecasts either directly or indirectly (as enablers)

• Quantified benefit estimates are required for all major investment decisions during phase 2, 3 or 4 of the FAA’s Lifecycle Management Process
  – User benefits
    • Might have a case for reduced cancellations and diversions, fuel savings and safety improvements
    • The following metrics are converted into TIME SAVINGS
      – Distance savings
      – More efficient capacity utilization, recovery of the runway
      – Increased throughput (en-route and terminal)
      – More uniform flow separations
    • From TIME SAVINGS the benefits are monetized and projected over the life cycle
# Claimed Benefits (Weather Programs)

<table>
<thead>
<tr>
<th>Program</th>
<th>Forecast Mechanism</th>
<th>Identified Benefit Categories</th>
<th>Primary Metrics/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather Radar Processor (WARP)</td>
<td>Updated mosaics from NexRADS to en-route controller displays</td>
<td>1) Navigating through holes, 2) deviating further upstream, 3) avoiding storm cells behind a front in en-route airspace</td>
<td>Delay savings (en-route weather-related delay)</td>
</tr>
<tr>
<td>Corridor Integrated Weather System (CIWS) – prototype</td>
<td>ARTCC based tool 0-2 hr forecast tops, includes winter weather</td>
<td>1) Keeping routes open, 2) proactive rerouting</td>
<td>Delay savings (airborne and ground)</td>
</tr>
<tr>
<td>Integrated Terminal Weather System (ITWS)</td>
<td>0-1 hour forecast using integrated data from FAA and NWS sensors for terminal and TRACON airspace</td>
<td>1) Arrival transition areas, 2) departure transition areas and 3) runways (better capacity utilization)</td>
<td>Delay savings (airborne and ground)</td>
</tr>
<tr>
<td>NextGEN Weather Processor (NWP) CoSPA – prototype</td>
<td>Longer term forecast – 2 to 8 hours</td>
<td>1) Airspace Flow Program (AFP) execution management, 2) enhanced playbook reroute planning and execution and 3) enhanced reroute planning</td>
<td>Delay savings (airborne and ground) and distance reduction</td>
</tr>
<tr>
<td>Terminal Doppler Weather Radar (TDWR)</td>
<td>Aviation weather products: precipitation, microburst, gust fronts, and related hazardous wind shear thru better detection</td>
<td>increased aviation safety</td>
<td>Reduced accidents, fatalities and hull damage</td>
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## Claimed Benefits
(Sample of Decision Support Tools (DSTs) that Use Forecasted Weather)

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<td>Route Availability Planning Tool (RAPT)</td>
<td>Integration of CIWS forecasts for decision making into the departure route status timeline</td>
<td>Better departure route management, improved route impact planning</td>
<td>Delay savings (ground)</td>
</tr>
<tr>
<td>Traffic Flow Management System (TFMS)</td>
<td>Integration of CIWS products on the traffic situational display (TSD)</td>
<td>Keeping routes open more efficiently, proactive rerouting</td>
<td>Delay savings (airborne and ground)</td>
</tr>
<tr>
<td>Collaborative Airspace Constraint Resolution (CACR) (under development)</td>
<td>proposes effective, efficient, and integrated resolutions to airspace congestion problems. Actions are based on forecast weather</td>
<td>More efficient routing</td>
<td>Delay savings (airborne and ground)</td>
</tr>
</tbody>
</table>
How it Should Work?

Legacy Weather Programs

- Methodology 1: ITWS BENEFITS
- Methodology 2: WARP BENEFITS

DSTs that Use Weather Forecasts

- Methodology 3: TFMS BENEFITS
- Methodology 4: User Request Evaluation Tool (URET) BENEFITS

NextGen Weather Programs

- Methodology 5: NextGen Weather Processor (NWP) BENEFITS
- Methodology 6: NextGEN Forecasting – Icing BENEFITS
- Methodology 7: NextGEN Forecasting - Ceiling & Visibility BENEFITS

Consolidated Benefits of Weather Forecasting Capability
Portfolio Perspective
What is Needed?

WEATHER
- METARs
- TAFS
- SIGMETS
- CCFP
- COSPA
- TURBULENCE (G2G)

DATA

OPERATIONAL
- ETMS
- ASPM
- ASQP
- OPSNET
- TAF
- NTML
- OAG
- PDARS/National Offload

MODELS and TOOLS

Establish relationship between weather and weather impact
Conduct sensitivity analysis, i.e., more traffic, different regional/local weather areas, different forecasts
Challenges of Measuring and Articulating the Benefits of a Better Weather Forecast

Isolating an Enhanced Capability

• Are there positive signals in the data analysis?

• Are there any metrics that are being used for tracking operational performance since implementation?

• What is the analytical framework for capturing operational impacts of advanced forecasting, e.g., turbulence, icing and echo top forecasts?

• What is the feedback loop between capturing results from modeling and data analysis?

• How do we establish “similar days” for pre-post analysis?
Challenges of Measuring and Articulating the Benefits of a Better Weather Forecast (Cont.)

Portfolio Perspective

• Allocation between programs and NextGen operational improvements
  – How do we isolate added value to one acquisition when multiple tools working collectively might be impacting an air traffic decision?

• What is the value of weather integration into DSTs, e.g., value of CIWS into the TFMS or Traffic Management Advisors (TMAs)
What Should We Be Doing?

• Develop a multi-year baseline of the operational performance of a sample of Origin-Destination (O-D) pairs in various weather conditions
  – Winter precipitation, IMC, convective weather (terminal, TRACON, en-route), terminal winds, etc.
• Understand the current state of the environment, e.g., x # of TMI s occurred in this airspace because of ____
• Integrate relevant databases and data sets into an FAA-owned relational database/warehouse that can address the “contribution of the forecast” questions
• Use post-analysis modeling tools to identify opportunities to measure events
• Take advantage of current Weather Impact Traffic Index (WITI) and WITI-Forecast Accuracy (WITI-FA) Toolset
• Continue metrics development work (e.g., similar days and TRACON WITI) with the Aviation Weather Group