

# REDAC / NAS Operations



Next**GEN**

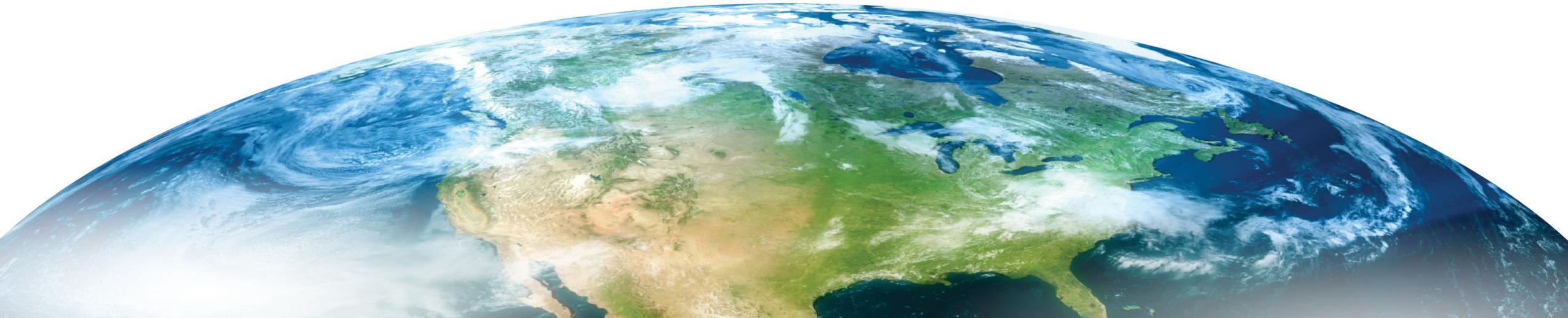
*Name of Program: Weather Technology in the Cockpit (WTIC)*

*BLI Number: A11.q*

*Presenter Name: Gary Pokodner*

*Date: March 16, 2021*

*Review of FY 2021 - 2023  
Proposed Portfolio*



# WTIC Program Overview

## What are the benefits to the FAA

- Enhanced safety by resolving/reducing adverse-weather safety risks before they result in an accident/incident
- Enhanced NAS efficiency and increased capacity resulting from consistent and predictable pilot adverse weather decision making due to established cockpit minimum weather service(s)
  - Reduced emissions due to enhanced efficiency
  - Reduction in flight delays
  - Enhanced flight routing in and around adverse weather
- Enhanced safety resulting from the resolution of pilot MET-training shortfalls



# WTIC Program Overview

## What determines program success

- Number of standards released incorporating WTIC Minimum Weather Service (MinWxSvc) recommendations
- Number of transitions of WTIC MinWxSvc recommendations into commercial products or operations
- Number of transitions of WTIC training materials to use in courses, textbooks, guidance, Wings Credit Courses, FAA pilot exam questions, and commercial training products
- Number of MinWxSvc recommendations incorporated by pilots and other stakeholders into practice, guidance, or endorsements by representative groups such as Aircraft Owners and Pilots Association (AOPA), Air Line Pilots Association (ALPA), and National Association of Flight Instructors (NAFI)
- Benefits analyses using model simulations and demonstration/operational data
- Tangible reduction in avoidable delays and aircraft accidents/incidents/risks due to weather



# Weather Technology in the Cockpit (WTIC) Program Support

**People:** Program Manager: Gary Pokodner

- Subject Matter Experts: Dr. Ian Johnson (Human Factors), Eldridge Frazier (Lead Engineer)

## Stakeholders and Laboratories:

### Government

- FAA
  - Flight Standards Service
    - Test questions AFS-630
    - NEXRAD Online Course AFS-850
    - ASRS report AFS-430
  - Aircraft Certification
  - Small Aircraft Directorate
  - Office of Aviation Safety
  - Human Factors Research & Engineering
  - William J. Hughes Technical Center(WJHTC)
  - Civil Aerospace Medical Institute (CAMI)
  - Future Flight Services
- NASA - Ames
- NTSB
- NCAR

### Airlines

- Delta
- United
- American

### Publishers

- Routledge

### Standards Bodies

- RTCA
- ASTM

### Academia

- Embry-Riddle Aeronautical University
- Florida Institute of Technology
- Georgia Institute of Technology
- Iowa State University
- Purdue University
- Texas A&M University
- The Ohio State University
- University of Oklahoma
- Western Michigan University
- Virginia Tech

### Professional Societies

- AOPA
- GAMA
- ALPA
- Others (via GAJSC)
- NAFI

### Industry

- Lockheed Martin (via PEGASAS)
- Frasca (via PEGASAS)
- Mindstar Aviation (via PEGASAS)
- Fly8Ma (via PEGASAS)
- WebManuals (via PEGASAS)
- Aspen Avionics (via PEGASAS)

# Current FY21 Accomplishments

- **Remote Oceanic Meteorological Information Oceanic (ROMIO)**
  - Configuration achieved 99.02% up time from Sept 1 – Dec 1, 2020
  - Completed development of a script to ingest lightning flash data, began ingest, and updated monitoring diagrams
  - Delta Airlines incorporated ROMIO into pilots' weather app and provided training
- **ADS-B Turbulence**
  - Phase 2 final report delivered and accepted, included details on process to filter out the effects of the vertical rate data being quantized and aircraft maneuvers
  - Awarded Phase 3 contract and completed kickoff meeting. Phase 3 plans include maturing algorithms, holding a limited flight demo, assessing quality of data in terrestrial and satellite ADS-B reports, and identifying end users
- **Effectiveness of Pilot Self-Briefings Versus Specialist Briefings**
  - Kickoff meeting completed
  - Developed an automated method to retrieve and archive over 300 current web-based aviation-weather images for use to simulate preflight scenarios



# Current FY21 Accomplishments

- **Augmented Reality and Pilot Report (PIREP) Enhancements**
  - Completed interactive, augmented reality, WeatherXplore compatible, 3-D thunderstorm training module
  - Module to be used to evaluate the benefits of using 3-D images for pilot training
  - Presented MinWxSvc recommendations on using augmented reality at the ICAO Global Innovation Symposium with the panel drawing the largest audience
  - Western Michigan University doing trial run of “Aviation Weather with Augmented Reality” with aviation meteorology students
  - Completed study on pilot lexicon to implement voice recognition to enter PIREPs
  - Evaluated multiple voice recognition systems using the developed lexicon and machine learning
- **ADS-B PIREPs**
  - Version 3 Minimal Operation Performance Standards (MOPS) for 1090 Extended Squitter was published and included ADS weather PIREPs requirements and test procedures for three new messages



# Current FY21 Accomplishments

- **Helicopter Operations Weather Information (HOWI)**
  - Completed analysis of rotorcraft technology and developed a dashboard to enable analysis of the findings, and to begin resolution of identified gaps
  - Submitted for magazine publication “Analysis of Weather-Related Helicopter Accidents and Incidents in the United States” based on findings and analysis to date
- **Pilot Evaluation of NEXRAD with Latency Nulled Out**
  - Nearly completed converting the study to an online virtually conducted study versus in-person due to on-going COVID-19 delays.
  - Test plan update completed and IRB package approved
- **Crowd Sourcing Wind Using Analytics**
  - Contract awarded after major delays, kickoff meeting completed, and project plan submitted for approval
- **Crowd Sourcing Visibility and Ceiling Phase**
  - Next phase contract awarded, kickoff meeting and project plan completed
  - Began coordination to run hybrid solution on AvCam experimental site for evaluation



# Current FY21 Accomplishments

- **Tactical Turbulence Technical Transfer Package Update**
  - Integration of Convective Diagnosis Oceanic (CDO) and Cloud Top Heights (CTH) products nearly completed to enable notification of convection
  - Adding evaluation of space-based ADS-B data to enable worldwide use and enhance location accuracy
  - Still targeting joint technical transfer meeting (ROMIO also) for late summer
- **Industry Perspective**
  - Worked on completing questionnaire to resolve issues identified in peer and management reviews
  - Coordinated with National Business Aviation Association (NBAA) and Air Line Pilots Association (ALPA) on questionnaire updates
- **VFR Not Recommended (VNR) Automation Inputs**
  - Technical interchange meeting with Leidos on a new departure advisor tool they developed with functionality and human-machine interface that aligns well with WTIC VNR research
  - Updated scenarios and procedures based on dry runs
  - Drafted experiment to assess pilot risk thresholds for adverse weather

# Current FY21 Accomplishments

- **RTCA SC-206 Support**

- Completed work on DO-358B (FIS-B MOPS)
- Continued work on DO-364A (Minimum Aviation System Performance Standards (MASPS) for Aeronautical Information (AI)/Meteorological (MET) Data Link Services)

- **Increasing Weather Information Saliency**

- Completed data collection on experiment to assess saliency benefits of two options for normalizing a weather display. On going data analysis.



# Anticipated Research in FY22

## Planned Research Activities

- Complete VNR research and transition recommendations to AJR for implementation
- Complete technical transfer of ROMIO and updated Tactical Turbulence and Adverse Weather Notification
- Resolve selected rotorcraft gaps identified in Phase 1 (18 gaps presented in Fall 2020)
- Development of cockpit interface for downlinking PIREPs over ADS-B Version 3
- Gap analysis on pilot use of “non-correlated (outside performance range)” weather information
- Proof of concept studies using Starlink satellite network and crowd sourced weather information
- Expand ADS-B turbulence algorithms to scale for larger variety of aircraft and mature technical transfer approach for identified end users.
- Technical support to RTCA SC-206
- Experiment and results analysis comparing the effectiveness of weather self briefings to a specialist provided briefing



# Anticipated Research in FY22

## Expected research Products

- Initial MinWxSvc recommendations for automating VNR
- Technical transfer packages for ROMIO and for Tactical Turbulence and Adverse Weather Notification
- MinWxSvc recommendations to resolve selected rotorcraft gaps
- MinWxSvc recommendations for an interface to format PIREPs for ADS-B Version 3
- Gaps related to the use of “non-correlated” weather information
- White paper on Starlink satellite applications to enhance weather information in cockpits
- Matured ADS-B Turbulence algorithms that can be scaled to most airframes and produce turbulence data to provide benefits to selected end users
- New and updated Aeronautical / MET information data link system RTCA standards
- MinWxSvc recommendations for system design and instructions for weather self-briefing systems, and for pilot training for performing a self-briefing



# Emerging FY23 Focal Areas

- Use of “Big Data” and Artificial Intelligence to develop cockpit decision support tools to resolve gaps associated with the use of “non-correlated” weather information for pilot decision making
- Developing cockpit applications to enhance safety and efficiency for existing and new entrant aircraft using data produced by new and evolving cockpit weather technology, such as digital airborne weather radar
- Use of expanding data link bandwidth and coverage to enhance the generation, communication, and rendering of adverse weather observations and information
- Use climatology, artificial intelligence, and enhanced weather forecasting to develop more accurate classification of precipitous terrain than the current static Point Value (PPV) algorithm
- Develop technical transfer package for ADS-B Turbulence to enable operational implementation



# WTIC Program

## Research Requirements

- Develop Part 121/135 and Part 91 MinWxSvc recommendations for cockpit weather information and technology to enhance safety and efficiency, and reduce gaseous emissions.
- Sponsored by ANG-C6, ALPA, AFS, industry, airlines, NextGen, AOPA, industry, NAFI, FAA Alaska AvCams (WCAM)
- POC: Gary Pokodner, ANG-C61, 202-267-2786

## FY 2023 Planned Research

- Use of big data and artificial intelligence for cockpit adverse weather decision support tools
- Enhance pilot adverse weather decision-making via data from new and evolving weather technology
- Research applications of increased data link bandwidth and coverage to resolve gaps in cockpit weather information
- Continue to develop resolutions to identified rotorcraft cockpit weather gaps
- Enhance cockpit decision support tools using advances in climatology data, artificial intelligence, and weather forecasting

## Outputs/Outcomes

- More efficient and safer routes and re-routes to avoid adverse weather for all parts aircraft
- Reduced delays due to enhanced aircraft observations and distribution of adverse weather information
- Enhanced pilot weather training and adverse-weather experience due to augmented and virtual reality
- Cockpit decision support “toolbox” to assist in using “non-correlated” weather information
- New and updated FAA and RTCA standards, and other guidance documents

## Out Year Funding Requirements

	<b>FY21</b>	<b>FY22</b>	<b>FY23</b>
RE&D	\$0.97M	\$0.97 M	\$0.97 M