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FAA Office of NextGen (ANG)

REDAC / NAS Ops

Review of FY2023 – 2025 Proposed Portfolio

Weather Technology in the Cockpit (WTIC)

BLI Number: A12c

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Weather Technology in the Cockpit (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

Weather Technology in the Cockpit (WTIC) Program Overview

What determines program success

- Number of standards released incorporating WTIC 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 Managers:
  Gary Pokodner
- Subject Matter Experts:
  Ian Johnson (Human Factors),
  Eldridge Frazier (Engineering Lead)
- Contract Support:
  Joe Bracken (AvMet)

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 (vis PEGASAS)
- WebManuals (via PEGASAS)
- Aspen Avionics (via PEGASAS)

Current FY23 Accomplishments

- Prepared FY22 Project Level Agreement (PLA) projects' task orders and submitted contract/grant Purchase Requests. Grants are in review, one contract still needs to be awarded. Other contracts awarded.
- Developed the Phase 1 project plan and initial experimental design to use MITRE's Digital Co-Pilot as the basis for a cockpit cognitive assist tool.
  - The primary goal of Phase 1 is to assess the feasibility and potential benefits for this tool to aggregate weather products, derive insights from the weather data, and present the weather-related insights to the pilot in an actionable manner. Also, to identify questions and tasks pilots would find most helpful.
- ADS-B Vertical Rate Turbulence – Phase 4 final report and briefing delivered and accepted
  - Algorithm performance is ready for demonstrations
  - Still some over and under estimates, but good performance identifying turbulence encounters

Current FY23 Accomplishments

- PEGASAS completed the final report for the Augmented Weather Interfaces Project (AWIP). Multiple phases/years included in the final report.
  - Evolve augmented animation support for dynamic weather information content to support GA pilot knowledge, skills and abilities
  - Improve GA pilot abilities to generate and disseminate pilot reports (PIREPs)
  - Enable stable and scalable information architectures to support augmented interface designs information access using industry partnerships (e.g. ASA)
- PEGASAS completed the final report the Helicopter Operations Weather Information (HOWI) Project
  - Provided a better understanding of the gaps and shortfalls in weather-related information available / presented in the cockpit for helicopter operations
  - Determined how causal factors attributed to weather-related incidents/accidents are influenced by those gaps and shortfalls
  - Created several BowTie and FlowTie diagrams to represent helicopter hazards related to various weather phenomena for helicopter specific missions and operations

Current FY23 Accomplishments

- Began experimental design to evaluate the utility of providing pilots with information on the weather sensor(s) that is most likely to be representative of their area of flight when there is no in-range official weather sensor
  - May include a confidence or probability rating as well
  - Using actual data collected on representativeness research
- Continued supporting and acting as the Government representative for RTCA SC-206
- Awarded follow-on to the Industry Perspective Project to get broader concurrence on gaps to address
  - An initial draft presentation has been developed and shared with the ALPA in order to receive feedback on the direction and content

Anticipated Research in FY23/FY24

Planned Research Activities

- Phase 2 Digital Co-Pilot – Incorporate selected weather decision support into digital co-pilot and perform a benefits assessment to the prototype tool
- Conduct an offline and online evaluation of ADS-B Vertical Rate Turbulence to produce turbulence information and disseminate it
- Enhance Flight Profiler to use as a preflight weather briefing tool and evaluate is impacts on a pilot's mental model of adverse weather for an entire flight plan
- RTCA SC-206 technical support
- Evaluate potential options and the utility of providing more weather observation information to pilots through the use of weather sources that are not approved (ie, mesonet information)

Expected Research Products

- Prototype Digital Co-Pilot with selected weather decision support incorporated and completion of an assessment of its utility to pilots
- Final reports of ADS-B Vertical Rate Turbulence offline and online demonstrations
- Final report on Flight Profiler assessment
- Developing inputs for RTCA standards on turbulence and data linked weather information
- Final report on crowd sourcing weather information sources research and methods to tag it quality
- Final report on potential to provide more weather observation information to cockpits

Emerging FY25 Focal Areas

- Increasing the quantity and enhancing the quality of weather observation information in cockpits to increase access to remote regions
- Providing pilots with a weather cognitive assist tool to enable effective use of more weather observation information from a broader range of sources
- Research methods of using automated tools that employ Artificial Intelligence and Machine Learning to provide an objective analysis of a crew member's performance and discover trends for better weather training (collaboration discussions ongoing with Flight Safety)
- Incorporate Extended Reality (XR) into more pilot weather scenario based training

Weather Technology in the Cockpit (WTIC)

Research Requirements

- Develop MinWxSvc recommendations for cockpit weather information and technology to enhance safety and efficiency, and reduce gaseous emissions
- Address the need for enhanced cockpit weather technology, information, and human factors principals to achieve NextGen objectives, and identify potential enhancements in a data centric national airspace system

Outputs/Outcomes

Enhanced safety, operational and route efficiency, and access via the following research outputs:

- Minimum weather service recommendations
- Inputs to standards, guidance documents, and handbooks
- Technical transfer packages to enable implementation of successful research

FY 2025 Planned Research

- Research innovative ways to provide pilots with more weather observations that enhances access to remote regions and promotes safety
- Increase use of Extended Reality to improve weather training and experiential learning
- Identify technologies to assist pilots in making safe and efficient adverse weather avoidance decisions

Out Year Funding Requirements

RE&D

FY23	FY24	FY25
$2.3 M	$2.5 M	$2.5 M