Weather-Aware Post Event Analysis

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Consider This…. 

- In the absence of irregular operations, the **NAS performs pretty well**

- It is **during irregular operations** when NAS goes “nonlinear”….impacts soar and both inefficiencies and opportunities abound….

- By far, most significant cause of irregular operations is **adverse aviation weather**

- Despite continued and heightened use and development of NAS post-event metrics, **dedicated, weather-aware post event analysis of weather-induced irregular operations continues to be challenging and relatively elusive**
NAS Operation – Weather Post Event Analysis

Some Key Challenges and Needs

• Post-analysis of NAS operation given adverse weather constraints and impacts has historically included little to no explicit weather-aware data / analysis

• Standard, objective measures of impact / performance used for post weather-event NAS analysis have not been readily available *(subjective, anecdotal, non-repeatable……all bad)*

• Convective WX Impact events (and associated impacts, plans, and outcomes) can come in 100’s of varieties…..
  – It’s misleading and incomplete to analyze NAS weather impact events (TMI usage, delays, airborne holding) when comparing against all NAS days or all NAS weather events
  – Most informative post-event analysis must be conducted for similar weather events

• Post-analysis of weather impact events focuses on “what happened” but often stops short of analyzing “how would alternative approach change things”
  – Lack of robust weather, forecast, and TMI-aware “what-if” simulator tools that support these types of analyses
Weather-Aware Post Event Analysis
A Way Forward....

Targeted, Well-focused Assessment of Performance, Needs, Challenges, and Best Practices

This Was My Operational Day
Weather-Aware Post Event Analysis Summary Concept

Core Components

Build context around weather day of interest
(More than just the Weather)

Historical Review/Recap of WX Impact Event

“Control” Analysis for Similar Historical Events

Similar Event Analysis and Operational Evaluation

Assess / Demonstrate Value of Alternative ATM Strategies & Outcomes

“What-If” Simulation Modeling

Identification of Similar Event

Distribution of National Plans/WX Forecasts

Comparative Analysis of Operational Outcomes

User specified output, data, and distributable information

Iterative Process

Output
Weather Post-Analysis Enabling Capabilities

Similar Weather Event #1
29 May 2012 – 2100Z

Similar Weather Event #2
12 Sep 2013 – 2100Z
Weather Post-Analysis Enabling Capabilities

Dynamic Airspace Routing Tool (DART) ©

- **Weather-Aware Superfast-time NAS Simulator**
  - Model 50,000 flights for day-in-the-NAS in 2 min
- **Ingests detailed air traffic, weather data:**
  - Full ETMS flight plans
  - Terminal (METAR), en route convective weather (NCWD, CIWS VIL, Echo Tops)
  - Convective weather forecasts (LAMP 2-6 hour, CIWS, CoSPA)
- **Model or enforce key Traffic Management Initiatives (TMI); “hybrid” modeling**
- **Computes weather-degraded airport and en route (sector) capacity (using NASA-based airspace permeability model)**
- **“Step-out-and-scan” rerouting rechecks for developing reroutes**
- **Flight, airway, airport, airspace resource-specific outputs for flight distance, delay, cancellations, diversions, etc.**

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Weather Event Post-Analysis and Benefits Quantification

• “Weather” Benefits Quantification is incredibly challenging
  – Improved forecast performance → Advanced operational ATM utility / innovation?
  – Leave “weather” in a hurry and move towards resource constraint management, ATM / ATC / AOC actions, and ops-specific outcome measures

• Benefits analyses start with proper scoping of shortfall / opportunity space
  – Informed by operational scenarios if properly controlled for pertinent constraint events

• Requires objective, repeatable, data-driven analysis for defendable benefits assessment

Routine, repeatable, objective, well-scoped (but agile) weather post-event analysis capability can be leveraged for significant WX-ATM benefits quantification advancements