Weather Forecast Guidance and Impact on NAS Management
August 3, 2016
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FAA
Air Traffic Organization
INTRODUCTION

NAS management is moving toward “Plan - Execute – Review – Train – Improve” (PERTI)

Successful NAS management depends on understanding the probability of weather following the forecast, as well as the ability to rapidly adapt when weather doesn’t follow the forecast

This briefing contrasts two similar weather days in the NAS, and the NAS management challenges associated with forecast differences

How can we be more efficient on days when forecast uncertainty is high and/or weather does not follow forecasts?

- Plan for weather following the forecast
- Tactical adjustments to Plan if weather doesn’t follow forecast
6-hour CCFP (issued at 13Z) - Valid for 19Z

Shown for two different days

– What traffic management initiatives would you expect to see for each day?
– GDP, AFP, GS, TRANSCON routes, CDRs?
NAS Management
**When Convective Weather Follows Forecast...**

- **Plan**
- **Monitor**
- **Communicate**
- **Execute**

**When Convective Weather Does Not Follow Forecast...**

- **Plan**
- **Communicate**
- **Execute**
- **Monitor**
- **Re-Communicate**
- **Re-Plan**

**Decreased system predictability**

**Decreased efficiency-Increased workload**

**Operation more reactive – “churn”**
Complexity of Decision Making
A number of convective forecasts exist for FAA to review and determine mitigation strategies

Collaborative Convective Forecast Product (CCFP)
- Target Time: 2-hour, 4-hour, 6-hour, and 8-hour forecasts
- Collaborative, human generated product in 2014; auto generated in 2015 and 2016
- Uses percent coverage and confidence thresholds to graphically represent areas of expected convective occurrence (pseudo-probabilistic forecast product)
Collaborative Storm Prediction for Aviation (CoSPA)

- Target Time: 0-8 hour forecasts
- Deterministic forecast of precipitation and echo tops by showing storm locations, growth/decay, motion and scale
Collaborative Aviation Weather Statement (CAWS)

- Target Time: Ideally 4-hour lead time to impact
- Experimental 2014; CAWS considered for strategic planning in 2015 and 2016
- Collaborative product identifying areas of convection that will result in an impact (and/or action to be taken) to FAA operations
Operational Challenges
7/18/15
OPERATIONAL CHALLENGES FOR SATURDAY 7/18/15

Morning convection in NE (ZNY, Northern ZDC, and Eastern ZOB) underforecast by CCFP

Broad area of low confidence, sparse coverage for NE in afternoon; by 21Z thunderstorms developed along PA/NY border however most ZNY and ZDC clear of convection
MORNING UNDERFORECAST AND RESULTING TMIS FOR 7/18/15

6-hour auto-CCFP and 6-hour HRRR Echo Tops valid 11Z

Indicates morning initiatives due to unexpected convective constraint

Morning underforecast impacted afternoon planning and actions
11Z FORECAST GUIDANCE (FOR 17Z) AND
OPS PLAN FOR 7/18/15

6-hour auto-CCFP and 6-hour HRRR Echo Tops valid 17Z

NCWD 17Z Observed Weather

Note LGA Runway Closure
13Z FORECAST GUIDANCE (FOR 19Z) AND OPS PLAN FOR 7/18/15

6-hour auto-CCFP and 6-hour HRRR Echo Tops valid 19Z

NCWD 19Z Observed Weather

AFPs inserted into plan after 17Z
6-hour auto-CCFP and 6-hour HRRR Echo Tops valid 21Z

NCWD 21Z Observed Weather

17-18Z DVL P6 TS FL370
18-19Z DVL P6 TS FL400
19-21Z TS FL400-450
15-18Z TS FL370

Programs valid 1800Z to 0159Z
Likely forecast guidance during this time period drove decision to issue AFPs
Lack of Significant Convection by 2200Z; AFPs cancelled over 3 hours early
WX-PAC SIMILAR EVENT REVIEW FOR 7/18/15

7/18/15 (Saturday)  8/5/14 (Tuesday)

Similar Weather Search parameters:

- ZNY-centric convective weather
- Primary focus on similar weather from 17Z-23Z period
- From output, we selected a similar weather day with more accurate forecast
 Fewer total operations for Core NY airports (EWR, JFK, LGA) on 7/18/15 vs. 8/5/14

<table>
<thead>
<tr>
<th>Date</th>
<th>Facility</th>
<th>Air Carrier</th>
<th>Air Taxi</th>
<th>General Aviation</th>
<th>Military</th>
<th>Total Operations</th>
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<tbody>
<tr>
<td>07/18/2015</td>
<td>EWR</td>
<td>756</td>
<td>275</td>
<td>19</td>
<td>0</td>
<td>1,050</td>
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<tr>
<td>07/18/2015</td>
<td>JFK</td>
<td>1,184</td>
<td>87</td>
<td>13</td>
<td>2</td>
<td>1,286</td>
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<tr>
<td>07/18/2015</td>
<td>LGA</td>
<td>563</td>
<td>64</td>
<td>4</td>
<td>0</td>
<td>631</td>
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<tr>
<td>Sub-Total for 07/18/2015</td>
<td></td>
<td>2,503</td>
<td>426</td>
<td>36</td>
<td>2</td>
<td>2,967</td>
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<tr>
<td>08/05/2014</td>
<td>EWR</td>
<td>888</td>
<td>389</td>
<td>36</td>
<td>8</td>
<td>1,321</td>
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<tr>
<td>08/05/2014</td>
<td>JFK</td>
<td>1,179</td>
<td>145</td>
<td>18</td>
<td>0</td>
<td>1,342</td>
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<tr>
<td>08/05/2014</td>
<td>LGA</td>
<td>1,009</td>
<td>167</td>
<td>22</td>
<td>0</td>
<td>1,198</td>
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<tr>
<td>Sub-Total for 08/05/2014</td>
<td></td>
<td>3,076</td>
<td>701</td>
<td>76</td>
<td>8</td>
<td>3,861</td>
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Percent Difference 7/18/15 vs. 8/5/14

- 19% Less
- 39% Less
- 53% Less
- 75% Less
- 23% Less
FORECAST GUIDANCE FOR 7/18/15 VERSUS 8/5/14

Weather was “similar” on both days; however, forecasts for 8/5/14 were significantly better

- Forecast for 8/5/14 shows focused area of high confidence, sparse coverage
- Forecast for 7/18/15 shows broad area of low confidence, sparse coverage
- 7/18/15 CAWS indicated high confidence of TS development between 17Z and 19Z attempting to add focus and value to CCFP

Note: CAWS considered for strategic planning in 2015; No experimental CAWS was issued for 8/5/2014
WX-PAC SIMILAR EVENT REVIEW FOR 7/18/15

TMI Issuance Comparison - Afternoon

7/18/15 (Saturday)

Multiple AFPs, GDPs, and GSs used on 7/18/15

8/5/14 (Tuesday)

Only a single LGA GS on 8/5/14
For official FAA use only. Not for public or media release. All data is preliminary and subject to change.
On 8/5/14 - a Tuesday with 30% more demand than 7/18/15 - the afternoon weather impact was managed with a single LGA ground stop

- Overall completion rates across NY terminals slightly better on 8/5/14
- Overall cancellation / diversions / go-arounds comparable day over day
- Airborne holding for JFK slightly lower on 8/5/14 during afternoon hours
- Less gate arrival and departure delay on 8/5/14 for EWR, JFK during afternoon hours
SUMMARY / DISCUSSION

- Preceding analysis was a snapshot of two days in the NAS
- Contrast NAS management strategies when weather doesn’t follow forecast
- Similar Weather Search was used to identify similar convective events with very different NAS management strategies
- Would probabilistic weather forecasts improve planning and execution of NAS strategies?
- Illustrates NAS management challenges and impacts on outcomes
- How do we incorporate this kind of analysis in daily NAS planning?
- This is an important consideration as we implement PERTI
Building upon Similar Weather search:

- Develop a capability to identify similar forecasts from historical weather data
- Identify subset of days where the forecast supported effective NAS management planning
- Consider actions from these days to inform planning
- Also identify days where the weather did not follow the forecast; analyze tactical adjustments made and compare against NAS performance metrics
Our ability to expand the NAS Planning window depends upon the inclusion of data driven analysis:

- Similar weather and similar forecast search
- Probabilistic forecast information
- Statistics of objective forecast verification
- Historical NAS performance outcomes
SUMMARY / DISCUSSION (CONCLUDED)

**Future analytic capabilities needed:**

- Similar forecast search methodology
- Better definitions of “good” vs. “poor” NAS performance
- Methodology for application of probabilistic forecast information into plans and contingencies
- Ability to execute against “80% forecast”, contingency planning for remaining “20%”
Closing the NAS Management Feedback Loop:

- Collaboration with stakeholders
- Data that drives decision making and collaboration on resulting plans
- Capture of information for post-operations analysis
- Incorporation into training, leading to improved NAS performance
Questions/Closing
### CUSTOMER COMMENTS FROM 7/18/15

<table>
<thead>
<tr>
<th>USA</th>
<th>17:44</th>
<th>Overall we thought the Northeast operation went well in difficult conditions. We did get help with problem flights when requested. Thank you. One specific flight had a problem that should be able to be avoided. AAL159 GPH-CUN was filed per RTA in ADZY (50). After gate departure that flight was given a 28RIMN reroute. I tried to coordinate a shortcut after the flight was airborne with ZAH but was denied due to volume. I would think it’s possible to see a volume issue in advance and have earlier coordination for an alternative. Fortunately we were able to absorb that reroute but that’s not always the case when trying to operate flights in good wx conditions in an economical matter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAL</td>
<td>20:16</td>
<td>The early morning snap event seemed as though it could have been run much more efficiently then it was. The weather did not appear to be that bad as we have seen much better airspace usage with even worse conditions. The fact that we had to gate return multiple flights for duty issues and had to cancel a few as a result seemed unnecessary and avoidable for the departure flow seen more efficiently conducted. We also saw this event as a non AFP day and voiced our concerns on the 07:15 SPO and we felt that this was more of a structured routings kind of day especially since it was Saturday behind.</td>
</tr>
<tr>
<td>USA</td>
<td>01:34</td>
<td>It was a very difficult day, especially in CLT. We had multiple diversions including AAL 787 CDG-CLT which diverted to GSO. Communication and coordination with ATC/UC, CLT ATCT and ZTL was excellent. We came out of the CLT GS with pending rather than a GSP. While CLT could land at a consistent rate, we could not move departures as fast as CLT could land them. A ground stop was issued in the 2000 hour to prevent gridlock. The facilities were great with handling special requests such international recovery, crew duty issues and EDC requests. Thank you to the TCA for coordinating those requests.</td>
</tr>
<tr>
<td>AAL</td>
<td>01:58</td>
<td>Very busy evening in the NAS. Thought ZAH, TRACON and TOWER did an excellent job in managing a very challenging evening. SCT was very helpful coordinating our EVSU recovery for LAX.</td>
</tr>
<tr>
<td>DAL</td>
<td>03:20</td>
<td>Plenty of weather related issues, as is typical in July. Agree with other comments that the APPS and SOPs in support were overly cautious. Very pleased with ATL weather IMPACT/OUTCOME. ATL/AIR/2TL deliver the goods for us. Thanks for the GP package to SCC also.</td>
</tr>
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