Quantifying Aviation Weather Forecast Benefits in a Common Framework

Presented to: Friends of Aviation Weather Forum
By: Dan Citrenbaum, FAA, Investment Planning and Analysis Office, Operations Research Group
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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.
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>
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<tr>
<td>Corridor Integrated Weather System (CIWS)</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>
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<tr>
<td>– prototype</td>
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<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>
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<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?

Consolidated Benefits of Weather Forecasting Capability

Portfolio Perspective

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

Quantifying Aviation Weather Forecast Benefits in a Common Framework
What is Needed?

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

**DATA**
- MODELS and TOOLS
  - Establish relationship between weather and weather impact
  - Conduct sensitivity analysis, i.e., more traffic, different regional/local weather areas, different forecasts

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