Traffic Flow Management (TFM): Dealing with the Impact of Weather Through Collaborative Decision Making (CDM)

An Overview of the CDM Weather Evaluation Team (WET)’s Ongoing Activities

Kevin Johnston • FAA System Operations
Tom Lloyd • JetBlue Airways

Presented to: AMS
New Orleans, LA
January 25, 2012
Agenda

- TFM and CDM
- CDM WET Overview
- WET Task & Activity Updates
  - Approach Area Winds
  - Common Winter Weather Forecast
  - Improvements to Convective Weather Forecasts for TFM
    - ECFP
    - CCFP Evolution
    - Operational Bridging
TFM and CDM

- TFM is a function of Air Traffic Control (ATC) but it is distinct in that its goal is to control flows of traffic in the National Airspace System (NAS) rather than control specific flights.

- TFM employs a system approach through CDM with NAS stakeholders, where consensus building is the goal in determining the best approach to a given situation. Stakeholders include ATC facilities, airlines, business and general aviation.
TFM and CDM

- Air Traffic Control (ATC)
- **TFM** controls flows of traffic in the National Airspace System (NAS)
- System Approach: **CDM**
  - Consensus building
    - ATC facilities
    - Airlines
    - Business/General Aviation
TFM and CDM

- In managing traffic flows, specialists are trained to use a number of tools and techniques referred to as traffic management initiatives (TMIs), in order to minimize delay, maximize efficiency and provide for a smooth flow of the thousands of flights over the U.S. at any given time.

- The primary reason for implementing TMIs is the impact weather has on the NAS. Seventy percent of the delays in the national airspace system are attributed to weather.
Traffic Management Initiatives (TMI)

- Minimize delay
- Maximize efficiency
- Smooth traffic flow

Weather is by far the primary TMI driver

Source: Bureau of Transportation Statistics
CDM WET Overview

**Sub-team of CDM**
- Joint initiative between FAA and NAS Stakeholders
- Solve problems in the NAS through sharing of information
- Tasks assigned by CDM Stakeholders Group (CSG)

**Membership & Participation**
- FAA
- Stakeholders (Airlines, NBAA)
- NOAA
- Contractors
WET Task: Approach Area Winds

- Vertical wind forecast; common presentation
  - Problem: Compression on final
  - Initial focus: NYC metro area
  - ✔️ Common presentation
  - Work continues: “translation” of winds to **compression**
    - Path-Based Shear with forecast winds
    - Adapted “calculators”
NEW YORK TRACON
WIND SPEED OUTLOOK
PSBL CONSTRAINT: COMPRESSION
ISSUED: 0100Z APRIL 12, 2011
BY: CWSU - NEW YORK

DISCUSSION:
SURFACE WIND: S-SW FLOW 8-13KT.
PEAK WINDS ALOFT: MAX WINDS 50-55KT FM SW AROUND 04Z BTN 2000-4000FT THEN DECREASING BY 07Z. THEN MAX WINDS 35-40KT ABV 5000FT.

GREATEST WIND SPEED BETWEEN SFC - 7000 FEET
(A RED, YELLOW, GREEN DESIGNATION DOES NOT NECESSARILY MEAN A WIND COMPRESSION EVENT WILL NOT OCCUR)

<30KT
30-50KT
>50KT
WET Task: Common Winter Weather Forecast

- Collaborated forecast up through Day 2+
  - Problems:
    - Conflicting forecasts
    - Situational awareness
  - Requirements:
    - Non-resource-intensive/automated
    - Simplicity
    - Winter 2011-12
WET Task: Common Winter Weather Forecast

Automated: Short-Range Ensemble Forecast
- Similar to Winter Weather Guidance (HPC)

Scope
- “Core 29” terminals – FAA Core 30 except HNL
- Timeline: 0-72 (87) hours, 3 hour increments

<table>
<thead>
<tr>
<th>Operational Requirement</th>
<th>SREF Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snow Intensity/Rate/Accumulation</td>
<td>Snowfall per 3 hours¹</td>
</tr>
<tr>
<td>Freezing Rain intensity</td>
<td>Freezing Rain accumulation per 3 hrs</td>
</tr>
<tr>
<td>Visibility and Blowing Snow</td>
<td>Visibility (if $T_{sfc} \leq 28^\circ F$)²</td>
</tr>
</tbody>
</table>

¹ Includes Ice Pellet accumulation
² Visibility if $T_{sfc} \leq 28^\circ F$ at forecast hour
## Airports Grouped by Relative Winter Impact (Average Annual Snowfall)

<table>
<thead>
<tr>
<th>Group I 30”+</th>
<th>Group II 15-30”</th>
<th>Group III 0.1-15”</th>
<th>Group IV Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEN (60”)</td>
<td>EWR (28”)</td>
<td>SEA (11”)</td>
<td>FLL/MIA (T)</td>
</tr>
<tr>
<td>SLC (59”)</td>
<td>LGA (26”)</td>
<td>CLT (6”)</td>
<td>LAX (T)</td>
</tr>
<tr>
<td>MSP (50&quot;)</td>
<td>JFK (23&quot;)</td>
<td>MEM (5&quot;)</td>
<td>MCO (T)</td>
</tr>
<tr>
<td>BOS (42&quot;)</td>
<td>IAD (22&quot;)</td>
<td>DFW (3&quot;)</td>
<td>PHX (T)</td>
</tr>
<tr>
<td>DTW (41&quot;)</td>
<td>BWI (21&quot;)</td>
<td>ATL (2&quot;)</td>
<td>SAN (T)</td>
</tr>
<tr>
<td>MDW (39&quot;)</td>
<td>PHL (21&quot;)</td>
<td>LAS (1&quot;)</td>
<td>SFO (T)</td>
</tr>
<tr>
<td>ORD (39&quot;)</td>
<td>DCA (17&quot;)</td>
<td>IAH (½”)</td>
<td>TPA (T)</td>
</tr>
</tbody>
</table>
## Forecast Conditions x Airport Group = Potential Impact

<table>
<thead>
<tr>
<th>3h Forecast&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Group I (Cold Weather Cities)</th>
<th>Group II (NYC – PHL – DC)</th>
<th>Group III (Warm Weather Cities)</th>
<th>Group IV (Southern Tier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN</td>
<td>ZR</td>
<td>Vis&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8”</td>
<td>.1”</td>
<td>&lt;½</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4”</td>
<td>.05”</td>
<td>½</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>.01”</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.1”</td>
<td>--</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trace SN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Precip /VMC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> SREF Probability ≥ 30%

<sup>2</sup> Visibility if $T_{sfc} \leq 28^\circ F$ at forecast hour
Aviation Winter Weather Dashboard

Output
- Web based, public-facing, updated 4 times daily (on SREF cycle)
- Tabular, color coded display by airport and time interval
- Drives SPT agenda and airport-specific discussions

Next Steps
- “Plug In” to formal extended planning process (work underway)
- Content and interface enhancements

Diversion and Tarmac Delay Applications
### Aviation Winter Weather Dashboard

|      | 17/18 | 17/21 | 18/00 | 18/03 | 18/06 | 18/09 | 18/12 | 18/15 | 18/18 | 18/21 | 19/00 | 19/03 | 19/06 | 19/09 | 19/12 | 19/15 | 19/18 | 19/21 | 20/00 | 20/03 | 20/06 | 20/09 | 20/12 | 20/15 | 20/18 | 20/21 | 21/00 | 21/03 | 21/06 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| DEN  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| SLC  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MSP  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| BOS  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| DTW  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| NDIW |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ORG  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| EWR  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| LGA  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| JFK  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| IAD  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| BWI  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| PHL  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| DCA  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| SEA  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| CLT  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ALEA |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| DFW  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ATL  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| LAS  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| IAH  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MIA  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| FLL  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| LAX  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ANC  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| PHX  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| SAN  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| SFO  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| TPA  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

Last update: 2012-01-17 20:14 UTC
Approximate next update time: 2012-01-18 12:00 UTC

Group 1 High Criteria:
SN: 8.0+”
FZRA: .10+”
VSBY: < .5SM
Aviation Winter Weather Dashboard (AWWD)

- **Intent:** drive SPT agenda, airport-specific discussions
- **Next Steps**
  - “Plug In” to an extended planning process (work underway)
  - Content and interface enhancements
  - Support for diversion management / tarmac-delay applications
- **Gaps**
  - Better accounting for high-operator-impact Ice Pellet events
  - Improved integration with near-term forecasts
WET Tasks: Improvements to Convective Weather Forecasts for TFM

ECFP • CCFP Evolution & Operational Bridging
Experimental Extended Convective Forecast Product (ECFP)
Collaborative Convective Forecast Product (CCFP)

- **Current**
  - Issued every 2 hours
  - 2-4-6 hour intervals
  - Hand-drawn
  - Criteria-driven

- **Evolved**
  - Event- and impact-driven
  - More robust communication
  - Leverage automation & multiple forecast sources
  - Adjust role of human met.
Operational Bridging, Convective Weather Forecasts and ATM Decision Making

- TFM
- Probabilistic (provider and user)
- ATMITL
- Near Deterministic
- ATC

Might or might not Low to medium confidence

Operational Bridging MITL

CCFP

CIWS

LCH

CoSPA

Strategic Decision Making

Tactical Decision Making

3+ hours ~4 hours ~2 hours ~20 minutes

Image: Mitre
Operational Bridging: What Is It?

- Human Over The Loop (HOTL) of automated forecasts
  - Meteorologist well versed in NAS components & processes
  - Reconciles multiple forecast sources and types
  - “Tunes” forecast to traffic impact

- Product: Aviation Weather Statement (AWS)
  - Modeled on SPC’s Mesoscale Discussion
  - Event driven, generally 2-4 hours prior to forecast impact

- Continuous collaboration with traffic managers
DISCUSSION...RECENT VIS SAT IMAGERY REVEALS DEVELOPING CU FIELD OVER E PA EXPECTED TO DVLP INTO ISOL CLUSTERS OF CONVECTIVE CELLS BY 19Z AND CONT E ACROSS N NJ BY 21Z AFFECTING N90 AND NY METRO BETWEEN 22-00Z. COSPA IN GOOD AGREEMENT WITH CELL MVMT AND CVRG CRITERIA (25%). ACTIVITY EXPECTED TO WEAKEN AND GRADUALLY DISSIPATE AFTER 23Z AS TSTMS MOVE E OVER LI AND ADJ WATERS. MAX TOPS TO FL350, MEAN STORM MOTION VECTOR 26035.
Q3: Indicate the change in the level of your understanding of the IMPACT of the forecast convective situation(s) after receiving the Operational Bridging briefing.

Q6: Please indicate which if any of the following outcomes may be attributable to Operational Bridging.
Operational Bridging: Demo & Deployment

- Live operational demonstration: Convective Season 2012
  - Scope: limited days/hours
  - Graduated implementation – full public demo by midsummer

- 2013: Live in the NAS
  - Refocus of CCFP resources, automate and “shift right” to 4-6-8 hours with CIWS on TSD
Links

- WET: [http://flycdm.org/Workgroups/weather_eval.html](http://flycdm.org/Workgroups/weather_eval.html)
- Operational Bridging AWS: stay tuned