Federal Aviation Administration

# Aviation Weather Research Transition Update

Presented to: **FPAW Meeting**

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# Overview

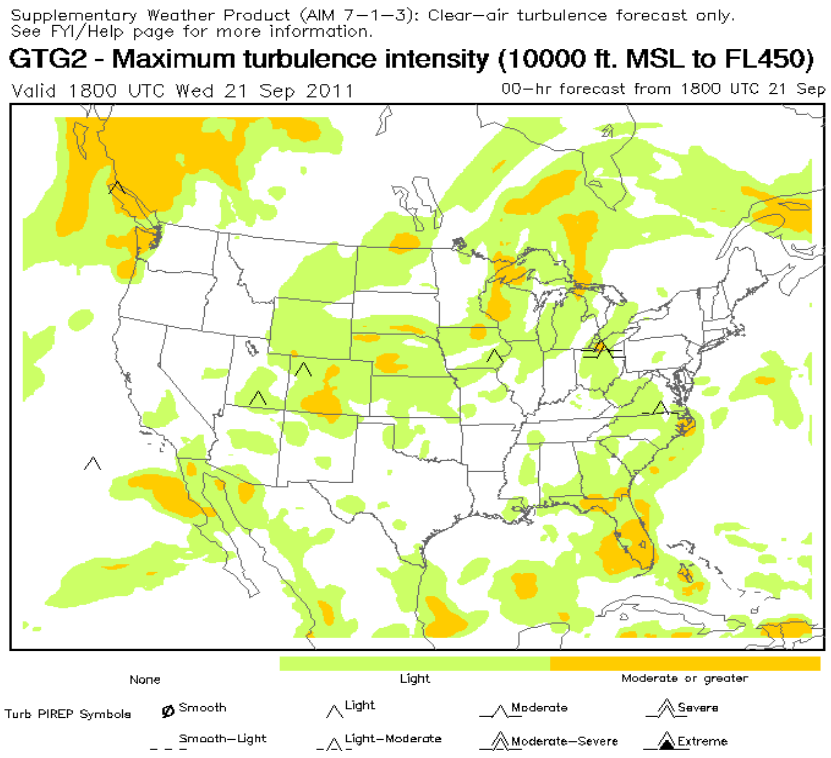
- **AWRP-funded new weather capabilities transitioned to NWS for production and dissemination to NAS users:**
  - Turbulence (GTG)
  - In-flight Icing (CIP/FIP)
  - Ceiling & Visibility (CVA)
    - Helicopter Emergency Management System (HEMS)

- **Other AWRP-funded initiatives:**
  - CoSPA
  - Liquid Water Equivalent (LWE)
  - High Ice Water Content (HIWC)
  - Model Development & Enhancement (MDE)
  - Right-sizing: Flexible Terminal Sensor Network (FTSN)

- **Weather integration**

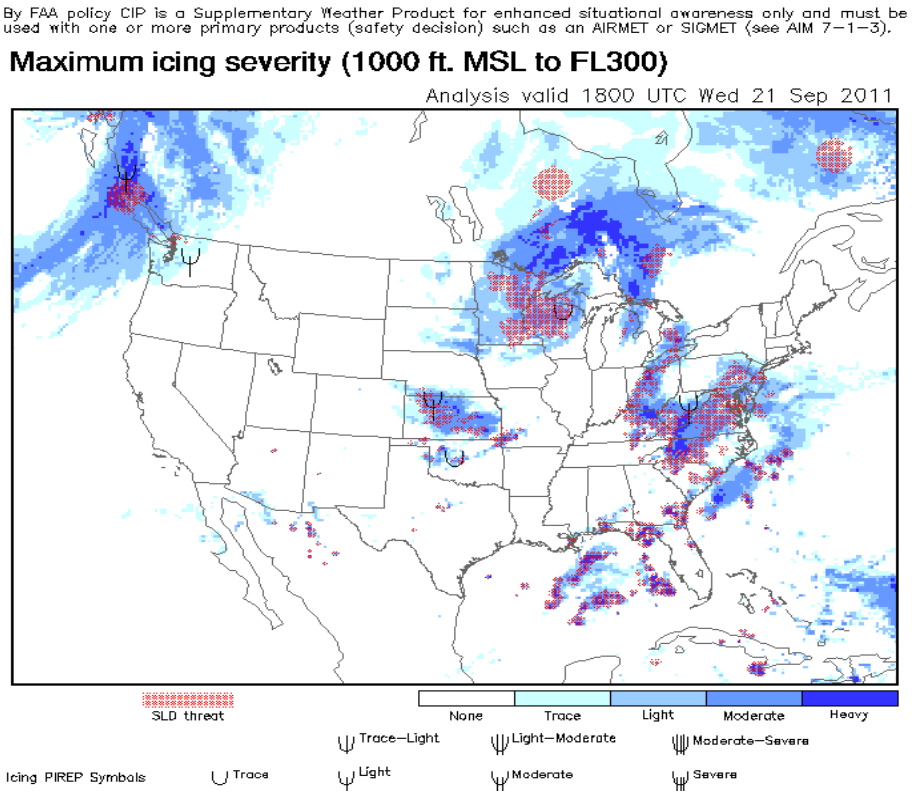
# Graphical Turbulence Guidance (GTG)

- **GTG 2.0 on ADDS**
  - CONUS+ domain; 10,000 MSL to FL450
  - Hourly forecast increment out to 12 hours
  - Based on RUC; exploits aircraft EDR data
- **GTG 2.5 coming soon**
  - Represents an algorithm update to accommodate WRF-RR
  - Release tied to WRF-RR implementation
  - No change in product appearance or functionality from GTG 2.0
- **GTG 3.0 release in FY13**
  - Expanded domain to SFC
  - Includes mountain wave turbulence
  - Exploits expanded aircraft EDR network



# Current/Forecast Icing Product (CIP/FIP)

- **CIP/FIP–Severity on ADDS**
  - Includes current and forecast icing probability and severity
- **CIP/FIPS-RR (Rapid Refresh)**
  - Algorithm update to accommodate WRF-RR
  - Transition to operational ADDS expected 2FY12
- **FY13+**
  - CIP/FIP-Alaska
  - CIP/FIP-IOC

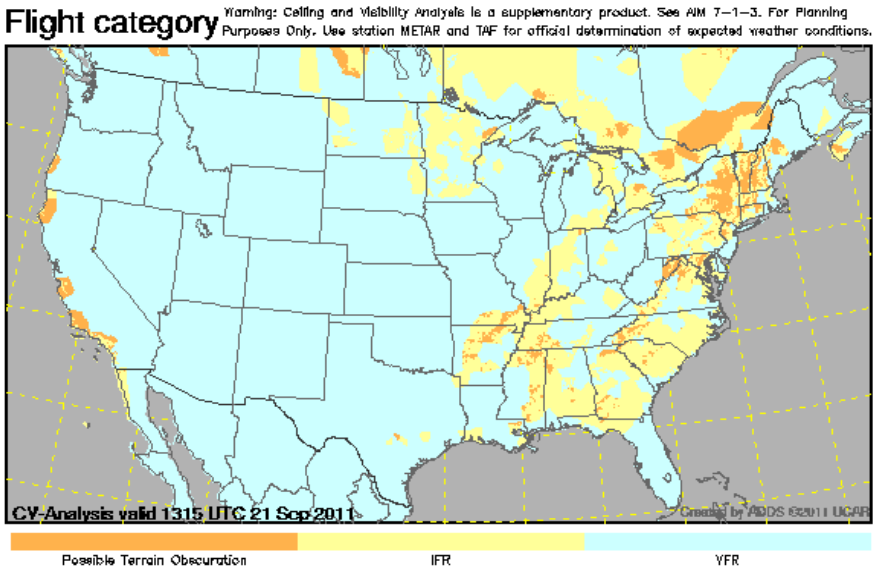


# Ceiling & Visibility (CV)

- **CV Analysis (CVA) completed**
  - Released to AWC in August 2011
  - On ADDS by mid-2012

- **CV Forecast (CVF)**
  - Partnering with NWS to integrate CVF into existing automated C&V guidance on AWIPS (LAMP)
  - Longer-term…NWS-produced national CVA and CVF grids in the 4D Cube for access by NAS users, DSTs, etc.

- **Helicopter Emergency Management System (HEMS)**
  - Currently uses CVA; disseminated on experimental ADDS
  - Working with AFS-250 to plan migration of HEMS to CVA/F grids via the 4D Cube when available



# Additional Research Initiatives

- **Liquid Water Equivalent (LWE)**
  - **FY11**: Final report on LWE research including assessment of system performance for SN, FZRA, FZDZ, IP, and frost completed as well as system description and software package
  - **FY12/13**: LWE integrated into Terminal Area Icing Weather Information System (TAIWIS)
    - Freezing rain and freezing drizzle rates
    - Improved supercooled large drops data in the terminal area for new aircraft certified after the new SLD rule
    - Liquid water equivalency for falling and/or accumulating winter precip

# Additional Research Initiatives

- **High Ice Water Content (HIWC)**
  - More than 100 engine events, including stall, flameout, engine damage in HIWC environments
  - Field campaign – Darwin, Australia – to gather data needed for accurate laboratory simulation of HIWC conditions and evaluation of proposed regulatory envelope(s)
    - Trial campaign – Feb-Mar 2012
    - Full campaign – Jan-Mar 2013

- **Initial nowcast & forecast algorithms also ready for field trials**

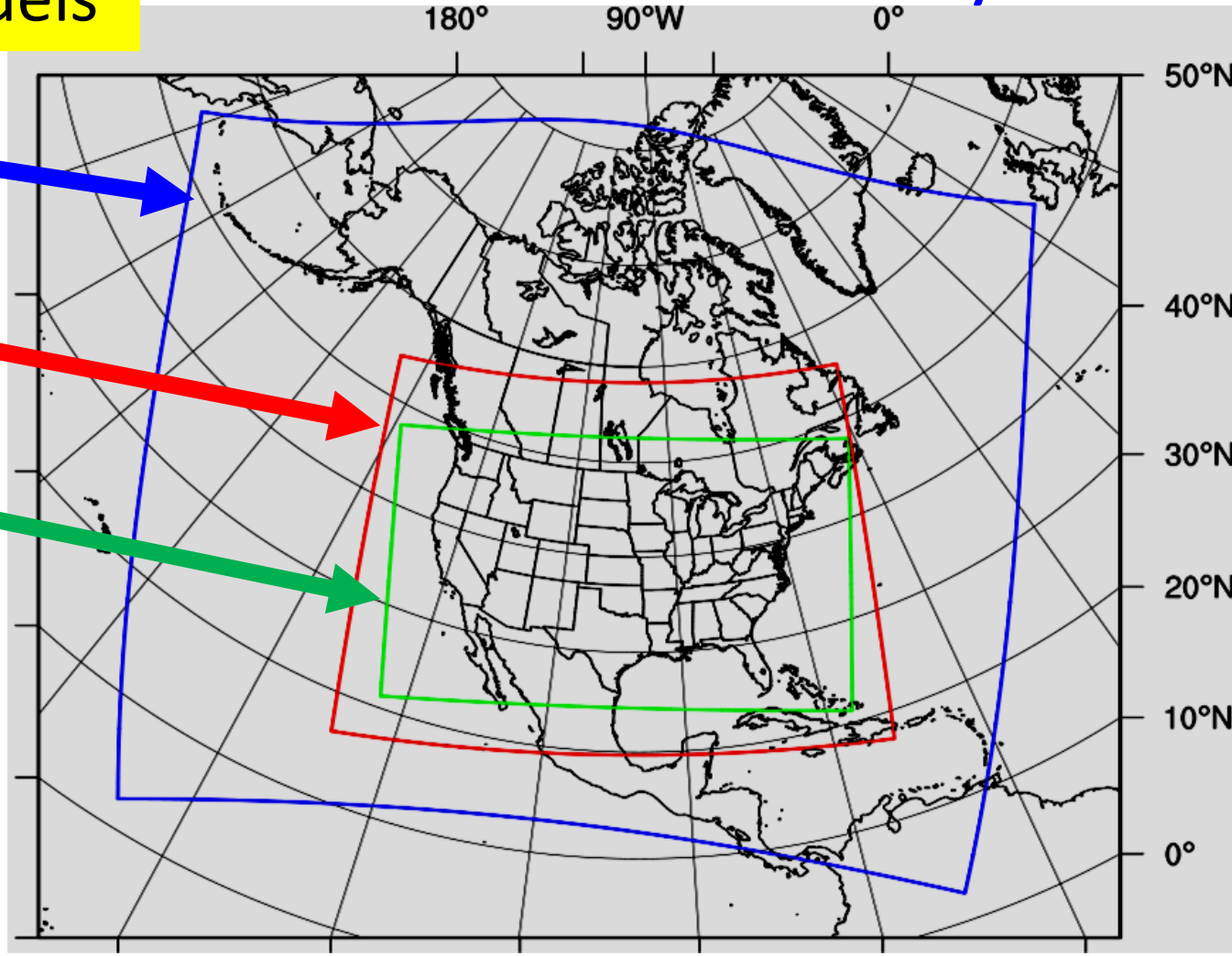
# Hourly Updated NOAA NWP Models

## Rapid Refresh (RR) replaces RUC at NCEP in 2012 – 18h fcst every hour

**13km Rapid Refresh**

**13km RUC**

**3km HRRR**




**RUC – current ops model, 18h fcst every hour**

**High-Resolution Rapid Refresh Experimental 3km nest inside RUC or RR, 15-h fcst every hour, *central to 2-8h CoSPA***

# MDE in 2011

## WRF-RR

- **Development complete; in queue for implementation**
  - Rotated lat-lon coordinates cover Alaska
  - Improved treatment of ice/snow
  - Improved microphysics
  - Enhanced GSI Analysis
    - Improved cloud analysis
    - Use of new/expanded observations (TAMDAR, etc.)
    - Better use of surface obs
    - Use of satellite radiance data

## HRRR

- **Real-time & retrospective testing on shadow system**
  - Use of RR as parent model
  - Reduced latency to 2 HRs
  - Improved microphysics
  - Optimization of time-step selection wrt convective and mountain wave instabilities

# MDE Plans for 2012

- **WRF-RR: *Implement* and continue to improve**
- **HRRR: Develop, test and improve**
- **Improve physics in WRF-RR, HRRR and NAM for aviation parameters (icing, turbulence)**
- **Develop, test & implement improvements to the operational GSI 3DVAR for RR NAM runs**
- **Commence development of NARRE (6 members at 13km)**

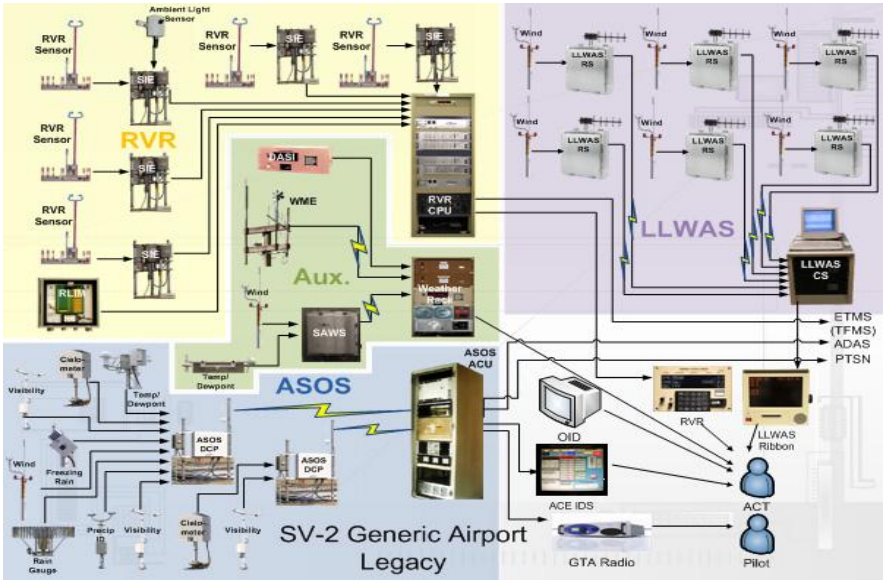
# Rightsizing the Sensor Network

## Flexible Terminal Sensor Network (FTSN)

### Current Sensor Network

- Stove-pipe configurations
- Limited data access
- Expensive to maintain
- Limited communications
- Aging/Obsolete
- Difficult to expand

Over sampling visibility at PHL




Generic terminal – ASOS, RVR, LLWAS


Aging equipment at PHL

# Rightsizing the Sensor Network

## Flexible Terminal Sensor Network (FTSN)

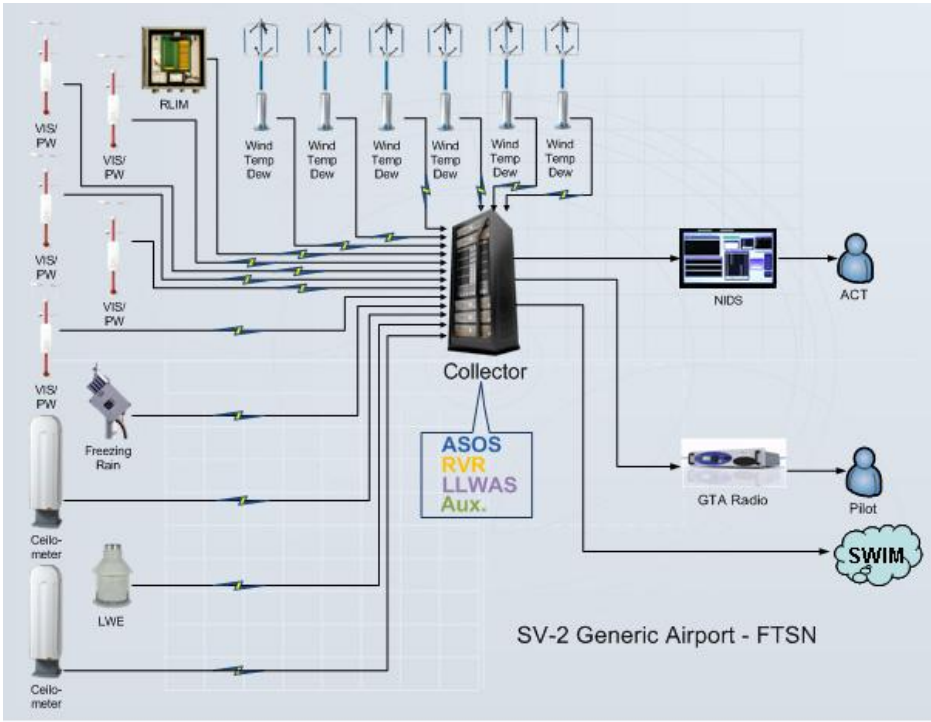
- Built with standard processors and operating system
- Drastically reduced acquisition and maintenance costs
- Improves representativeness of critical measurements
- Improved sensor access via 4D cube
- Increases critical reliability and availability
- Open architecture
- Expandable to meet unique needs

## Deliverables

- **FY11**
- Initial FTSN Design Document
- Market Survey of Industry Capabilities

- **FY12**
- Demonstration of the FTSN Collector
- Terminal Site Survey Process

- **FY13**
- Demonstration of FTSN Prototype

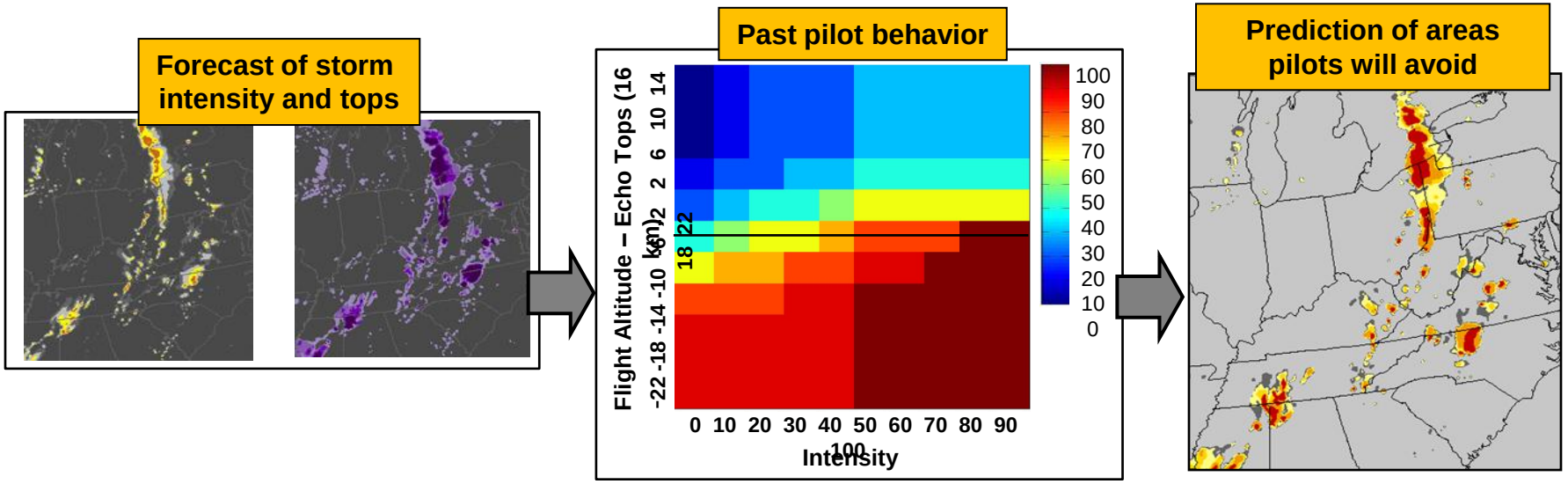



**FTSN Configuration**

# ATM-Weather Integration

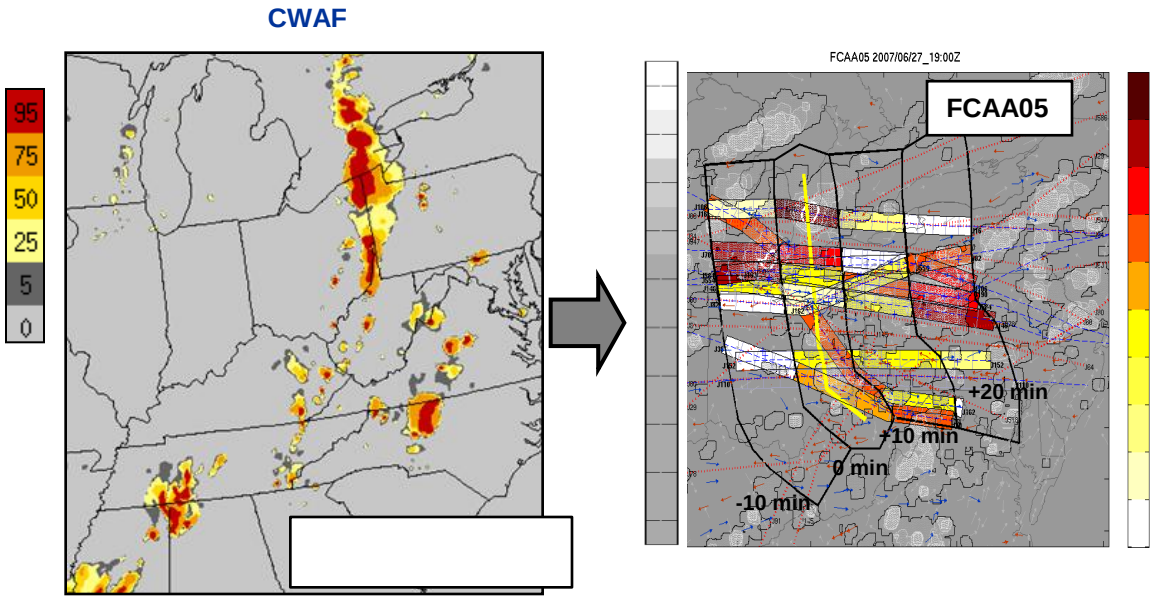
- **Translate weather data into operationally-meaningful information to enable integration into ATM decisions**

- **FY11 activities**
  - Documented wx integration concepts for Time-Based Flow Management (TBFM) and Surface Trajectory-Based Operations (STBO)
  - Evaluated technologies for translating weather data into actionable information and down-selected for further investment
  - Researched convective weather avoidance fields (CWAF) for terminal area



# Collaborative Trajectory Options Program (CTOP)

- **Formerly called "SEVEN" – being developed by Sys Ops**
- **Designed to meet requirement to determine a capacity across a Flow Constrained Area (FCA)**
- **CWAF applied to routes across an FCA predicts FCA capacity in a matrix**




**FCA Capacity Forecast Matrix**

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 81 | 96 | 78 | 38 | 72 | 85 | 78 | 68 | 40 | | | | |
| 12 | | 90 | 78 | 46 | 64 | 88 | 91 | 82 | 39 | 37 | | | |
| 13 | | | 89 | 57 | 71 | 76 | 88 | 84 | 66 | 28 | 20 | | |
| 14 | | | | 88 | 85 | 81 | 86 | 89 | 74 | 51 | 17 | 20 | |
| 15 | | | | | 96 | 88 | 85 | 90 | 70 | 47 | 16 | 19 | 49 |
| 16 | | | | | | 90 | 61 | 65 | 68 | 28 | 6 | 13 | 30 |
| 17 | | | | | | | 77 | 67 | 69 | 63 | 20 | 9 | 17 |
| 18 | | | | | | | | 78 | 61 | 54 | 59 | 19 | 3 |
| 19 | | | | | | | | | 50 | 36 | 29 | 33 | 20 |
| | | | | | | | | | | 30 | 10 | 13 | 16 |
| | | | | | | | | | | | 11 | 5 | 7 |
| 22 | | | | | | | | | | | | 6 | 4 |
| 23 | | | | | | | | | | | | | 6 |

Predicted Available A05 Capacity
< 75% < 50%

# QUESTIONS?