REDAC / NAS Ops

Review of FY 2018 Proposed Portfolio

Weather Technology in the Cockpit (WTIC)

BLI Number: 111140

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Weather Technology in the Cockpit (WTIC) - Program Description

- Research projects to develop, verify, and validate requirements for incorporation into Minimum Weather Service (MinWxSvc) standards
  - 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 to resolve/reduce identified safety risks and NAS inefficiencies
• Recommend enhancements to pilot MET-training to resolve training shortfalls

Budget

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<th>FY15 (funded)</th>
<th>FY16 (funded)</th>
<th>FY17 (request)</th>
<th>FY18 (request)</th>
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<td>Budget</td>
<td>$3.1M</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 cockpit MET information that allows for 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 safety resulting from the resolution of pilot MET-training shortfalls
How do we know the program is working:

- MinWxSvc recommendations incorporated into FAA and commercial standards and other guidance documents
- Industry incorporates MinWxSvc recommendations
- Reduction/resolution of identified MET information in the cockpit gaps
  - Potentially measured benefits with associated operational shortfalls (i.e. less injuries due to turbulence encounters)
- Specific outcomes:
  - Enabled data linked near-real time turbulence information to the cockpit
  - Harmonized data linked service capabilities, technologies, and interoperability of MinWxSvc information services globally
  - Wind and temperature requirements to support NextGen 4-D navigation operations
WTIC - Contractors and Labs

• Part 91 Projects
  • Tech Center Contractors and AWDE Lab
  • NCAR/UCAR
  • PEGASAS
  • Rockwell Collins
  • ATSC
  • ERAU

• Part 121/135 Projects
  – SE2020
  – NCAR/UCAR
  – MITRE
  – MITLL
  – ATAC – METRON Inc.
Part 121/135 Projects – Recent Accomplishments (Partial List)

• Tactical Turbulence Notification
  – Human Over the Loop #2 demonstration of benefits in cabin crew preparation and coordination, and initiation of route change communication
  – Latency acceptable

• Convective Weather Notification
  – Human in the Loop (HITL) demonstration of more timely adverse weather avoidance decisions especially with Boeing pilots (versus Airbus)
  – Anecdotally EFB weather with ownship caused decreased trust in onboard weather radar due to differences in displayed information
Part 121/135 Projects – Recent Accomplishments (Partial List)

• Phase 4 Wind Study research plan
  – Developing additional interval management (IM) and advanced IM trade spaces
  – Assessing impacts of increasing FMS wind altitudes from 4 to 9
  – Assessing accuracy of available “truth winds” for future wind analyses

• Identified numerous gaps of cockpit MET information supporting operations in oceanic airspace
  – Need to quantify impacts of gaps and benefits pool
FY18 - WTIC Part 121/135 MinWxSvc

Research Requirement

• FAA goals to enhance NAS efficiency, safety, and capacity, and to reduce greenhouse emissions
• Research Question: What gaps in MET information in the cockpit are safety risks or causal factors in reducing NAS efficiency or capacity?
• Requirement is to identify and resolve operational inefficiencies (current and NextGen) and safety risks attributable to MET information in the cockpit gaps
• Sponsors/Collaborations: AFS, AVS, NextGen

Outcome and Implementation

• Outcome supported: FAA goal to increase NAS operational efficiency and capacity in current and NextGen operations, and to enhance overall safety
  • Develop recommendations for a Part 121/135 MinWxSrc that resolves MET information in the cockpit gaps
• Benefits resulting: Resolution of MET information in the cockpit gaps contributes to enhanced NAS efficiency and capacity, and resolves safety risks attributable to the information gaps

FY18 Outputs

• Plan for flight demonstration of tactical turbulence notification and method of selecting notified aircraft
• Identification of cockpit technology advancements with potential to enable NAS efficiency increases
• Updated functional analysis using updated ConOps and assessment of impacts of NextGen far term concepts on Version 1 MinWxSvc recommendations
• Demonstrated integration of Nav and flight (inc Wx)) information into pilot decision support tools
• MinWxSvc recommendations to resolve selected oceanic airspace gaps
• Support RTCA SC-206 document updates to harmonize AI and MET services with EUROCAE
• Identification of benefits pool for providing MET uncertainty information in the cockpit

FY18 Planned Expenditures

• Approximately $2.3M
Part 91 Projects – Recent Accomplishments (Partial List)

• Flight Standards formally accepted 100 MET questions for inclusion in the pilot written exam

• Project plan for Phase 2 research to demonstrate crowd source processing and cloud technology
  – Identified Bayesian algorithm for determining crowd size(s)
  – Identified candidate cameras for images to process

• Phase 2 research on gaps and causal factors of inadvertent flight into IMC
  – Generic weather training provided no measurable benefit
  – Shortfalls identified included over-reliance on technology, time to decide, and misperception of risks
Part 91 Projects – Recent Accomplishments (Partial List)

• Evaluation of weather forecast uncertainty information in the cockpit impacts on pilot decision making
  – No benefit in pilot decision making was demonstrated
  – Risk assessment tool used to convey uncertainty outperformed pilots indicating tool has potential to provide a benefit
    • Cumulative risk/uncertainty difficult to mentally calculate
  – Rendering of tool and insufficient training on tool may have impacted demonstration results

• Developed database of accident reports for performing detailed trend analysis on extensive list of keywords
  – Developed initial immersive training for selected trend items
Part 91 Projects – Recent Accomplishments (Partial List)

- Completed development of PC-based latency trainer and associated training materials
  - Plan to use at Sun ‘N Fun Fly In and Expo
  - Trainer being provided to Embry Riddle Aeronautical University (ERAU)
**FY18 - WTIC GA MinWxSvc**

**Research Requirement**
- FAA goal is to lower the GA accident/incident rate
- Research Question: What gaps in MET information in GA cockpits and shortfalls in GA pilot MET training are safety risks?
- Requirement is to define a minimum weather service for GA cockpits to resolve MET information gaps identified as safety risks, and to resolve shortfalls in pilot weather training and test questions
- Sponsors/Collaborations: AFS, AIR, AVS, NextGen, GA JSC, NTSB, AOPA

**Outcome and Implementation**
- **Outcome Supported:** FAA goal is to reduce the overall GA accident and incident rate by resolving safety risks before they become causal factors in GA accidents
  - Develop recommendations for a GA minimum weather service that resolve MET information in the cockpit gaps and pilot MET training shortfalls that have been identified as safety risks
- **Benefits Resulting:** More effective and consistent adverse weather decision making by GA pilots enhances GA safety and the defined minimum weather service resolves MET information gaps identified as safety hazards

**FY 18 Outputs**
- Training modules and additional test questions
- MinWxSvc recommendations for latency demonstrator capability and associated training, rendering to resolve selected gaps (i.e. change blindness), and initial crowd sourced information applications.
- Trade studies to resolve unique safety risks for special GA operations (HEMS, Alaska, etc)
- MET uncertainty information trade studies per roadmap
- Service analyses as necessary
- MinWxSvc recommendations for selected causal trends

**FY18 Planned Expenditures**
- Approximately $1M