NAS Ops Subcommittee Review

Weather Technology in the Cockpit (WTIC) – Project Updates and Review of FY20 Portfolio

By: Gary Pokodner, Program Manager, Weather Technology in the Cockpit (WTIC)

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Weather Technology in the Cockpit (WTIC) - Program Description

- Research projects to develop, verify, and validate recommendations for incorporation into Minimum Weather Service (MinWxSvc) standards/guidance
 - FAR Part 121, <u>OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL</u> <u>OPERATIONS (i.e. commercial operations)</u>
 - FAR Part 135, <u>OPERATING REQUIREMENTS: COMMUTER AND ON DEMAND</u> <u>OPERATIONS AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT (i.e.</u> <u>commuter, on demand, and air taxi operations)</u>
 - FAR Part 91, <u>GENERAL OPERATING AND FLIGHT RULES</u> (includes General Aviation operations)

• The MinWxSvc is defined as:

- Minimum cockpit meteorological (MET) information
- Minimum performance standards (e.g. accuracy) of the MET information
- Minimum information rendering standards
- Enhanced weather training
- Minimum cockpit technology capability recommendations



WTIC Program Overview

Purpose

- Identify causal factors for weather-related General Aviation (GA) safety risks/hazards
- Identify causal factors for Part 121/135 adverse weather safety risks/hazards and NAS operational inefficiencies (current and NextGen)
- Recommend MinWxSvc(s) to resolve/reduce identified safety risks and NAS inefficiencies
- Recommend enhancements to pilot MET-training to resolve training shortfalls





WTIC Program Overview

Benefits

- 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

Tracking

 Developing spreadsheet to track gaps, operational shortfalls, and MinWxSvc(s) recommendations



Open NAS Ops Recommendations and Action Items

• No NAS Ops Open Action Items or Recommendations



CURRENT AND PLANNED ACCOMPLISHMENTS – HIGHLIGHTS <u>ON SELECTED</u> PROJECTS



Wind Study Phase 6

Project Description

 Support efforts by RTCA SC-206 to develop "Guidance for Data Linking Forecast and Real-Time Wind Information to Aircraft" by performing needed research. Continue to evaluate industry proposed enhancements to wind handling in Flight Management Systems (FMSs) to support NextGen applications and to align industry with the needs of developing NextGen applications that are impacted by wind information errors

Project Accomplishments

- Developed and released DO-369 on data linked wind information
- Working to resolve selected gaps based on review of 4DTBO demonstration and flight demo reports (NASA 19-day test on IM)
- Began evaluations of FMS enhancements to support Low-Altitude RTAs
- Developing research plan to enable strategic versus tactical pilot-originated reroute requests due to adverse winds

- Phase 6 final report
- Complete evaluation of future FMS enhancements to support RTAs down to Final Approach Fix
- Complete research planning for strategic reroute requests due to adverse winds



Remote Oceanic Meteorological Information (ROMIO)

Project Description

- Operational demonstration to evaluate feasibility to uplink convective weather information to aircraft operating over oceanic & remote regions.
- Explore strategies and evaluate benefits/impacts of using updated cloud-top height (CTH) and convective diagnosis oceanic (CDO) weather graphics on flight deck, by OCCs, & by Airline Operations Centers (AOC)

Project Accomplishments

- Pilot training courseware updated, ATC training courseware being updated
- Incorporated ERAU NextGen lab and AAtS infrastructure into test architecture
- Flew three operational flights as a demonstration shakedown. Identified problems being addressed (aircraft position, EFB Aircraft Viewer being updated)
- VA Tech updated their models to support ROMIO benefits analyses

- Delta participating pilots (230) training to begin in March, first data collection flights immediately after training
- American and United data collection flights to begin after rack tests and training



BACKUP Why Two Convective Products?



- Two products better characterize convective storm
- CTH gives full extent of cloud cover and height
- CDO shows location of updraft/lightning hazards

Crowd Sourcing

Project Description

 Use commercially available crowd sourcing infrastructure to produce visibility information from Alaska webcams. Store and distribute resulting information via cloud storage.

Project Accomplishments

- Phase 2 final report and briefing completed
- Phase 3 kickoff/scope meeting
 - Crowd sourcing ceiling at 5 sites in Alaska
 - "Photo PIREP" digitized and georeferenced
- Collaboration with MITLL edge detection (AWRP)
- Lab analysis of updates and automation inputs (edge detection)
- Briefed project at Alaska Wx Workshop
 - Research well aligned with needs

• Planned Next Two Quarter Activities

- Assess locations provided by Alaska weather unit for feasibility to crowd source ceiling
- Evaluate impacts and performance of edge detection and ASOS as crowd inputs
- Evaluate data potential of digitized "photo PIREPS" (coverage, update rates, etc)



Source WxR Image Graphic



Weather Cells Segmented and Georeferenced (Displayed in Google Earth)

Crowd Sourced Visibility

• Summary of Phase 2 Findings

- 81.4% of the visibility results were within 20% of the ASOS visibility
- 16.5% were between 20% and 50%
- 2% were more than 50% from ASOS visibility
 - Many large variations were due to camera placement issues
- ASOS results may not always provide maximum utility to pilots in "challenging" visibility conditions
 - Pilot assessments of visibility conditions varied greatly
- Some cameras are not good choices for crowd sourcing
- Mechanical Turk provided large pool of workers, but participants varied so difficult to keep rated workers

NOTE – Benefits assessment results previously reported



Susan Hoshaw Vice President EVERTS AIR

RE: AACA Annual Convention & Trade Show,

Scott Habberstad Secretary ALASKA AIRLINES

> Wilfred Ryan Treasurer RYAN AIR

Danny Seybert Past President PENAIR

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> Mike Laughlin REGAL AIR

Norman Chance Sky Airparts International

Chuck Miller WINGS OF FREEDOM

Dennis Parrish CONOCO PHILLIPS

> Executive Director

Jane Dale ALASKA AIR CARRIERS ASSOCIATION The Alaskan aviation industry invites you to join us at the AACA Annual Convention & Trade Show, May 2nd or 3rd, 2018 at a time TBD at the Ted Stevens International Airport.

We would hope that you can speak during the convention, where you will have interaction between the air carriers on topics related to research to further support the aviation industry.

As you are aware, Alaska is deficient in infrastructure yet over 82% of the communities rely entirely on aviation for transportation. As a result, Alaska often serves as the test bed for new technology. AACA is thrilled to learn about the advances being made in edging, the possibilities associated with publishing radar photos of areas not currently served and others. We would hope you might share your progress with AACA members on May 2 or 3,2018.

If you have questions about the format or other, please don't hesitate to call AACA at (907)277-0071 or email at aaca@alaskaaircarriers.org. This is a great opportunity to meet with the Alaska Air Carriers membership.

Thank you for considering our invitation and the potential donation of your valuable time.

Sincerely,

Matt Atkinson President, Alaska Air Carriers Association

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Jane Dale Director, Alaska Air Carriers Association



Backup

Part 91 Projects - Tech Center

Project Description

• Multiple GA projects to develop resolutions to previously identified gaps

Project Accomplishments

- Completed assessment, analysis, and draft report on FIP/CIP current renderings usability in cockpits (Supports RTCA 206 DO-358 update)
 - Began planning assessment of optimized renderings based on MinWxSvc
- VFR Not Recommended (VNR) scenarios selected and being reviewed by SMEs, weather archived, coding nearly complete for online accessibility. Identifying test locations and pilot participants.
- Completed slant range study and draft final report. 50% improvement by pilots in judging visibility versus current estimating techniques.

- Data collection for VNR project and preliminary analyses
- Development of FIP/CIP enhanced renderings, complete demonstration plan, IRB, and test design including simulator software (reusing old scenarios)
- Publish slant range report. AOPA interested in doing an article for outreach.
- Develop plan for "Time to Contact Adverse Wx" experiment (FY18 PLA)



Part 91 Projects - PEGASAS

Project Description

Multiple GA projects to develop resolutions to previously identified gaps

Project Accomplishments

- Assessed current market PIREP and PIREP comparable applications and evaluated against issues identified by AOPA survey and NTSB (Pugh matrix)
 - Presented enhanced PIREP option of prepopulating using "NWS requested" locations during flight planning at AK Wx Workshop with positive responses from users and NTSB
 - Planning HITL to evaluate "simulated" enhanced PIREP before prototyping
- Began implementing virtual reality in weather standard to enable "experiencing" Wx phenomena
- Completed experiential education module on deteriorating visibility
- Phase 3 draft final report delivered and reviewed, awaiting final delivery

- Complete PIREP analysis and develop "simulation" approach for quick impact assessment
- Finalize visibility experiential module for distribution/implementation
- Complete prototype virtual standard/handbook on weather phenomenon



RTCA SC-206 DFO and Human Factors Research

- Modifying DO-358 the Minimum Operational Performance Standards for Flight Information Services Broadcast (FIS-B) data using Universal Access Transceiver to include the six new weather products:
 - Lightning; Turbulence; Icing; Cloud Tops; Center Weather Advisory; Graphical Airmen's Meteorological Advisory
 - Correct any errors or deficiencies in DO-358 reported to SC-206 or found by SC-206 during the course of the DO-358 update and also advise FAA Surveillance Broadcast Service PMO of any system issues found during the update
 - Anticipated completion Date December 2018
- Evaluating rejoining EUROCAE Working 76 to expand DO-364 MASPS for AI/MET Data Link Services
 - Address AI & MET information input and associated quality to support aircraft/aircrew intended use
 - Harmonize DO-364 OSA and OPA with EUROCAE service descriptions



Transition to Implementation Accomplished

WTIC Output/Product	Recipient	How WTIC Output Used
Wind Trade Studies	RTCA S-206, 227, 186 NextGen Operations (AIM, TBO) Industry (FMS manufacturers)	 RTCA Wind Guidance Document (DO-369) July 13, 2017 Development of standards and performance requirements impacted by winds
MinWxSvc Recommendation Final Reports	RTCA SC-206 FAA Certification	MOPS for FIS-B with UAT (invoked by TSO-157B)
Human Factors Research Papers and Final Reports	SAE	ARP-5740
NEXRAD Scenario-Based Training Module	FAA AFS-850, AVS	Training on FAASTeam Website
Private Pilot written exam weather knowledge test questions	AFS-630	Updated weather knowledge questions on exam and practice questions
General Aviation gap analysis final reports and some initial MinWxSvc recommendations to resolve them	GA Pilot Community (AOPA) Aviation Industry	 Magazine articles including: FAA Safety, AOPA, Avionics News, Managing the Skies, Pilots Guide to Avionics, Journal of Human Factors, Air Traffic Management Presentations to pilots and industry at FPAW, Sun N Fun, NBAA, conferences
Eddy Dissipation Rate (EDR) Uplink and Technical Transfer Package	Delta Airlines, Boeing, Communications Providers	 Delta pilots using EDR viewer Boeing selling EDR as option in ACMS package (sold to United already)



Transition to Implementation Plans

WTIC Output/Product	Recipient	How WTIC Output Used
Weather Information Latency Trainer (WILD)	FRASCA, Redbird, other simulator manufacturers, AFS- 600	Incorporate WILD capabilities into commercial trainers and simulators
WILD Training Curriculum	Schools, FAASTeam Website	Provide training on weather latency with or without a WILD or WILD capability
Psychometrics of test questions	Flight Standards (AFS-630)	Identify level of pilot weather knowledge to be tested
Crowd Sourced Visibility Information (Potentially Wind Also)	FAA Alaska Webcam Site (Prototype site first) National Weather Service (based on information quality)	Populate visibility and wind fields in new Weather InSight configuration
Tactical Turbulence Notification MinWxSvc Recommendation	FAA Flight Standards Airlines Industry	Weather product application and/or standard defining performance
Mobile MET MinWxSvc Recommendations	Industry Pilots	 Provide Mobile app developers recommendations to support pilot decision making. Educate pilots on app features to look for.
Cloud Top Heights and Convective Oceanic Diagnostic	FAA Flight Standards, Airlines	Enhanced decision making an efficiency in oceanic regions with respect to convection

PROFICIENCY: INTO THE WILD PILOTS GET WAKE-UP CALL ABOUT WEATHER

By David Hughes

Having datalinked in-flight weather information is a major safety advancement, assuming it's utilized correctly. Outdated or unnoticed weather information can lead to accidents. To help general aviation pilots understand how easy it is to misinterpret weather information displayed in the cockpit. FAA researchers developed a simulation that demonstrates some of the most dangerous pitfalls.

Transition via Outreach

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Weather Forecasting Deserves Some Credit For **Eve-Popping Aviation Safety Headlines**

Under funding from the Federal Aviation Administration's Aviation Weather Research Program and Weather Technology in the Cockpit Program, an automated in situ turbulence reporting capability was developed at NCAR that allows for more accurate and timely information on turbulence experienced by aircraft in flight. The Eddy Dissipation Rate (EDR) algorithm uses data from aircraft

Participate in Cockpit Weather Display Training at AirVenture



•The FAA has begun research to help answer that question and measure the present effectiveness of "VFR not recommended." The agency's Weather Technology in the Cockpit (WTIC) program has made this research a priority as the FAA prepares to award its Future Flight Service Program contract in 2018. AOPA believes that making a decision about the usefulness of "VFR not recommended" should be a top-priority task for the FAA's flight service.

Avionics and Air Traffic Seminars and Events

There are several avionics-focused trainings, events and panel discussions occurring next at AirVenture this year. Here are some of that you may find interesting.

Cockpit Weather Display Training

An ongoing feature at AirVenture will be "The Partnership for the Enhancement of GA Safety, Accessibility, and Sustainability (PEGASAS) Weather Information Latency Demonstrator (WILD)" located in the Pilot Proficiency Center. The project is one of 20 under the PEGASAS umbrella and aims to address the number of weather-related accidents in general aviation, 80% of which are fatal, according to EAA.

Pilots will be able to fly the WILD simulator, which provides a demonstration of how information on some of the most common cockpit weather displays are delayed in comparison to actual airspace conditions. The FAA is looking to use the findings of the PEGASAS "Weather Technology in the Cockpit (WTIC) project" to define minimum weather service standards and developing educational and technological solutions that will help improve safety for general aviation pilots



Federal Aviation Administration

SHOC PLOT'S GANDA DID YOU NOTICE YOUR DESTINATION AIRPORT **JUST WENT IFR?** HUMAN FACTORS VFR 'Not Recommended' Research Underway FAA's weather technology in the cockpit

STRIA

ERGONOMICS

researchers are currently evaluating Visual Flight Rules (VFR) not recommended - or VNR for short - in order to make the statement more effective for pilots. The VNR statement is an advisory that flight service station specialists use during weather briefings when the forecast includes weather phenomena that may prevent visual flight conditions.

The goal is to make VNR more objective, description

FY20 Portfolio

Plan Based on Current Funding Estimates

• Due to Reduced Funding:

- Portfolio will focus on completing ongoing projects and projects that can be worked in smaller phases
 - Trying to have small projects still answer selected research questions with an output worthy of transition to stakeholders
- Reduced ability for outreach and transition of research
- Delaying start of new projects to resolve gaps not yet being addressed
- Reduced effort in producing training materials
- No contractor support of RTCA (transition)
- Cancelled assessment of pilot perspectives on implemented NextGen
 operations and impacts of automated Wx information to the cockpit
 - Includes NextGen environment verification
- Indefinite delay of producing WTIC Far Term ConOps



FY20 Portfolio

Portfolio and Planned Accomplishments

- Trade studies to identify resolutions to helicopter and special GA unique gaps (gap analysis in FY18)
- Identification of en-route objective criteria to support strategic reroute requests due to adverse weather (smaller phases spread out from FY17-FY21)
 - Begin development of MinWxSvc recommendations to support climate optimized aircraft trajectories
- Release of Version 1 set of Minimum Weather Service recommendations (culmination of ongoing/previous GA rendering work and recommendations)
- Part 135/91 assessment of MRMS versus NEXRAD (FIS-B may switch to MRMS from (NEXRAD) and MinWxSvc recommendations (assumes planning accomplished in FY19)

