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)

Date: March 27, 2018
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, OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS (i.e. commercial operations)
  - FAR Part 135, OPERATING REQUIREMENTS: COMMUTER AND ON DEMAND OPERATIONS AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT (i.e. commuter, on demand, and air taxi operations)
  - FAR Part 91, GENERAL OPERATING AND FLIGHT RULES (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

Budget

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<thead>
<tr>
<th>Year</th>
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<tr>
<td>FY17</td>
<td>$3.12M</td>
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<td>FY18</td>
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<td>FY19</td>
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<tr>
<td>FY20</td>
<td>$0.939M</td>
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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 ON SELECTED 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

• **Planned Next Two Quarter Activities**
  • 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

• **Planned Next Two Quarter Activities**
  • 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
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)
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
RE: AACA Annual Convention & Trade Show,

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

Jane Dale
Director, Alaska Air Carriers Association
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.

• Planned Next Two Quarter Activities
  • 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

• **Planned Next Two Quarter Activities**
  • 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

<table>
<thead>
<tr>
<th>WTIC Output/Product</th>
<th>Recipient</th>
<th>How WTIC Output Used</th>
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</thead>
<tbody>
<tr>
<td>MinWxSvc Recommendation Final Reports</td>
<td>RTCA SC-206&lt;br&gt;FAA Certification</td>
<td>MOPS for FIS-B with UAT (invoked by TSO-157B)</td>
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<tr>
<td>Human Factors Research Papers and Final Reports</td>
<td>SAE</td>
<td>ARP-5740</td>
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<tr>
<td>NEXRAD Scenario-Based Training Module</td>
<td>FAA AFS-850, AVS</td>
<td>Training on FAASTeam Website</td>
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<tr>
<td>Private Pilot written exam weather knowledge test questions</td>
<td>AFS-630</td>
<td>Updated weather knowledge questions on exam and practice questions</td>
</tr>
<tr>
<td>General Aviation gap analysis final reports and some initial MinWxSvc recommendations to resolve them</td>
<td>GA Pilot Community (AOPA)&lt;br&gt;Aviation Industry</td>
<td>1. Magazine articles including: FAA Safety, AOPA, Avionics News, Managing the Skies, Pilots Guide to Avionics, Journal of Human Factors, Air Traffic Management&lt;br&gt;2. Presentations to pilots and industry at FPAW, Sun N Fun, NBAA, conferences</td>
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<tr>
<td>Eddy Dissipation Rate (EDR) Uplink and Technical Transfer Package</td>
<td>Delta Airlines, Boeing, Communications Providers</td>
<td>1. Delta pilots using EDR viewer&lt;br&gt;2. Boeing selling EDR as option in ACMS package (sold to United already)</td>
</tr>
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<td>WTIC Output/Product</td>
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<td>How WTIC Output Used</td>
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<tr>
<td>Weather Information Latency Trainer (WILD)</td>
<td>FRASCA, Redbird, other simulator manufacturers, AFS-600</td>
<td>Incorporate WILD capabilities into commercial trainers and simulators</td>
</tr>
<tr>
<td>WILD Training Curriculum</td>
<td>Schools, FAASTeam Website</td>
<td>Provide training on weather latency with or without a WILD or WILD capability</td>
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<tr>
<td>Psychometrics of test questions</td>
<td>Flight Standards (AFS-630)</td>
<td>Identify level of pilot weather knowledge to be tested</td>
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<tr>
<td>Crowd Sourced Visibility Information (Potentially Wind Also)</td>
<td>FAA Alaska Webcam Site (Prototype site first) National Weather Service (based on information quality)</td>
<td>Populate visibility and wind fields in new Weather InSight configuration</td>
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<tr>
<td>Tactical Turbulence Notification MinWxSvc Recommendation</td>
<td>FAA Flight Standards Airlines Industry</td>
<td>Weather product application and/or standard defining performance</td>
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<tr>
<td>Mobile MET MinWxSvc Recommendations</td>
<td>Industry Pilots</td>
<td>1. Provide Mobile app developers recommendations to support pilot decision making.</td>
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<td>2. Educate pilots on app features to look for.</td>
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<tr>
<td>Cloud Top Heights and Convective Oceanic Diagnostic</td>
<td>FAA Flight Standards, Airlines</td>
<td>Enhanced decision making an efficiency in oceanic regions with respect to convection</td>
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Transition via Outreach

Weather Forecasting Deserves Some Credit For Eye-Popping Aviation Safety Headlines

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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)