Friends and Partners of Aviation Weather (FPAW) – WTIC Program Helicopter Research

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Weather Technology in the Cockpit (WTIC) Program Overview

- Portfolio of research projects to develop, verify, and validate recommendations to incorporate into Minimum Weather Service (MinWxSvc) standards and guidance documents
- We define MinWxSvc as:
  - Minimum cockpit meteorological (MET) information
  - Minimum performance standards/characteristics of the MET information
  - Minimum information rendering standards
  - Enhanced MET training

WTIC Program – Helicopter Gap Analyses Project Overview

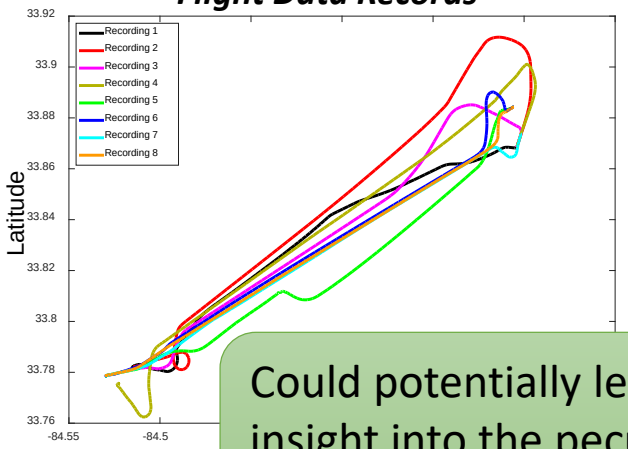
- Gap analyses by FAA Center of Excellence For General Aviation (PEGASAS) in FY19-FY20
  - Purdue, FIT, Georgia Tech, The Ohio State
- Helicopters to be addressed primarily by Part 91 MinWxSvc recommendations, and Part 135 as necessary
- Approaching research using 3 mission types: HEMS, Observation and Surveillance, and Air Tour
  - Missions should cover other variables (dispatch, Wx, etc)
- Leverage and expand Weather Safety Metrics and Bowtie Analyses from prior research

WTIC Program – Helicopter Gap Analyses Project Overview (cont)

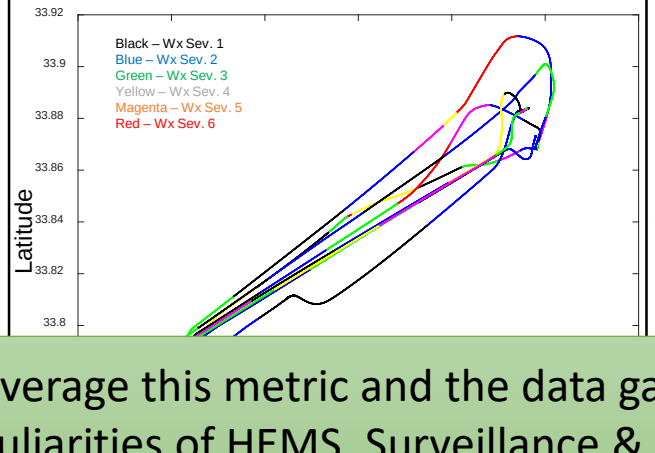
- Evaluate rotorcraft-specific weather information representativeness (including dynamics, resolution, and specificity) using relevant tools in sentinel cases
  - Based on mission scenario and associated adverse Wx (ie, hurricane)
  - Determine critical variables for decision making
- Review KSAs regarding pilot decision support and ability of technology to meet needs
  - What makes tasks cognitively challenging and interactions with technology
- Adapt GA Wx Trap Lessons for rotorcraft
- Begin gap resolutions in FY21

Proximity to Weather Safety Metric

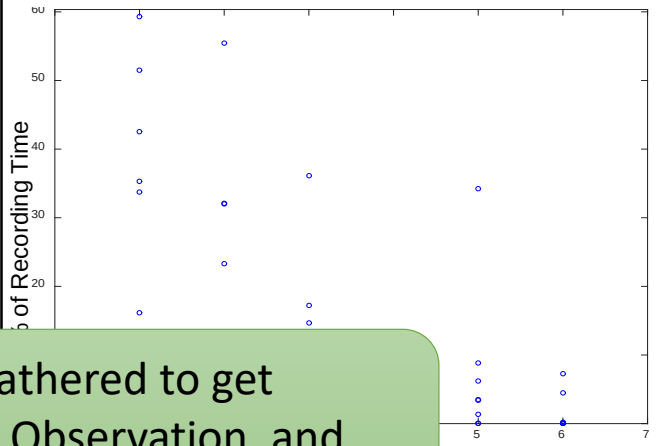
CIWS Weather Severity Levels + Flight Data Records



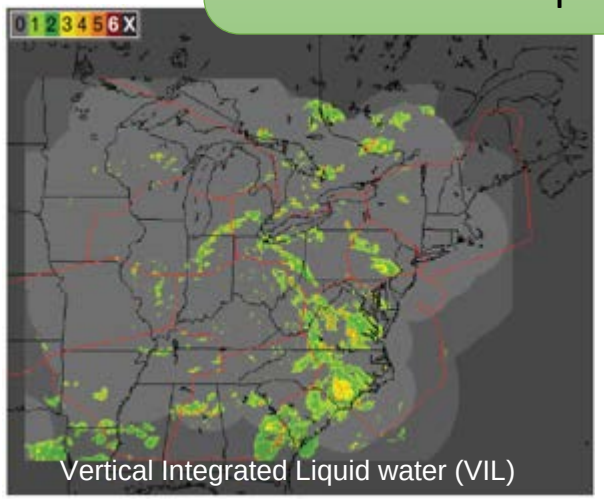
Less than ~10 flights

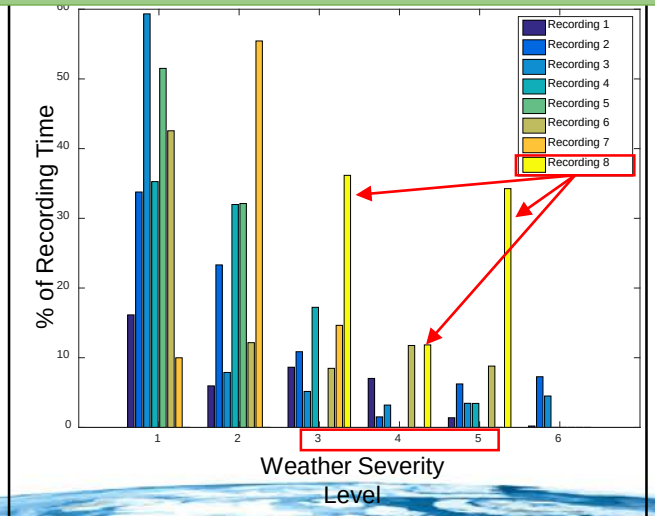


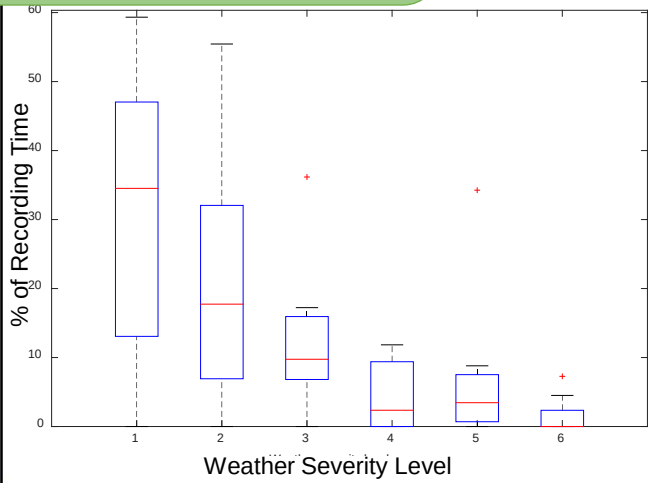
More than ~10 flights



Could potentially leverage this metric and the data gathered to get insight into the peculiarities of HEMS, Surveillance & Observation, and Air Tour with respect to various weather phenomena

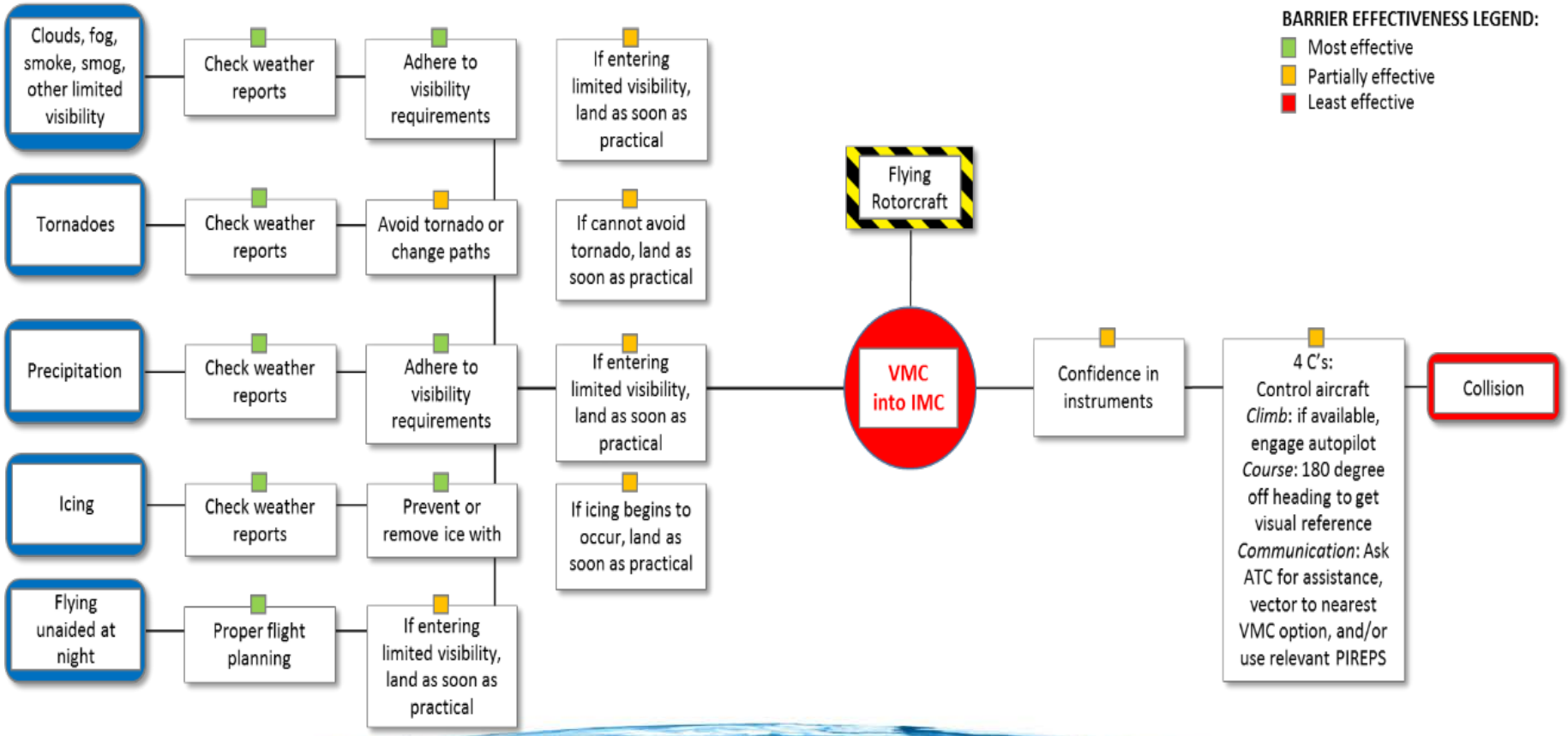






Bowtie Analysis

- Left-hand side shows threats that could lead to hazard or safety event and proactive barriers that the pilot could employ to reduce the risk of encountering that event
- Right-hand side assumes that the safety event has been encountered and shows reactive barriers that could be applied to reduce the risk of encountering potentially dramatic consequences



Wx Trap Lesson-1: Decision Making (VFR cross-country – experienced pilot)

Scenario

- Pilot of a small single engine aircraft receives preflight weather brief (online or FSS) for a VFR cross-country flight.
- A review of TAFs and METARs indicates that VFR conditions prevail along the route. After departure, pilot begins to encounter MVFR conditions due to lower ceilings than expected.
- The pilot uses in-cockpit weather technologies and finds that VFR conditions are at the destination. Pilot also does not see any precipitation on radar and feels that with in-cockpit weather technology s/he can avoid any IFR conditions.
- The flight eventually enters IMC, and the pilot has to work with ATC to get help.

Lessons Learned

- Proper use of in-cockpit weather technology is essential. Clouds do not show on Datalink radar; the METAR does not tell the entire in-flight weather situation.
- Actual conditions are more reliable than predicted or reported conditions with in-cockpit weather technology.

Usable Product

- *Experiential Education Module*: Estimating Visibility – to help improve decision-making when faced with deteriorating visibility (VFR into IMC). **Location on PURR**
- *Weather Information Latency Demonstrator (WILD)*: Flight in deteriorating weather conditions in Alaska. **Location on PURR**

Key Points:

- **Reported or predicted weather information is less reliable than actual conditions.**
- **Pilots should be better aware of the limitations of inflight weather technology products.**

Helicopter Project Overview – Draft Research Questions (Samples)

- How significant are the differences from the horizontal wind observed by surface stations and the 3D wind that can be experienced prior to touchdown?
  - Is using surface wind observation (ie, wind sock) suitable to assess conditions aloft for approach?
  - What are the gaps in wind information available to helicopter operations?
  - Is safe operation being ensured by ONLY observing surface/horizontal wind?
  - Are there training issues?

Helicopter Project Overview – Draft Research Questions (Samples)

- What sources provide the most utility to helicopter pilots for adverse weather conditions (ASOS, wind socks, etc)?
  - Do any of these systems provide misleading information (ie, wash influencing wind sock position)?
  - Does new technology have potential applications to better advise helicopter pilots of adverse weather conditions?
- Are there “personal techniques” used to ascertain weather conditions based on proximate landing sites, etc? If so, what are they and associated gaps?

WTIC Helicopter Related Research – Crowd Sourcing Wx Information

Overview: The hybrid system integrates image processing assessments and human assessments into a composite visibility assessment.

- The primary expected benefit of the hybrid system is to provide an efficient and cost-effective method for visibility using cameras.
- The image processing visibility provides a cost-effective and efficient method for assessing most of the images.
- The human visibility assessment provides a method for assessing the difficult images that the image processing is challenged to produce a quality result.

Next Steps:

- Analysis and Algorithms update, including determine appropriate “triggers” for machine assessment vs. human expert assessment
- Develop interface for selective crowd (expert) assessment.
- Determine appropriate operational usage of output.

Crowd Sourcing Wind, Ceiling, and Forward Looking Radars Information

- Additional Crowd Sourcing Research Continuing in FY19
  - Successful feasibility study using Harris Helios product and analytics to calculate wind speed and direction via a camera pointed at a wind sock
    - Harris planning to participate in visibility demonstration using experimental Avcams Plus website
  - Mature preliminary technique to produce ceiling information to confirm feasibility, utility, and applicability
  - Evaluate potential and technical parameters to crowd source cockpit Wx info (Wx radar, winds, temperature, etc.) that provides utility to pilots, and develop lab demonstration
    - Prior research demonstrated proof of concept

Questions