REDAC / NAS Operations

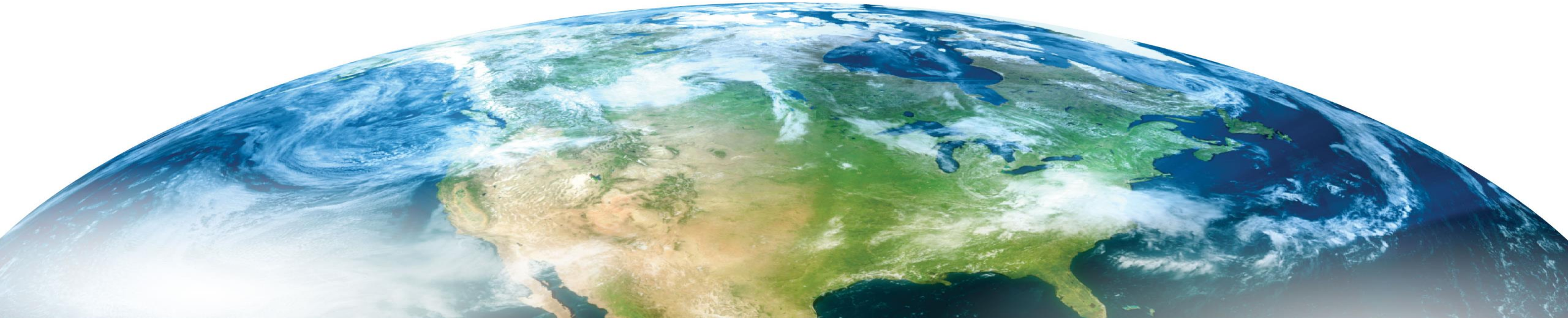
Weather Program

BLI Number: A11.k

Presenter Name: Randy Bass

Date: March 16, 2021

Review of FY 2021 - 2023
Proposed Portfolio



Weather Program A11.k Overview

What are the benefits to the FAA

- Enhanced NAS safety via reduction of accidents associated with hazardous weather
- Improved NAS capacity/efficiency via reduced delays and cancellations and increased capacity in high traffic areas
- Reduction in environmental impact (i.e. lower fuel consumption via improved accuracy and accessibility of observed and forecast weather information)
- Enhanced GA safety via improved accuracy and accessibility of observed and forecast weather information

What determines program success

- Transition of research capabilities into evolving ATM decision support processes
- Research capabilities align with NSIP and NextGen emerging solution sets as well as the 2035 Charting Aviation's Future Vision
- Incorporation by National Weather Service (NWS) of research capabilities to improve delivery of FAA required services
- Incorporation by NWS or commercial industry of research capabilities into weather information that is enhancing GA safety
- Tangible reduction in avoidable delays and aircraft accidents due to weather
  - Transition of successful weather research capabilities into operations have directly contributed to a reduction in NAS delays due to weather from 68% in 2007 to 54% in 2019

Weather Program A11.k
Program Support

People:

- Program Manager and 12 Project Leads/Subject Matter Experts

Laboratories:

- NOAA ESRL – Model Development & Enhancement (MDE), Quality Assessment, Terminal Area Icing Weather Information for NextGen (TAIWIN), Ceiling & Visibility (C&V)
- NOAA NSSL – Wx Radar Techniques, TAIWIN
- NOAA NCEP (EMC and AWC) – MDE, C&V
- NWS MDL – C&V
- MIT/LL – Convective Storms, C&V, Weather Observations (Wx Obs)
- NCAR – In-flight Icing, Turbulence, Convective Storms, C&V, MDE, TAIWIN, High Ice Water Content (HIWC), Wx Obs
- FAA Tech Center – Aviation Weather Demonstration and Evaluation (AWDE), Wx Obs, TAIWIN, HIWC
- NRC – TAIWIN
- ECCC – TAIWIN
- Diakon – TAIWIN
- NASA – HIWC, TAIWIN, In-flight Icing
- Australian BoM – HIWC
- Metron Aviation, Inc. – Turbulence

Current FY21 Accomplishments

- Convective Storms (CS)
  - Completed assessment of Offshore Precipitation Capability (OPC) v3 (w/Geostationary Lightning Mapper)
  - Expanded OPC domain to CONUS wide and eastern Pacific view
  - Enhanced OPC to include up to 12-hour CS forecast
- In-flight Icing (IFI)
  - Full dataset from the In-Cloud Icing & Large-drop Experiment (ICICLE) field program processed and made available to IFI researchers and scientists to support development of enhanced icing detection & forecasting capabilities to meet FAA aircraft certification requirements
  - Enhanced Current Icing Product (CIP) and Forecast Icing Product (FIP) to use the higher resolution High Resolution Rapid Refresh (HRRR) numerical weather prediction model (versus the coarser resolution Rapid Refresh (RAP) model) as well as incorporating new weather satellite and weather radar datasets
- Modeling Development and Enhancement (MDE)
  - Enhanced versions of the RAP and the HRRR developed under Wx Program sponsorship were operationally implemented by the NWS
  - Commenced development of the Rapid Refresh Forecast System (RRFS) which will subsume the RAP and HRRR
- Turbulence (TRB)
  - Continued development of turbulence capability in support of ICAO World Area Forecast System requirement
  - Developed Graphical Turbulence Guidance (GTG) Global calibration file to ensure compatibility with current NWS platforms
- Ceiling and Visibility (C&V)
  - Completed the quality assessment of a capability to estimate visibility in FAA Weather Camera imagery using automation (Visibility Estimation through Image Analytics (VEIA) algorithm)
  - Developed a VEIA confidence value, determined when human input provides value to VEIA and used findings to improve VEIA algorithm, and wrote a draft Operational Concept Description for VEIA
  - Continued development to increase the temporal resolution of Localized Aviation Model Output Statistics Program (LAMP) C&V forecasts and used satellite data to improve the performance between stations
  - Continued research to improve the HRRR C&V capability through assimilation of cloud products and diagnostics of cloud fields
  - Improved the quality control and display of non-certified weather observations in the Helicopter Emergency Medical Services tool

Current FY21 Accomplishments (cont'd)

- Quality Assessment (QA)
  - Completed assessment of the improvements to OPC Ground Based vs. Satellite Based Lightning Detection
  - Completed verification plan for OPC westward expansion
  - Completed assessment of the VEIA algorithm
- Aviation Weather Demonstration and Evaluation (AWDE) Services
  - Conducted a virtual Table Top Demonstration for Precipitation on the Glass (PoG) and delivered a briefing summarizing demonstration results and recommendations to ANG-C6, AJV, NATCA, and the PMO
  - Conducted a virtual assessment for the Icing Product Alaska-Diagnosis (IPA-D) and delivered a briefing summarizing assessment results and recommendations to ANG-C6
  - Commenced collaboration with Aviation Weather Center (AWC) Testbed staff to develop approach to virtually "recruiting" participants and collecting data from participants during the upcoming Summer Experiment focusing on the Graphical Forecast Area - Alaska product
- Terminal Area Icing Weather Information for NextGen (TAIWIN)
  - Completed ICICLE Data Update Workshop and data processing of ICICLE datasets
  - Initiated preparations for TAIWIN demonstration in Winter 21/22
  - Commenced development of initial TAIWIN capability discriminating between Appendix C and Appendix O icing conditions in the terminal area
- High Ice Water Content (HIWC)
  - Began preparation for HIWC Japan campaign to collect ice crystal icing aircraft data in high aerosol environments
  - Initiated planning for user demonstration and evaluation of the HIWC weather tool, ALPHA (Algorithm for the Prediction of HIWC Areas)
- UAS Wx
  - Completed initial report on current and planned UAS test sites within FAA, DHS, DoD, NASA and Industry
  - Completed initial report on ongoing UAS research efforts that may be candidates for technology transfer

Anticipated Research in FY22

Planned Research Activities

- CS
  - Complete transition of 12-36 hour probabilistic forecast of CS (Ensemble Prediction of Oceanic Convective Hazards (EPOCH)) to NWS
  - Expand near-term Traffic Flow Management (TFM) weather requirements into research
  - Begin infusion of artificial intelligence (AI) to enhance the TFM Convective Forecast (TCF) used by the Command Center, airlines and others
- IFI
  - Use explicit icing parameter output (such as liquid water content, drop size, and precipitation type) from the HRRR model to better define icing threats
  - Begin initial development of capabilities to support UAS operations
- MDE
  - Further development and enhancement of initial RRFS to include deterministic and ensemble capabilities
- TRB
  - GTG-Global probabilistic experimental implementation
  - Complete GTGN2 (RRFS-based), conduct quality assessment, Technical Review Panel, and Safety Risk Assessment
  - Continue Turbulence Avoidance Model (TAM) development in support of ATM planning processes
- C&V
  - Adapt VEIA to 360 degree camera imagery and begin development of Cloud Estimation through Image Analytics
  - Continue development of LAMP 15-minute forecasts and prototype LAMP forecasts of onset and cessation of IFR conditions at airports
  - Increase the use of satellite data and other novel data sets to improve the accuracy of RRFS C&V fields
  - Begin research and development of a follow-on capability to forecast cessation of fog and stratus at SFO (SFO Marine Stratus)
- Advanced Weather Radar Techniques (AWRT)
  - Implement winter weather and convective products into the developmental Multi-Radar Multi-Sensor (MRMS) system for performance monitoring
- QA
  - Coordinate, and conduct scientific meteorological assessments of GTG4, CIP and FIP comparison between 13-km RAP and the 3-km HRRR forecast models
  - Quality assessment/evaluation comparing the performance of the RRFS to the current HRRR model

Anticipated Research in FY22 (cont'd)

Planned Research Activities

- AWDE
  - Continue to develop virtual techniques to improve data collection and collaborations with participants and internal/external partners
  - Develop Use Cases and CONOPs for IPA-D
  - Conduct interviews with airlines to determine concerns and needs regarding radiation effects on flight crew and passengers
  - Conduct user assessments for the OPC, TAIWIN, SFO Marine Stratus, and TAM
- TAIWIN
  - Assess and validate data from Numerical Weather Prediction models, weather radars, and other data sources in comparison with ICICLE research flight data collected
  - Leveraging findings, develop capability to discriminate between freezing drizzle and freezing rain at surface and aloft in terminal area
  - Demonstrate initial TAIWIN prototype and perform user evaluation
- HIWC
  - Prepare for Japan flight campaign in FY23
  - Evaluate options for operational transition of HIWC weather tool, ALPHA
- UAS Wx
  - Determine Urban Air Mobility weather needs
  - Identify existing weather capabilities for low altitude operations that may be applicable to UAS operations
- Weather Observations
  - Initiate exploration of new sensor technology to determine if sensor capabilities can be consolidated for future iterations of surface observing systems
  - Explore how various Liquid Water Equivalent (LWE) measurements during mixed-phase precipitation can be used to develop more robust determinations of LWE

Anticipated Research in FY22 (cont'd)

Expected Research Products

- CS
  - The transfer of EPOCH to NWS will enable more accurate convective weather forecasts and warnings for oceanic airspace to support international weather requirements
- TRB
  - A Global Probabilistic Gridded Turbulence Forecast and transition of GTG family of forecasts to 3km resolution
  - TAM for use by ATM
- C&V
  - VEIA operational on the FAA weather camera website
  - Accurate model derived forecasts of onset and cessation of IFR condition at airports to support TFM
- IFI
  - An experimental CIP and FIP, employing new satellite information and 3-D and dual-polarization weather radar information for increased diagnosis of icing environments, along with improved fuzzy logic techniques adapted to higher resolution (smaller grid spacing) output
- MDE
  - An experimental RRFS with improved convective weather output and uncertainty information through the use of more ensemble based techniques
- AWRT
  - Development of web tool to display terminal-area winter weather hazards using the MRMS system
- TAIWIN
  - Initial version of TAIWIN icing-detection and forecast capability
- UAS Wx
  - Initial set of weather observation and forecast requirements for UAM operations
  - Report on the use of existing weather capabilities that can support UAS domains

Emerging FY23 Focal Areas

Weather Program: Continued emphasis on transition to operations of successful weather projects into FAA, NWS and commercial industry systems. Development and implementation of weather standards for all segments of UAS. Alignment of research with 2035 Charting Aviation's Future (CAF) Vision.

- CS
  - Continue research against near-term TFM requirements
  - Begin targeting NAS high traffic areas for research and develop a prototype to assess user feedback on TCF improvements
- TRB
  - GTG4 and GTGN2 transfer to NWS
  - TAM Phase 4 transition to CSS-Wx/NextGen Weather Processor (NWP)
  - Turbulence mitigation capabilities for use in UAS/UAM operations as well as to support 2035 CAF Vision
- C&V
  - Demonstrate use of weather sensing drones to profile fog conditions near airports
  - C&V decision support guidance during low cloud and restricted ceiling conditions to support 2035 CAF Vision
  - Self-validating C&V sensors that combine traditional sensors and camera derived visibility and cloud information
  - Complete new SFO Marine Stratus capability
- IFI
  - Finalization of CIP and FIP code for transfer to NWS for operational implementation
  - Continue collaboration with TAIWIN on development of drop-size capability to address aircraft certification envelopes
  - Further development of initial UAS capability to adapt CIP, FIP, and IPA to low-level UAS operations
- MDE
  - Initial version of RRFS finalized and transferred to NWS for operational implementation to include both deterministic and ensemble probabilistic weather forecasts
- AWRT
  - Monitor performance of new products and algorithms on the developmental MRMS system, including winter precipitation algorithms and convective polygons
  - Investigate weather radar capability requirements for NWP and develop strategies for research opportunities in support of these requirements

Emerging FY23 Focal Areas (cont'd)

- TAIWIN
  - Analyze results of TAIWIN evaluation with focus on operational implementation and validation/verification needs
  - Prepare for and support 3rd party validation and verification efforts
- HIWC
  - Execution of FY23 high aerosol environment flight campaign
  - Evaluation of ice crystal icing certification envelope
  - Develop operational implementation path for ALPHA
- UAS Wx
  - Development of standards and validation of forecast performance of numerical models in UAS domains
- Wx Obs
  - Exploring further automation of ground truth techniques to evaluate surface sensor capabilities to better distinguish obstructions to visibility such as fog and/or mist from moderate to heavy precipitation events
- QA
  - Plan, coordinate, and conduct scientific meteorological assessments of icing drop size, upgrades to the CONUS – AK, high resolution modeling capabilities, UAS Weather, C&V short-term forecasts, GTG forecasts, and OPC mountain obscurations
- AWDE
  - Conduct assessments for IFI, CS, TRB, and C&V to ensure existing and emerging weather products enhance user decision making and support operational tasks
  - Conduct research to define information gaps to further enhance requirement development and design of weather capabilities
  - Continue working with Space Weather Prediction Center and other partners to further develop and define radiation effects on flight crew and passengers and determine airline needs in terms of radiation information

Convective Storms

Research Requirement

- Improve observations and forecasts of convective storms. Create and improve standards and techniques integration into DSPs to mitigate impacts on and improve efficiency of the NAS
- Improve accuracy over legacy systems; higher spatial and temporal resolution; well-defined probabilistic and gridded information; guidelines and strategies for developing capabilities for integration into DSPs that meet users' requirements and are applicable to their needs
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: Jason Baker, ANG-C61, 202-267-1625

Outputs/Outcomes

- OPC: Produce an estimate of precipitation for areas that lack radar coverage, merged seamlessly with existing radar mosaic to provide controllers a radar-like visualization for better situational awareness of offshore sectors
- CWAM: Redesign of the model to incorporate machine learning techniques and optimize use in strategic time frames (2-8 hour forecasts)
- EPOCH: Transfer to NWS to improve forecast for oceanic airspace.
- TCF: More accurate forecast with infusion of high resolution data and AI

FY 2023 Planned Research

- Plan/scope forecast for near-term TFM requirement, with focus on NAS high traffic sectors
- Research and apply techniques to modernize TCF; develop prototype
- Begin operational transition of OPC
- Complete transition of EPOCH to NWS

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.2M	$ 1.2M	$ 1.6M

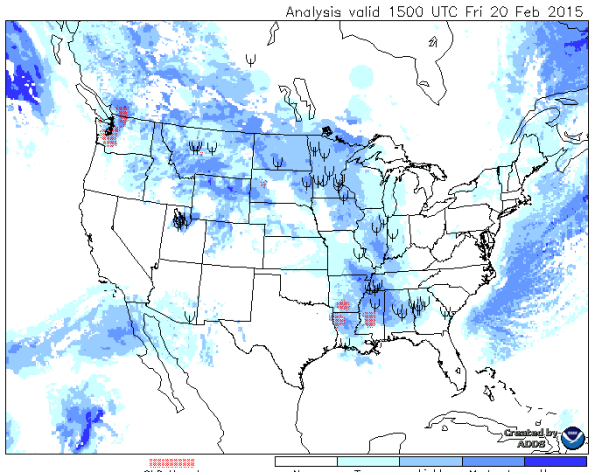
In-Flight Icing

Research Requirement

- Improve operationally-available diagnoses and forecasts of aircraft icing conditions that can be used by aviation users to make decisions on icing threat areas, optimum routings, and areas to avoid in compliance with recently updated regulations and aircraft certification envelopes
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: Danny Sims, ANG-C61, 202-267-2785

Outputs/Outcomes

- Diagnostic and forecasts up to and beyond 18 hours over the CONUS and Alaska for operational use by ATM, dispatchers, and pilots to enhance capacity and safety



FY 2023 Planned Research

- Transition enhanced high resolution in-flight icing diagnosis and forecast capability (CIP and FIP) to NWS for operational implementation
- Development of drop-size capability to meet aircraft certification envelopes
- Further development of initial UAS capability to adapt CIP, FIP, and IPA to low-level UAS operations

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.3M	$ 1.3M	$ 1.4M

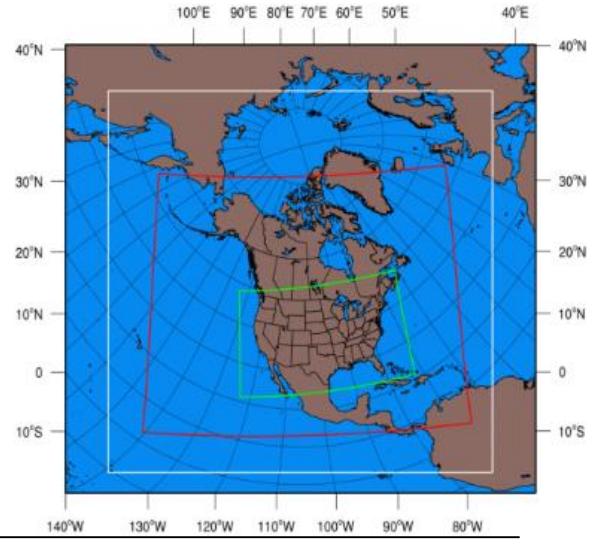
Model Development and Enhancement

Research Requirement

- Weather prediction models are the basis for all aviation weather hazard forecasts beyond 2 hours. Improvement of operationally available numerical weather prediction models to enhance forecasts of aviation weather hazards including inflight icing, turbulence, convective weather, and ceiling and visibility will require model enhancements
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: Danny Sims, ANG-C61, 202-267-2785

Outputs/Outcomes

- 0-48 hour high resolution rapid refresh to support aviation forecast products
- Enhanced NAS safety and capacity/efficiency from improved forecasts of aviation specific weather hazards



FY 2023 Planned Research

- Transfer initial RRFS code to NWS for operational implementation and replacement of HRRR.

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.0M	$ 1.0M	$ 1.1M

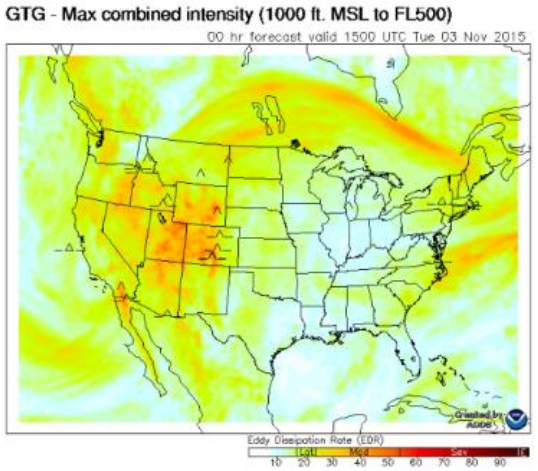
Turbulence

Research Requirement

- Improve turbulence observation and forecasting capabilities throughout the NAS to accurately identify & predict time, locations, & intensity of turbulence; improving safety, capacity, and efficiency in the NAS
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: Tammy Flowe, ANG-C61, 202-267-2796

Outputs/Outcomes

- High resolution, gridded, global detection and probabilistic forecasts of turbulence (clear-air, mountain wave & convectively-induced) to support ATM DSPs, dispatcher and pilots resulting in improved safety, increased capacity and reduced atmospheric emissions within the NAS



FY 2023 Planned Research

- Complete GTG4 and GTGN2 transition to NWS
- TAM Phase 4 transition to CSS-Wx/NWP
- Turbulence mitigation capabilities for use in UAS/UAM operations

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.0M	$ 0.8M	$1.0

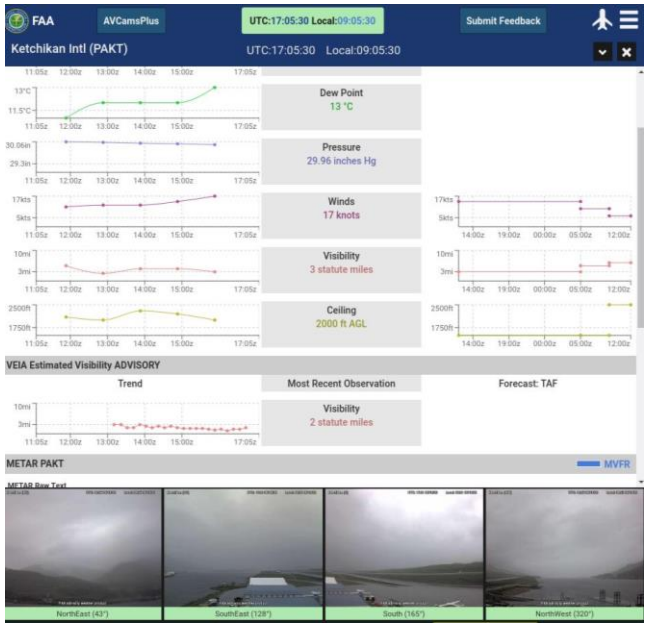
Ceiling and Visibility (C&V)

Research Requirement

- Improve C&V prediction models with the goal of reducing GA accidents/incidents and improving airport efficiency
- Applications for improved C&V predictions include support for current and future TAF AIRMETS and TRACON forecasts; production of automated TAFs in areas where no TAFs exists; updates to graphical weather tools; new observations in data-sparse regions
- Done in collaboration with NWS to improve products and services the FAA requires
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM, AVS
- POC: Jenny Colavito, ANG-C61, 202-267-2787

Outputs/Outcomes

- Improvements and expansion of C&V gridded data
- New sources for C&V observations: camera based & drone based
- Support enhanced GA safety & ATM based decision support processes to improve efficiency

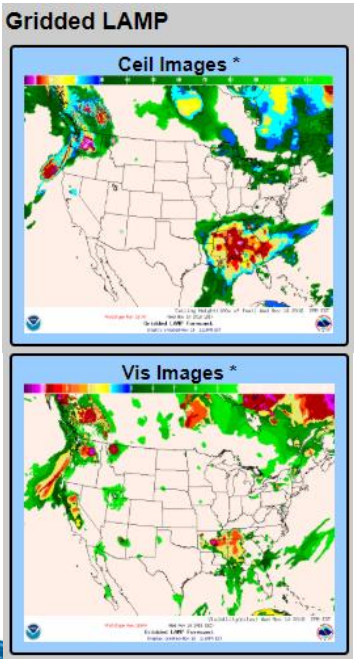


FY 2023 Planned Research

- Demonstrate use of weather sensing drones to profile fog conditions near airports
- Adapt VEIA to support sensor validation and issue reporting
- Investigate the use of high resolution model nests to improve forecast model performance of visibility and cloud amounts in areas of complex terrain and where air traffic is highly impacted
- Begin development to expand Gridded LAMP domain to Hawaii

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.0M	$ 1.0M	$ 1.0M

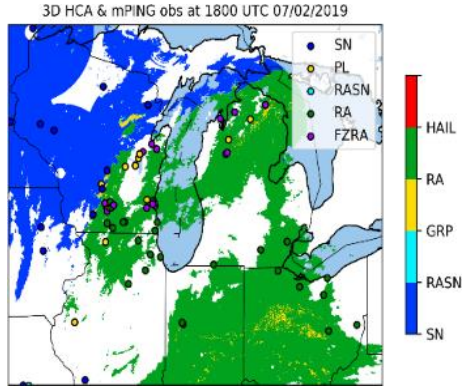


Advanced Weather Radar Techniques

Research Requirement

- Conduct and implement research toward a high-resolution, high quality, three-dimensional (3D) weather radar data analysis from national and international radar networks
- Provide improved detection and forecasting for hazardous phenomena such as turbulence, icing and convection, and deliver these products and services in a manner that allows for their rapid and effective use by NAS decision-makers
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: Randy Bass, ANG-C61, 202-267-2800

Outputs/Outcomes



- Aviation threat-specific information provided through the MRMS platform
- Reflectivity at specific flight levels beneficial to aviation users
- Improved diagnosis and depiction of icing conditions of interest to aircraft operations
- Improved validation techniques to ensure that MRMS data can be used effectively and reliably for operational decision-making
- Improved weather radar diagnosis and depiction of turbulence conditions of interest to aircraft operations

FY 2023 Planned Research

- Monitor performance of new products and algorithms on the developmental MRMS system, including winter precipitation algorithms and convective polygons
- Investigate weather radar capability requirements for NWP and develop strategies for research opportunities in support of these requirements

Out Year Funding Requirements

FY21	FY22	FY23
$ 350K	$ 350K	$ 350K

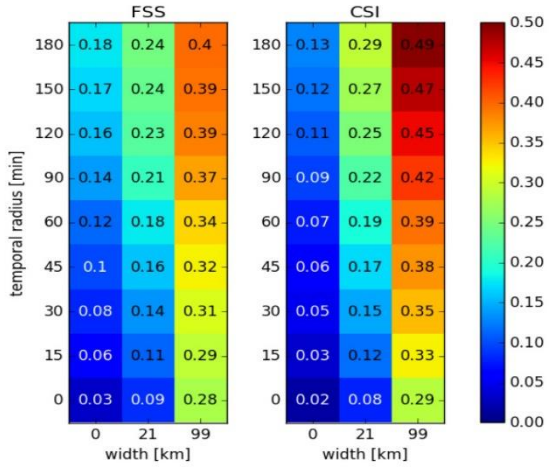
Quality Assessment (QA)

Research Requirement

- Improved observations & enhanced forecasts must have effective & reliable verification prior to becoming operational to ensure the accuracy, performance, and value of these products for NAS users
- Sponsored by ANG-C6, ANG-C7, AJV, AJR, AJM
- POC: ANG-C63 Sean Whelan 609-485-4838; ANG-C63 Steve Maciejewski 609-485-5950

Outputs/Outcomes

- Verification/assessment of aviation impact weather forecasts and analyses
- Data provided supports transition of research weather forecast products based on forecast accuracy, quality, and operational meaningfulness to ATM, dispatchers, and pilots



FY 2023 Planned Research

- Icing Drop Size and CONUS-AK Assessment
- UAS Weather Assessment
- C&V short-term forecasts
- GTG forecasts
- OPC mountain obscurations

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.0M	$ 1.0M	$ 1.0M

Aviation Weather Demonstration & Evaluation (AWDE) Services

Research Requirement

- NextGen Implementation Plan (Reduce Weather Impact & Validating Concepts) states human factors, human-in-the-loop testing and demonstrations are essential tools for validating NextGen concepts
- Demonstration and evaluation services are required to assess weather research maturity and concept readiness for transition
- Sponsored by ANG-C6, ANG-C7 AJV, AJR, AJM
- POC Sonia Alvidrez, ANG-C63; 609-485-7613

Outputs/Outcomes

- Enhanced demonstration and evaluation services with subject matter expertise, improved data resources including live aircraft situation data, and metrics capability

- Data & analysis to reduce programmatic risk, aid in definition & validation of requirements and inform AMS lifecycle management activities to improve the delivery of research capabilities developed

FY 2023 Planned Research

- Conduct user assessments for Icing, Convective Weather, Turbulence, and C&V
- Conduct research to define information gaps to further enhance requirement development & design of weather products
- Participate/support the AWC Testbed Summer/Winter Experiments
- Continue working with Space Weather Prediction Center and other partners to further develop and define radiation effects on flight crew and passengers and determine airline needs in terms of radiation information

Out Year Funding Requirements

FY21	FY22	FY23
$ 500K	$ 500K	$ 500K

Terminal Area Icing Weather Information for NextGen (TAIWIN)

Research Requirement

- Responds to operational needs - new SLD Rule 25.1420 and NextGen *Reduce Weather Impact* capacity and throughput requirements in freezing precipitation
- Develop capability/technology to manage impact of new certification Supercooled Large Drops (SLD) rule on terminal area operations; research on automated reporting systems and improved weather diagnostic/forecast tools
- Sponsored by: AFS-200, AFS-400
- POC Stephanie DiVito, ANG-E2; 609-485-7152

Outputs/Outcomes

- Improved icing weather information including SLD in terminal area
- Maintain/improve efficiency and safety in icing conditions under new SLD rules in terminal area, facilitating smooth transition to new operational rules and/or guidance anticipated from Flight Standards corresponding to new SLD certification rule

FY 2023 Planned Research

- Continue analysis of ICICLE flight test data to quantify ability to diagnose and forecast detection and discrimination of freezing drizzle from freezing rain aloft in the terminal area
- Evaluate capabilities met vs. required for a final TAIWIN capability
- Focus on planning operational implementation
- Prepare for validation and verification efforts

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.3M	$ 1.3M	$ 1.6M

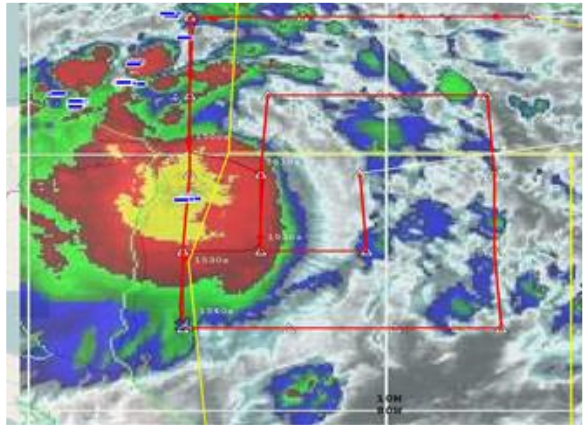
High Ice Water Content (HIWC)

Research Requirement

- NTSB: A-96-54, -56, & -58
- Characterization of HIWC ice crystal environments that can be a threat to turbine engines
- Diagnosis and forecasting of HIWC ice crystal environments
- Sponsored by AIR-6A1, AFS-400
- POC Jim Riley, ANG-E2; 609-485-4144

Outputs/Outcomes

- Atmospheric HIWC ice crystal data set sufficient for assessment of certification envelopes, development of test facilities, onboard detection for avoidance, and diagnosis and forecasting for avoidance
- Enhanced avoidance of HIWC conditions



FY 2023 Planned Research

- Conduct field campaign focusing on high aerosol impact on engine ice crystal icing
- Evaluation of ice crystal icing certification envelope
- Operational implementation path for ALPHA

Out Year Funding Requirements

FY21	FY22	FY23
$ 1.4M	$ 1.0M	$ 1.2M

UAS Weather

Research Requirement

- Gaps between current weather capabilities and weather information needed for safe and efficient airspace management of UAS operations
- The goals of the UAS Weather project are to further research identified gaps and explore the potential enhancement of current weather capabilities or development of new capabilities to close those gaps
- Sponsored by AFS 200,400,800, ANG-C6
- POC: Kevin Johnston, ANG-C64, 202-267-6377

Outputs/Outcomes

- Improved weather information required for safe and efficient UAS operations and integration into the NAS

FY 2023 Planned Research

- Continue collaboration with FAA UAS organizations
- Continuation of understanding weather needs for UAM operations
- Validation of forecast performance of numerical models in UAS Domains

Out Year Funding Requirements

FY21	FY22	FY23
$ 500K	$ 500K	$ 500K

Weather Observations (Wx Obs)

Research Requirement

- Conduct and transition research that enhances or increases weather observations on the surface with the goal of improving capacity and surface operations.
- Evaluation of emerging observing technologies are required to validate user needs and assess readiness for formal concept demonstration and transition into operations.
- Sponsored by ANG-C6, AJV, AJM
- POC Victor Passetti, ANG-C63; 609-485-6260

Outputs/Outcomes

- Affirmation of automated weather detection capabilities synchronized to new or emerging weather observation requirements
- Reinforce the safety risk management process via early user interactions with new observing technologies to clarify desired needs and harmonize transition of new capabilities into existing weather observing platforms

FY 2023 Planned Research

- Continue exploration of new sensor technology to determine if sensor capabilities can be consolidated for future iterations of surface observing systems
- Continue assessment of various Liquid Water Equivalent (LWE) measurements during mixed-phase precipitation to determine which can be used to develop more robust determinations of LWE
- Explore further automation of ground truth techniques to evaluate sensor capabilities to better distinguish obstructions to visibility such as fog and/or mist from moderate to heavy precipitation events.
- Explore the sensitivity of measuring false accretions during “wet” snow events to develop a method for determining wet snow conditions utilizing the existing ASOS sensors (This is a potential shortfall in observations for UASs)

Out Year Funding Requirements

FY21	FY22	FY23
N/A	$ 500K	$ 300K

Acronyms

- AI – Artificial Intelligence
- Airmet - Airmen's Meteorological Information
- AK - Alaska
- ALPHA – Algorithm for Prediction of HIWC Areas
- AMS – Acquisition Management System
- ASOS - Automated Surface Observing Systems
- ATM – Air Traffic Management
- AWC - Aviation Weather Center
- AWDE – Aviation Weather Demonstration and Evaluation
- AWRT – Advanced Weather Radar Techniques
- BOM – Australian Bureau of Meteorology
- CIP – Current Icing Product
- CONOPs – Concept of Operations
- CWAM – Convective Weather Avoidance Model
- DSPs – Decision Support Processes
- ECCC – Environmental & Climate Change Canada
- EMC – Environmental Modeling Center
- EPOCH - Ensemble Prediction of Oceanic Convective Hazard
- FIP – Forecast Icing Product
- FV3 – Finite-Volume Cube-Sphere Dynamical Core
- GA – General Aviation
- GFA – Graphical Forecast for Aviation
- GTG – Graphical Turbulence Guidance
- GTGN – GTG Nowcast
- HEMS - Helicopter Emergency Medical Services
- HIWC – High Ice Water Content
- HRRR – High Resolution Rapid Refresh
- ICAO - International Civil Aviation Organization
- ICICLE – In-Cloud Icing and Large-Drop Experiment
- IFR – Instrument Flight Rules
- IPA - Icing Product Alaska
- LAMP – Localized Aviation MOS Program
- LWE - Liquid Water Equivalent
- MDL – Meteorological Development Laboratory
- MRMS – Multi-Radar, Multi-Sensor
- NAS – National Airspace System
- NRC – National Research Council of Canada
- NSIP – NextGen Segment Implementation Plan
- NWP – Numerical Weather Prediction
- NWS – National Weather Service
- OPC – Offshore Precipitation Capability
- PoG - Precipitation on the Glass
- RAP – Rapid Refresh
- RRFS - Rapid Refresh Forecast System
- SLD – Supercooled Large Droplet
- TAF – Terminal Area Forecast
- TAIWIN – Terminal Area Icing Wx Information for NextGen
- TAM - Turbulence Avoidance Model
- TCF - Traffic Flow Management Convective Forecast
- TFM - Traffic Flow Management
- TRACON – Terminal Radar Approach Control
- TRB – Turbulence
- TRP - Technical Review Panel
- SRM - Safety Risk Assessment
- UAM - urban air mobility
- UAS – Unmanned Aircraft Systems
- VEIA - Visibility Estimation through Image Analytics
- WAFS – World Area Forecast System
- Wx - Weather
- Wx Obs – Weather Observations

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