Friends and Partners in Aviation Weather (FPAW)

"Weather Technology in the Cockpit (WTIC) – Near, Mid, and Far Term Research Status"

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Federal Aviation Administration

Presentation Overview

- Provide a brief overview of the WTIC Program, including goals and benefits
- Why do we need WTIC?
- Provide an update on WTIC current and future research initiatives
- Discuss program challenges
- Build support for the future of WTIC

WTIC Program Overview

A portfolio of research projects that support the common goal of enabling availability and enhancing the quality and quantity of meteorological (MET) information available to the aircraft to support safe and efficient commercial and general aviation operations

WTIC Goals and Benefits

- Support collaborative ATM Services philosophy to accommodate user preferences
- Enable the MET data exchange to/from the NextGen-defined Weather Common Service and its infrastructure
- Improved reaction to changing airport conditions

WTIC Goals and Benefits

- Enhanced FMS utilization of wind data
- Updated and improved MET training and MET guidance material
- Improved human factors and enhanced common situational awareness
- More efficient use of existing data link bandwidth allocated for MET
- MET data ready for full integration with cockpit decision support tools

Why WTIC?

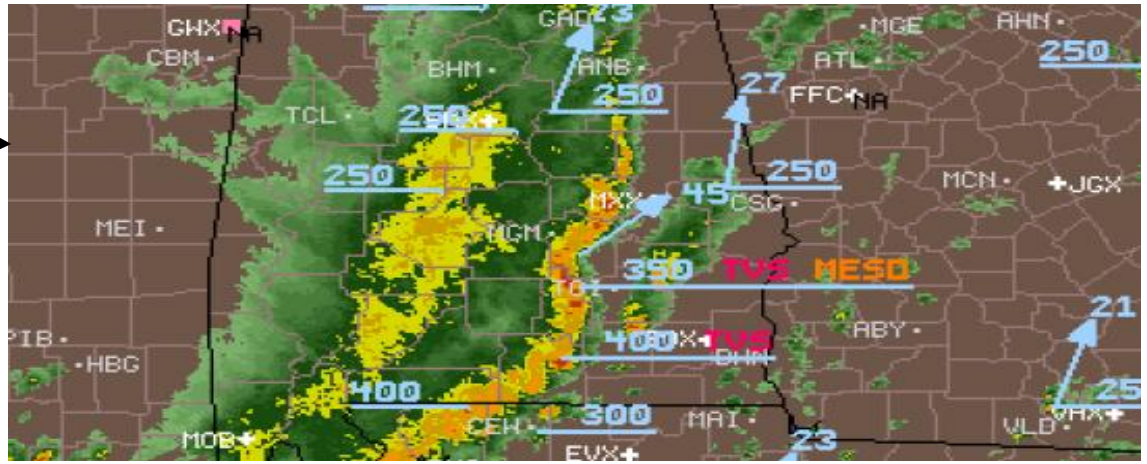
Reduce Display Inconsistencies and Information Gaps

- **Standardized MET information and presentations to reduce:**
  - Safety concerns
  - Lack of common situational awareness

Differing color legends on two METARs displays

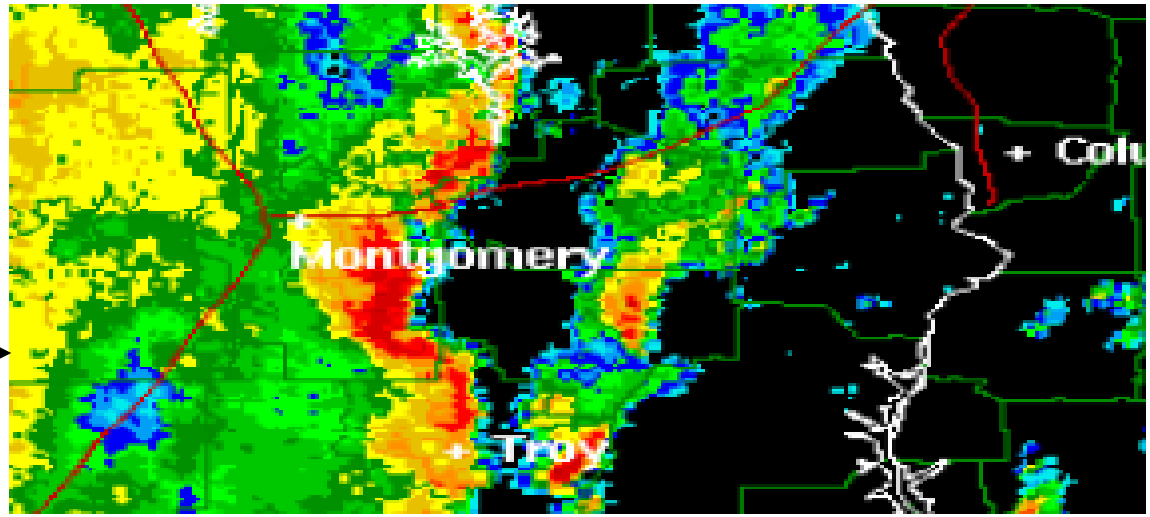
Reduce Interpretative Errors

Composite image



"Even on ground displays variances in storm presentations still susceptible to interpretive errors."

Single site image



Improve Common Situational Awareness

NTSB

SAFETY ALERT

National Transportation Safety Board

★ Thunderstorm Encounters

IFR pilots need to actively maintain awareness of severe weather along their route of flight

The problem

- Recent NTSB investigations have identified several accidents that appear to be wholly or partly attributable to in-flight encounters with severe weather.
- These accidents have all involved aircraft operating under instrument flight rules and in contact with air traffic controllers.
- Investigations show that pilots were either not advised about areas of severe weather ahead or were given incomplete information.
- Each pilot had readily available alternatives that, if utilized, would have likely prevented the accident.
- ATC training and briefings to controllers have not been sufficient to ensure that pilots receive the weather advisories needed to support good in-flight weather avoidance decisions.
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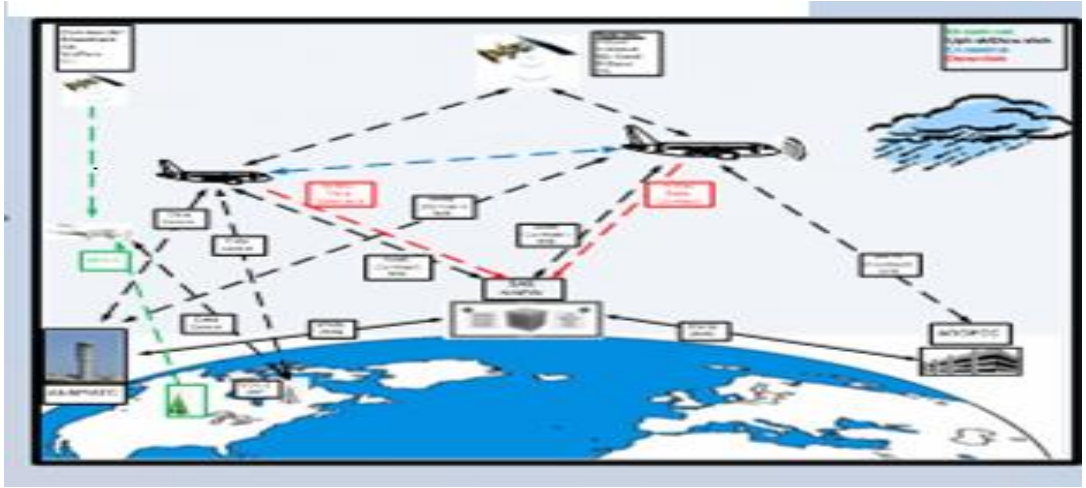
Verbalizing a ground MET display to a pilot is subject to error!

Reduce Paper in Cockpits

- Part 121 MET information typically presented in printed text
- Much of the information is extraneous
- Information can be difficult to interpret
- Latency issues exist
- Does not support cockpit decision making

Enhanced MET Data Link

- Reduce limitations outside the NAS
- Provide common MET data
- Aircraft act as a node in a MET data network
- Enhanced MET data in oceanic and remote regions
- Efficient use of MET-allocated bandwidth



Turbulence Information to the Cockpit

- **Cross link or uplink objective turbulence measurements and Eddy Dissipation Rate (EDR) to the cockpit to:**
  - Reduce occurrences of turbulence related injuries
  - Increase NAS capacity by reducing airspace avoidance attributed to severe turbulence
  - Reduce fuel consumption and emissions through optimized avoidance of severe turbulence

Support NextGen

- Enable NextGen concepts and operational improvements
- Prevent reductions in NextGen benefits resulting from adverse weather conditions

Completed and Current Initiatives

Recently Completed Research

- **Study on General Aviation (GA) Perspective**
  - User needs requirements based on pilot surveys,
  - Deficiencies in training near term and for NextGen (recommended more scenario based training)
  - Identified outdated and cumbersome FAA MET-related regulations
  - Surveys to determine pilot preferences for weather technology

Recently Completed Research

- **Very High Frequency (VHF) Digital Link Mode 2 (VDLM2) Laboratory Demonstration**
  - Feasibility of data linking graphical turbulence and icing products directly to cockpits using VDLM2
  - Demonstrated that full channel utilization is required to send full products
    - Since full channel utilization is deemed unrealistic, compression or scaled-down products would be needed to use VDLM2.
  - Model and analytical study verification

Current Research Projects

1. **CALLBACKs on 100 Aviation Safety Reporting System (ASRS) incident reports (Part 91 and 121)**
   - Aircraft equipped with data link capability
   - Incident identifies weather as a contributing cause
   - Trend analysis to find common attributes

2. Laboratory assessment on the impacts of non-standardized MET presentations

- Quantify GA pilot decision making with non-standardized data
- Results to served as baseline to assess future changes
- Human Factors parameters to be measured
- Results to prioritize and target WTIC and SAE G-10 efforts

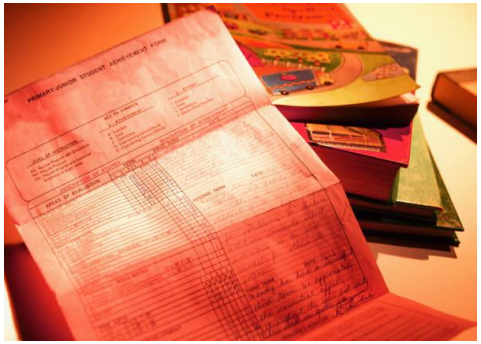
3. Human Over the Loop (HOTL) evaluation of cloud top heights

- Cloud top heights updated in-flight, in oceanic/remote
- Increase understanding of impacts to decision making in a collaborative environment
- Risk reduction for flight demonstration

4. Wind Diagnosis and Forecasting

- Research to reduce or eliminate wind errors via disseminating enhanced wind diagnosis and forecasts
- Reduce or negate wind error impacts on Trajectory Based Operations (TBO)

5. Feasibility and benefits study of up/cross-linking aircraft objective turbulence measurements



- Demonstrate feasibility of data linking turbulence measurements
- Benefits analysis
  - Reduction in occurrence of turbulence related injuries
  - Capacity benefits
  - Fuel savings

6. WTIC program actively supporting multiple RTCA committees and SAE G-10

Future Initiatives

Potential Research Projects

- Use of portable devices to enhance MET common situational awareness
- Human in the Loop (HITL) evaluation to understand how presentation of 4D convective forecast uncertainty derived from probabilistic forecasts impacts pilot decisions, safety, and efficiency
- Evaluation of translating cockpit MET presentations to weather avoidance fields
- Feasibility of exchanging color weather radar information between aircraft
- Gap analysis for MET information to be ready for direct integration with planned flight crew decision support tools

WTIC Program Challenges

WTIC Program Challenges - External

- **Different needs and solutions for General Aviation (GA) and Commercial Aviation**
- **Differentiation of FAA role and industry roles in moving forward, for example:**
  - FAA - standards and human factors
  - industry - builds displays and devices

- **Varying visions of MET information needed in cockpits**
- **Keeping equipage costs really low**
- **Common situational awareness between cockpit and ground**

WTIC Program Challenges - Internal

- **Building strong business cases for each initiative**
  - How to show specific benefits to safety, capacity and efficiency
  - “Selling” GA
- **Changes to NextGen concepts and operational improvements**
  - As some NextGen near and mid term goals slip to the right, so does the required WTIC plug in
- **Misconceptions about the program**
  - We are not building a “WTIC” to plug into the cockpit!
- **Funding**
  - Today’s challenging budget environment

Building WTIC Program Support

- **WTIC Team is actively engaging stakeholders (internal and external) to better define user needs**
  - Improved collaboration with internal FAA agencies including: Safety, Certification, Human Factors, …
- **We are always looking for your suggestions, feedback, and new research ideas**

WTIC Team – Key Personnel

- **Office of Primary Interest:** Aviation Weather Group (AJP-68) – Group Manager: Jaime Figueroa

- **Office of Primary Responsibility (OPR):** Aviation Weather Research (AWR-6850)
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