

# Weather PPT Portfolio Review

Weather Program, A11.k

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- Accomplishments
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## **Program Overview**

#### Why is this program necessary?

- Weather has been identified as a causal factor for 70 percent of delays and 20 percent of accidents as cited in "The Mission Need Statement (MNS) for Aviation Weather (#339)".
  - Shortfalls identified in the areas of weather detection and forecasting as well as product creation and dissemination
- > Supports NextGen Implementation Plan Weather Operational Improvements
- Supports FAA Strategic Goals related to efficiency, capacity, safety, and environmental impacts
- Facilitate transition of legacy weather requirements and products to meet emerging NextGen needs
- Weather frequently cited as primary or secondary cause in accidents and injuries (per NTSB, turbulence is leading cause of inflight injuries in Part 121 operations)
- GA fatality rate in weather related accidents, on average is 35% (GA accounts for 75% of weather related accidents)
- Supports the need to provide high quality weather analyses and forecasts to ATM, dispatchers and pilots to proactively select safe and optimal routes





# **Program Overview (cont.)**

#### What is this program?

#### Purpose

- Applied research to minimize the impact of weather on the NAS
  - Specific initiatives to support NextGen weather Operational Improvements contained in the NextGen Implementation Plan
  - Collaborative, complimentary initiatives with NWS to transition legacy capabilities to meet NextGen requirements
  - Focused initiatives to help mitigate safety and/or efficiency issues associated with well documented weather problems

#### Benefits

Increased NAS capacity/efficiency and safety and reduced environmental impacts

#### Funding

FY15	FY16
\$13,799,000 (final contract \$)	\$15,388,000 (total budget proposed) (includes PC&B, & travel)





# **AVS Wx Portfolio**

AVS sponsored and prioritized research initiatives to address select safety concerns in the short and mid-term time horizon, but consistent with current and future requirements

Develop Terminal Area Icing Weather Information for NextGen Improved icing weather information including SLD in terminal area in response to new SLD certification rule

Mitigate the Ice Crystal Weather Threat to Aircraft Turbine Engines HIWC ice crystal data set sufficient for assessment of certification envelopes, development of test facilities, and diagnosis and forecasting for avoidance

Lower Visibility for CAT 1 Approaches and RVR Conversion Identify concept of use for equating prevailing visibility sensor data (e.g. AWOS, ASOS, etc.) to a specific Runway Visual Range (RVR) value, enabling pilots to conduct low-visibility operations for airports not equipped with RVR

Safety-Driven Wx Requirements for Wake Mitigation Predict system safety for NG OIs that incorporate real-time wake mitigation; and establish the specific relationship of system safety to the accuracy and update rate of the wx obs used to support these OIs





# Hazardous Weather Mitigation

By FAA policy CIP is a Supplementary Weather Product for enhanced situational avarances only and must be used with one or more primary products (safety decision) such as an APMET or SIGMET (see AIM 7–1–3). Maximum icing severity (1000 ft. MSL to FL300)



## **Recent Accomplishments**

- Transferred high resolution in-flight icing diagnosis and forecast to NWS for operational implementation on ADDS (CIP & FIP)
- Turbulence ADDS display modifications approved by Safety Risk Management panel (display of EDR; displays for different aircraft weight classes (light, medium, heavy)) (Live on aviationweather.gov in Sept)
- Demonstrated new blending techniques to improve 1-4 hour forecasts in CoSPA
- Improved prototype of oceanic probabilistic convective guidance out to 36 hours; expanded domain across Pacific

## Description

**Need:** More accurate, relevant weather information to address efficiency and safety shortfalls in commercial and GA operations

**<u>Concept</u>**: Improve quality and applicability of weather information used for decision support in air carrier (emphasis on efficiency) and GA (emphasis on safety) operations

- Transition Alaska Icing Forecast capability to NWS Testbed for evaluation & feedback operations
- Complete development of turbulence forecast capability for Alaska
- Develop recommended guidelines for implementing airport ramp procedures during lightning events to enhance NAS safety and efficiency
- Collaborative research activities with NWS to integrate C&V improvements into the HEMS tool, TAFs, and TRACON area forecasts
- Develop World Area Forecast System (WAFS) turbulence severity forecast capability





# Evolving Current Capabilities



### Description

<u>Need:</u> Weather information as required today in many legacy capabilities must evolve significantly to meet emerging NextGen DST needs

**Concept:** FAA Weather requirements today, often levied on the National Weather Service, will evolve and change as NextGen concepts emerge. AWRP research, often in collaboration with NWS, will explore ways to derive legacy weather information from the highly automated weather paradigm likely in the future

## **Recent Accomplishments**

- Completed study determining NAS user's & operators understanding of wx uncertainty info & application to decision making
- Developed experimental technique for estimating visibility utilizing data from FAA AK weather cameras
- Auto-CCFP evaluation

- Develop 8-36 hour global ensemble thunderstorm forecast
- Improvements to the 0-2 hour LAMP C&V
- Derive SIGMETs from grids in collaboration with NWS
- Improve and enhance modeling and simulation techniques to validate performance requirements for both direct and indirect weather dependencies
- Improve the resolution of WAFS global forecast grids to provide more accurate depictions of long-haul and oceanic flight weather hazards





# Direct linkage to NextGen Implementation Plans



## **Recent Accomplishments**

- Proof of concept on techniques for quantifying the operational value of improved aviation weather guidance and forecasts
- Generated scenarios for modeling and simulation of FAA convective wx accuracy requirements
- Assessment on technical feasibility of generating aggregate, operationally relevant, convective weather forecasts from disparate weather models

### **Description**

**Need:** Research to meet specific NextGen weather Operational Improvements as called out in NextGen Implementation Plans

**<u>Concept</u>**: Emerging DSTs will require high fidelity, high resolution weather information, but many research questions must be asked:

- How "good" the weather information is today?
- What gaps exist in today's available weather information?

• What fundamental weather research needs to be done to actually support the performance of the new DST?

- Develop process and procedures for evaluating amount of weather that is "avoidable" for aviation operational decisions
- Perform GOES-R data use assessment for FAA research and operations





## Weather Modeling and Sensing



# **Recent Accomplishments**

- Developed higher resolution rapid refresh model ensembles with longer lead times to support aviation forecasts
- Implementation of RAP enhancements at NWS (improvement of wind, temperature, cloud and convective forecasts)
- Implementation of new algorithm to characterize 2D melting layer in MRMS (minimizes erroneous removal of precip pixels, improves icing detection)
- Implementation of real-time data feeds of prioritized Caribbean radar locations critical to or highly desirable for FAA Air Traffic Controllers

#### Description

**Need:** NextGen will rely on improvements and updates to atmospheric numerical models and weather sensing techniques to meet the emerging requirements of new DSTs and other advances to ATM applications.

**Concept:** Enhance numerical weather prediction models and data assimilation (inputs and techniques) to improve aviation weather hazard forecast and nowcast accuracy and resolution. Multi-Radar/Multi-Sensor (MRMS) research to improve real-time detection of in-flight hazards using high-resolution, high quality, threedimensional (3D) weather radar data analysis from national and international radar networks. This MRMS capability will also function as a validation tool for highresolution forecasts and decision support tools.

- Implement regional ensemble data assimilation supporting improved hazard forecasts especially convection
- Develop 0-24 hour HRRR ensembles to support probabilistic forecast products
- Develop 3D aviation-specific hydrometeor classification & radar icing algorithms
- Implement international radars including Bahamas, Jamaica, & Cayman Islands



# Ensuring Effective Research



Receiver operating characteristic (ROC) curves for GTG3 (red) and GTG2.5 (blue) for the 0.1(a) and 0.2(b) EDR thresholds

# **Recent Accomplishments**

- Completed Research Evolution Plan for Weather
   Uncertainty
- Completed Icing Product Alaska (IPA) forecast evaluation
- Completed Turbulence (mountain-wave, lowlevels) quality assessment
- Completed User Focus Assessments for Turbulence (mountain-wave, low-levels)



## Description

**<u>Need:</u>** To insure the relevancy of weather research, strict processes with regard to prioritization, quality assurance, and operational evaluation are adhered to.

**Concept:** All AWRP projects are subject to:

- Prioritization with respect to operational needs
- Quality assessment for scientific goodliness
- Evaluation and demonstration for operation relevancy

- Offshore Precipitation Capability quality assessment
- IPA diagnosis quality assessment
- Conduct User Assessments of Offshore Precipitation
  Capability
- Conduct initial assessment of Volcanic Ash Forecast Capability



# **Research Transition Teams (RTT)**

- ANG-3 (Bradford) briefed current FAA-NASA RTT process, as a model for consideration with NWS
- Concept of RTTs established in 2006
- Positively referenced by DOT IG Report on NextGen, NASA IG Audit on NextGen, two GAO NextGen Audits
- FAA took action to develop a similar process for FAA-NWS RTT activities
- RTT selection strategy:
  - Enable integration of closely coupled topics among the agencies
  - Mix of near-, mid-, and far-term objectives to determine best collaboration mechanisms
  - Accelerate R&D to achieve near-term results while accelerating and informing far-term objectives
- RTTs have consistently delivered operational products





# **Research Transition Teams (RTT)**

- A small FAA-NWS team was directed to develop a framework for disciplined, but agile, RTT-like R2O process focusing on:
  - 1. Deliverable(s)
  - 2. Schedule
  - 3. Roles & Responsibilities
  - 4. Cost(s)

### • FAA briefed NWS (Uccellini) April 3, 2015

- Rick Heuwinkel and Ming Ji appointed to manage process
- R2O to be mentioned, at a high level, in the NextGen Weather Executive Panel (NEWP) Charter
- Specifics and technical information reserved for individual TORs







# **Initial RTT Selection**

# **Ceiling & Visibility**

- Addresses the need for improved C&V condition information for aviation
- Reflects a coordinated effort involving:
  - Environmental Modeling Center (EMC)
  - Meteorological Development Laboratory (MDL)
  - Aviation Weather Center (AWC)
  - Earth System Research Lab, Global Systems Division, Earth Modeling Branch (ESRL/GSD/EMB)

#### • Stated focus areas include:

- Improvements to C&V analyses in the form of the Real Time Mesoscale Analysis (RTMA)
- Improvements to the 0-2hr C&V forecast in the Localized Aviation MOS Product (LAMP), by utilizing all available Automated Surface Observing Sensor (ASOS) observations
- Refinement and testing of national C&V grids and techniques for NWS forecasters, to make value-added changes to automated C&V products
- Integration of these C&V improvements into the Helicopter Emergency Medical Services (HEMS) Tool
- Phase I will deliver gridded C&V analysis and forecasts for use in the NCEP Production Suite
- Incremental improvements will be released each November
- End goal is a high quality, rapidly-updated analysis with reliable deterministic and ensemble-based probabilistic forecast guidance





#### **Simplified Needs to Solutions Process**





#### **Relationship – OWNA to Requirements**

Objective  $\rightarrow$  To develop validated operational performance requirements that address user needs and achieve the successful implementation of mid-term service capabilities.



#### Status

- Scenarios for en route and terminal convection completed March 16, 2015
- Scenarios for C&V and surface winds completed April 15, 2015
- Experimental design/project plans completed
  - + April 13, 2015 for AvMet
  - + May 15, 2015 for ANG-C41 (FAA Advanced Operational Concepts Division)
- Completed alterations to simulation platforms and preliminary results are being analyzed
  - AvMet runs using DART for all scenarios
  - + ANG-C41 selected specific ATL terminal convection scenarios be run with AirTOp





#### Schedule



