Strategies of Pre-flight briefing for Weather: General Aviation

Beth Blickensderfer, PHD

Embry-Riddle Aeronautical University

Daytona Beach, FL

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Overview

- Background and purpose of the study
- Method
  - Participants
  - Materials
    - Scenarios
    - Self-briefing tool
    - Measures
- Results
- Conclusion

Team Members

- **Beth Blickensderfer**, Human Factors, ERAU; PI
- **Tom Guinn,** Meteorology, ERAU; Co-PI
- **Bob Thomas,** Aeronautical Science, ERAU; Co- PI

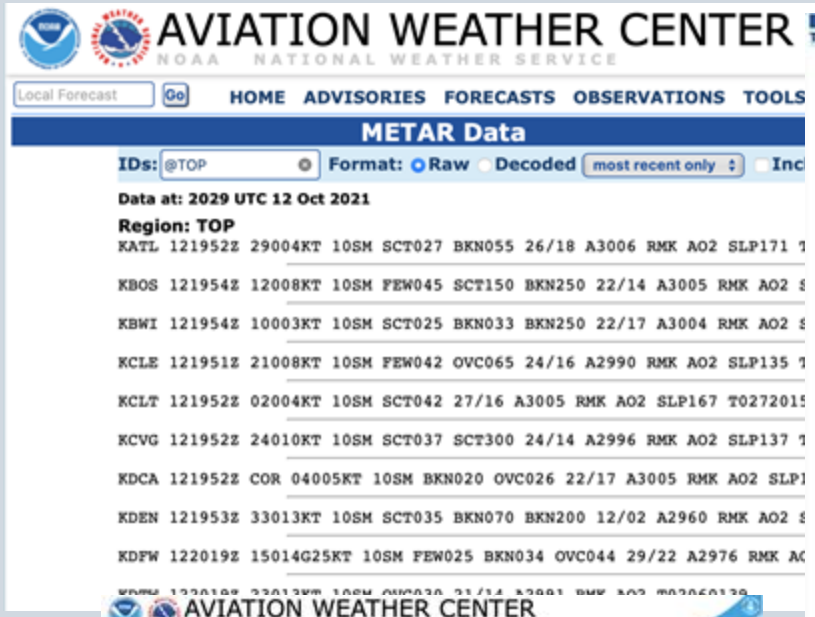
Graduate Research Assistants

- **Amber Cole**, Human Factors, ERAU; GRA
- **Cassandra Domingo**, Human Factors, ERAU; GRA
- **John Kleber**, Human Factors, ERAU; GRA
- **Vanesa Miksa,** Human Factors, ERAU; GRA; **CFII**

New additions:
Sarah Glickman
Jaia Huggins
Leo Materne
Stephen Woods

FAA

- **Ian Johnson,** FAA Project Manager; Technical POC
- **Gary Pokodner**, FAA WTIC Program Manager


AVIATION WEATHER CENTER
NOAA NATIONAL WEATHER SERVICE
Local Forecast
Go
HOME ADVISORIES FORECASTS OBSERVATIONS TOOLS
METAR Data
IDs: @TOP
Format: Raw Decoded
most recent only
Data at: 2029 UTC 12 Oct 2021
Region: TOP
KATL 121952Z 29004KT 10SM SCT027 BKN055 26/18 A3006 RMK AO2 SLP171
KBOS 121954Z 12008KT 10SM FEW045 SCT150 BKN250 22/14 A3005 RMK AO2
KBWI 121954Z 10003KT 10SM SCT025 BKN033 BKN250 22/17 A3004 RMK AO2
KCLE 121951Z 21008KT 10SM FEW042 OVC065 24/16 A2990 RMK AO2 SLP135
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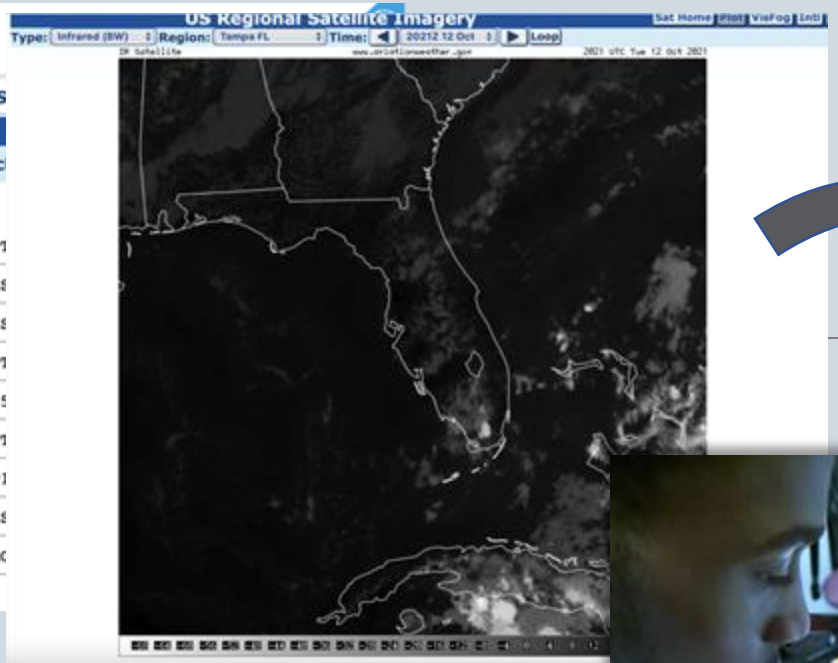
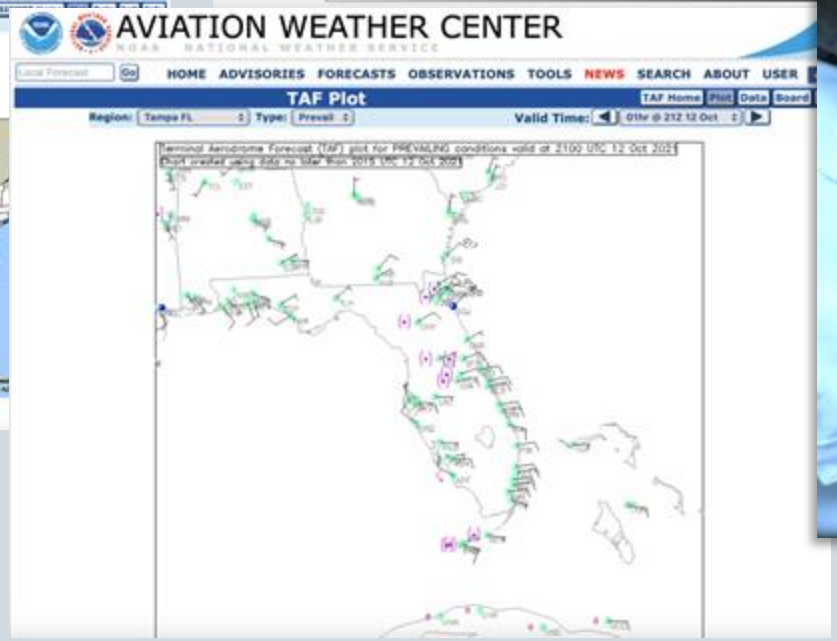
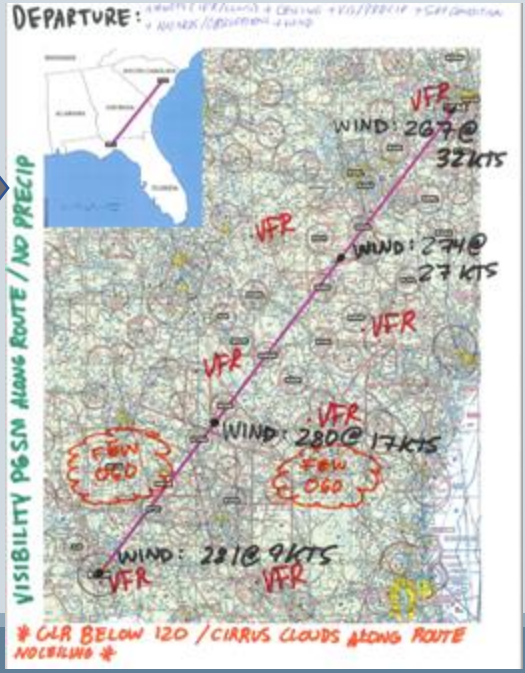
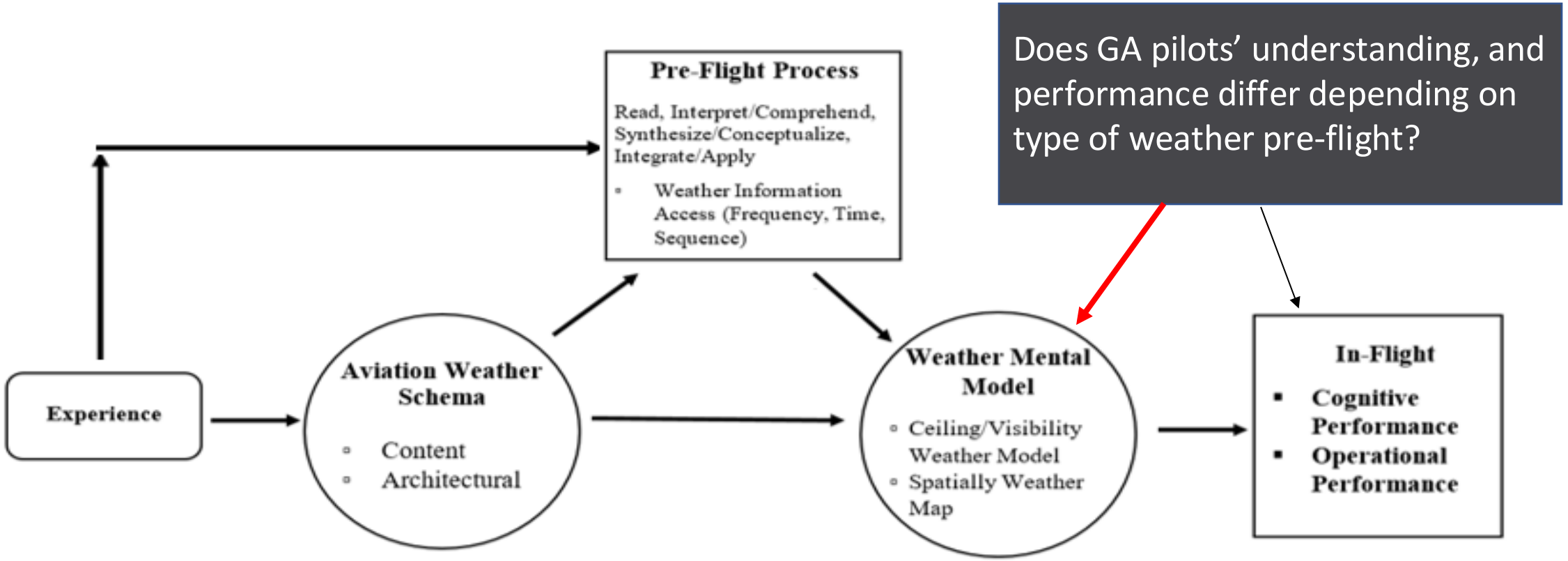

US Regional Satellite Imagery
Type:
Region:
Time:
Loop


AVIATION WEATHER CENTER
HOME ADVISORIES FORECASTS OBSERVATIONS TOOLS NEWS SEARCH ABOUT USER
SIGMET Plot


AVIATION WEATHER CENTER
NOAA NATIONAL WEATHER SERVICE
HOME ADVISORIES FORECASTS OBSERVATIONS TOOLS NEWS SEARCH ABOUT USER
TAF Plot
Region: Tampa FL
Type: Prevail
Valid Time:


DEPARTURE:
VISIBILITY P6SM ALONG ROUTE / NO PRECIP
VFR
WIND: 260@ 32KTS
WIND: 274@ 27 KTS
WIND: 280@ 17KTS
WIND: 281@ 9KTS
FEW 060
* CLR BELOW 120 / CIRRUS CLOUDS ALONG ROUTE NO CEILING *

Conceptual Model



Ortiz, King, & Blickensderferl, 2017

Project Overview

Purpose:

- The purpose of this project is to conduct a laboratory study examining general aviation pilots' capability to conduct Preflight Weather self-briefings as compared to using Flight Services to obtain weather briefings.

- Approach:
- Simulate the entire preflight weather briefing process

Experimental Design

		FSS Phone-in	
		No	Yes
Self-brief	Aviation App		
	None		

- Each Participant performed the two scenarios
  - a) VFR to IMC
  - b) Icing
- Counterbalanced to avoid order effects

Methods

Participants, scenarios, study conditions, measures

Participant Demographics

- n = 81 (13 female)
- M_{age} = 29 (SD = 16); Range 18-83
- Flight hours

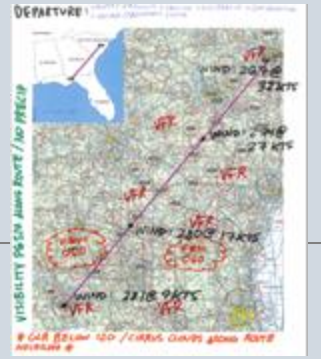
  M = 859

  Median = 250

  SD = 2343
- 35 Private, 15 Commercial, 26 CFI/II, 7 ATP
- 63 Instrument rated

Single engine, fixed-wing; depict marginal conditions; legal for flight

Flight scenarios



FOG

- At departure, weather conditions are VFR
- Potential fog inducing conditions are approaching the destination; projected to turn into IMC soon after arrival.
- Departure airport, Columbia Metro Airport (KCAE) at 0300 Zulu; arrives at the destination airport, Tallahassee International Airport (KTLH) at 0609 Zulu.

ICE

- At departure, low temperature combined with an incoming system result in icing conditions about 3/4 way through the flight.
- Departure airport KPIR at 1915 Zulu; Arrives at KBJI at 2157 Zulu.

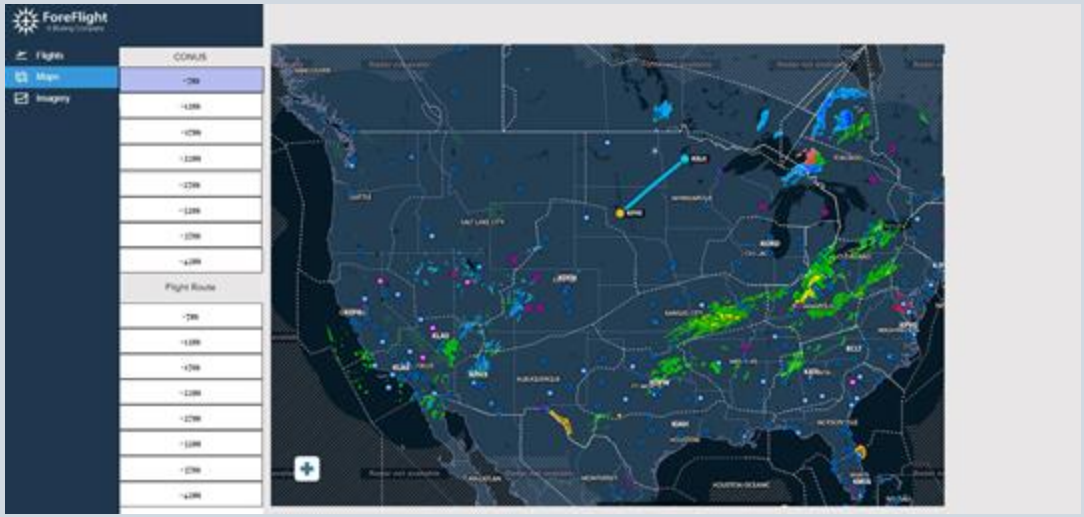
Correct interpretation of the weather products will reveal the flight is *legal* but high likelihood of *deteriorating weather*

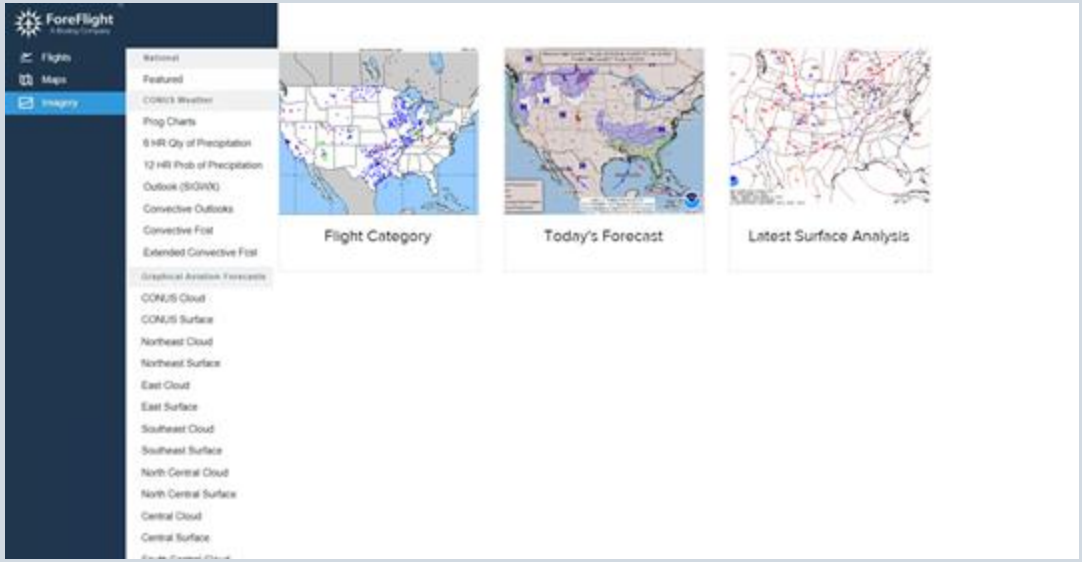
FSS “Phone-in” Briefing

An FSS prepared a script for a standard briefing for each scenario

Audio recorded Bob Thomas reading the briefing

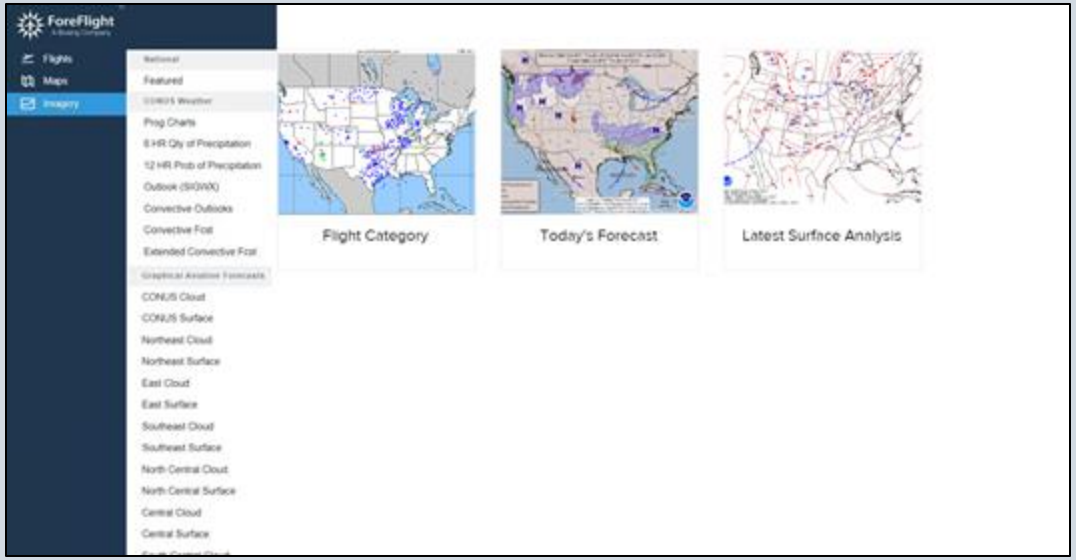
Pilots in the FSS briefing condition(s) listen to the recorded briefing





Self-Briefing: Simulated Foreflight App

FauxFlight



- Used an automated method to retrieve and archive of 488 current, web-based, aviation-weather images and animations for the simulated preflight scenarios.
- Products were pulled from an Aviation Weather Center repository.

Comprised of 74 websites interconnected websites

Each websites houses a subgroup of weather products

Weather products and titles are pulled from an Excel sheet specific to each website.

Scenario 1

CONTROL GROUP

ZFP
Zone Forecast Product

SATELLITE

METARS

ZFP

Return

FPUS53 KABR 190244
ZFPABR

Zone Forecast For Central/NE South Dakota WC MN
National Weather Service Aberdeen SD
100 PM CST Thu MAR 11 2021

SDZ006-190900-
Brown-
Including the city of Aberdeen
100 PM CST Thu MAR 11 2021

.REST OF TODAY...Partly cloudy. Lows around 30. South winds
10 to 15 mph.
.THURSDAY...Mostly sunny. Highs in the mid 40s. South winds 10 to
20 mph, then partly cloudy with a slight chance of showers
.THURSDAY NIGHT...Mostly cloudy with showers likely after midnight.
Lows in the mid 30s. South winds 10 to 20 mph. Chance of precipitation 60 percent.
.FRIDAY...Showers. Highs in the upper 50s.
South winds 10 to 15 mph with gusts to around 30 mph.
.FRIDAY NIGHT...Showers likely. Lows in the mid-40s.
West winds 10 to 15 mph with gusts to around 30 mph. Chance
of precipitation 60 percent.

$$

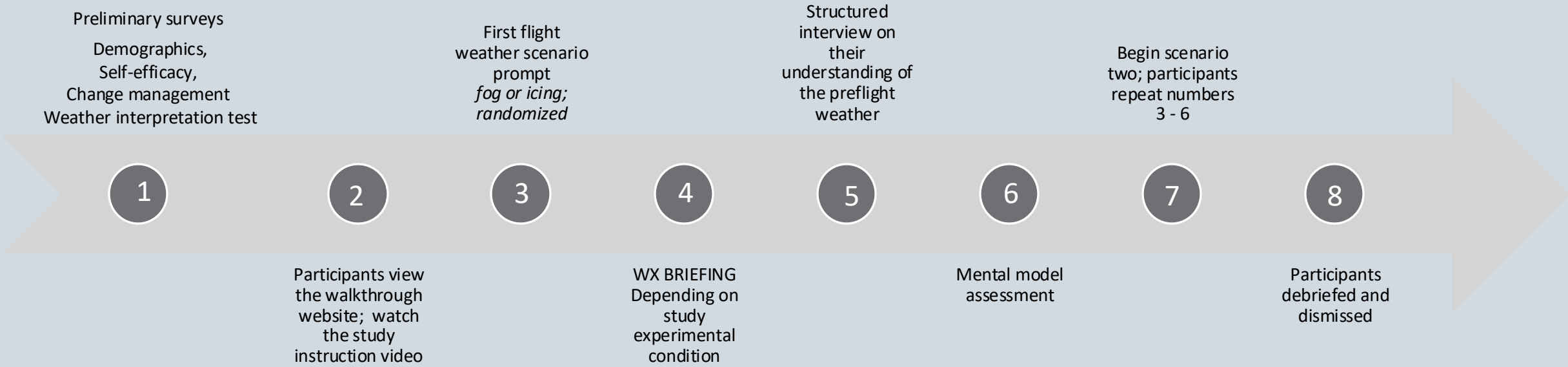
Satellite

Return

METAR

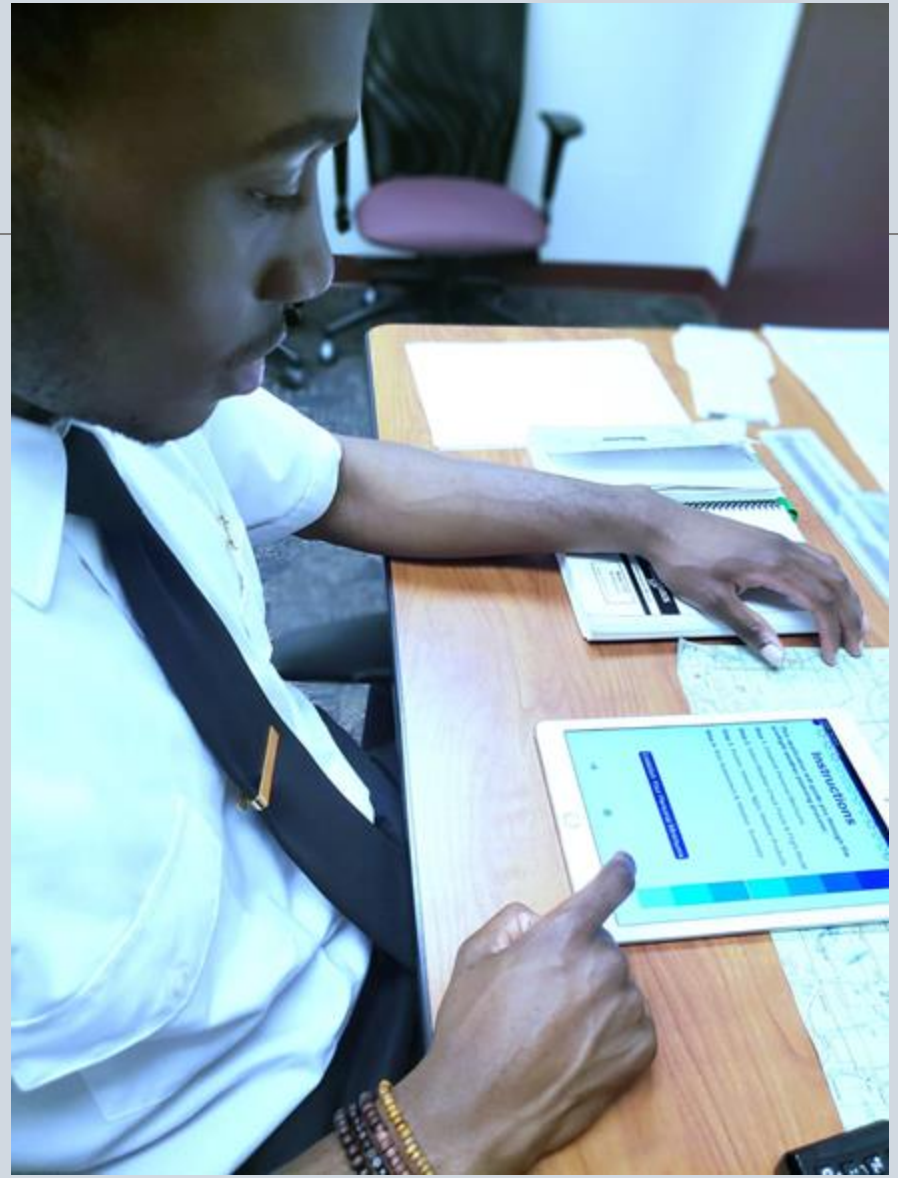
Return

Procedure


Preliminary surveys
Demographics,
Self-efficacy,
Change management
Weather interpretation test
1
2
Participants view the walkthrough website; watch the study instruction video
First flight weather scenario prompt
fog or icing; randomized
3
4
WX BRIEFING
Depending on study experimental condition
Structured interview on their understanding of the preflight weather
5
6
Mental model assessment
Begin scenario two; participants repeat numbers 3 - 6
7
8
Participants debriefed and dismissed

Measures

- Spatial mental model measures
- Structured interviews
- Behavioral observation

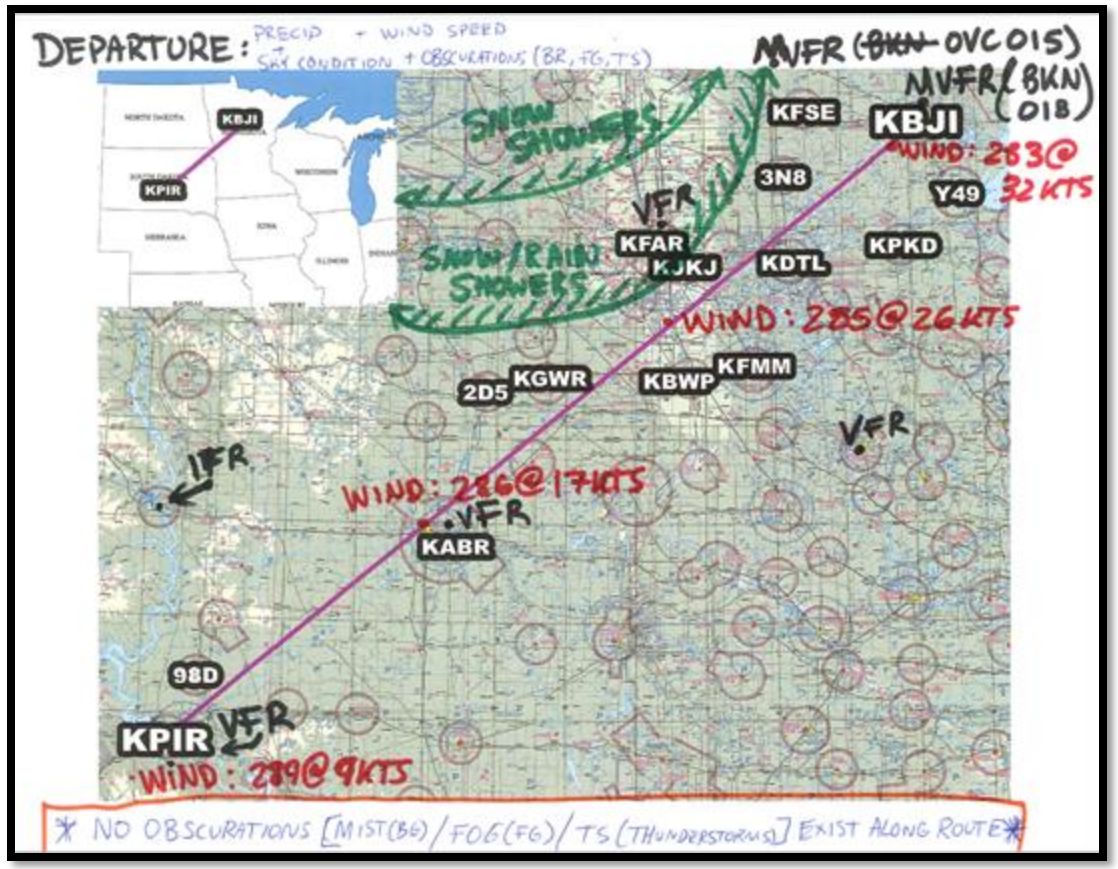


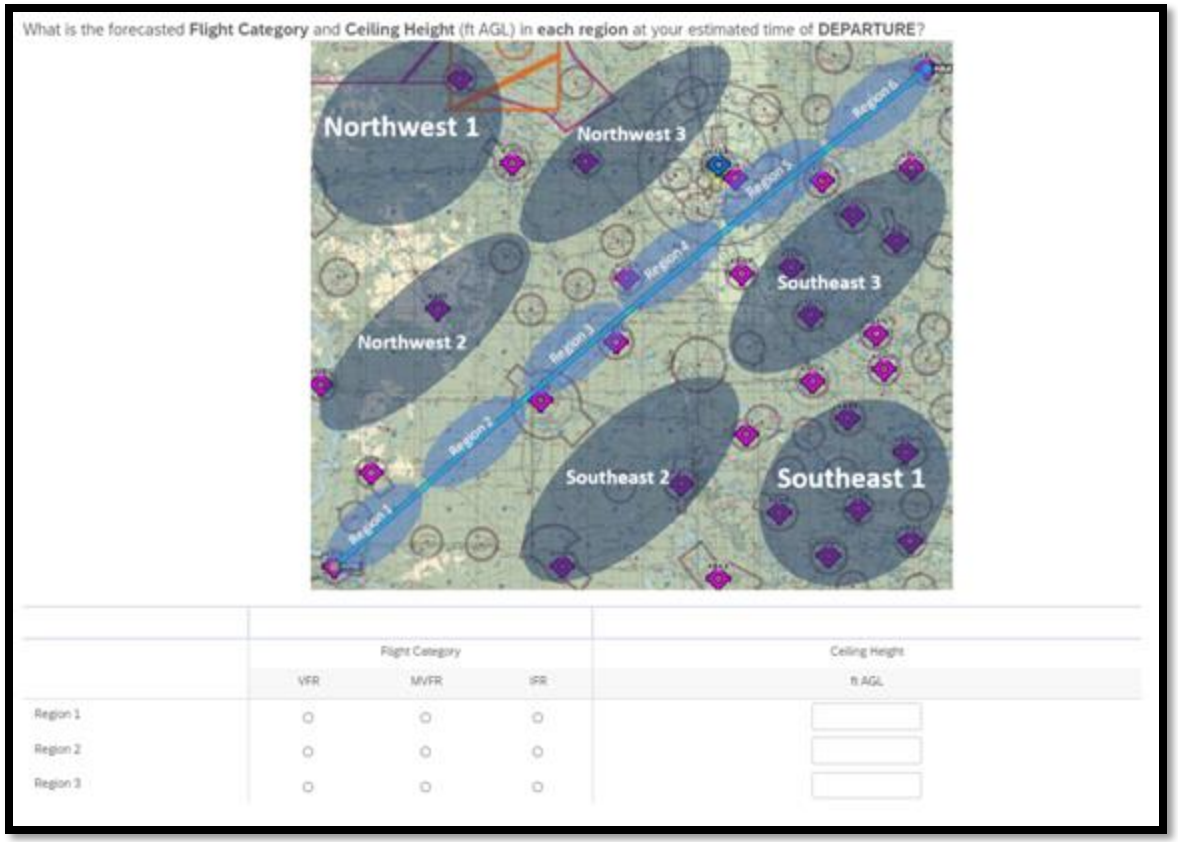
Spatial Mental Model Measures

Objective, Quantitative

Weather conditions in relation to flight path
Departure, Enroute, Projected Arrival

Flight category, ceiling height, winds, precipitation





Structured Interviews

Knowledge/Awareness of Conditions

- Please describe with as much detail as possible the weather conditions you expect to encounter.

Flight Information

- As planned, what is the Estimated Time Enroute (ETE)?
- What is the Estimated time of Arrival (ETA)?

Application & Decision Making

- How do you expect these conditions to impact your flight ?
- Is there anything that concerns you about this VFR flight plan?
- Would you choose to undertake this flight (go or not go)?
- Could you undertake this flight, safely at the altitude that was suggested?

Additional Examples: Objective Ratings

Please describe with as much detail as possible the weather conditions you expect to encounter.

1. **MVFR/VFR Conditions (Total Points 2):**
   - ☐MVFR/VFR Conditions throughout majority of flight/trending towards IFR (2)
     - ☐Good visibility (Positive 6 Statute Miles (P6SM)) (1)
     - ☐Ceiling above 1000 ft (1)
   - ☐No response (0)
   - ☐Incorrect response (0): _____

2. **Surrounding Clouds (Total Points 1):**
   - ☐Few to Overcast clouds in the surrounding area (1)
   - ☐No response (0)
   - ☐Incorrect response (0): _____

3. **AIRMET Zulu (Total Points 5):**
   - ☐Icing/Moderate Icing (2)
   - ☐In latter portion of flight/Moving into flight route (coming from north) (2)
   - ☐Freezing level - 9000 feet (1)

10.

a. **Could you undertake this flight, safely at the altitude that was suggested (Scenario 1- 5,500ft; Scenario 2- 4500ft) (Total Points 1)?**

- ☐Yes (0)
- ☐No (1)

If No…

b. **Could you undertake this flight, safely at an altitude other than the originally designated altitude?**

If Yes **(Total Points 2)**

Please state at what altitude you could safely fly and explain why you choose this altitude?

- ☐2500 ft MSL (or lower) (1)
  - ☐Likely still unsafe (1)
    - ☐Potential cold front encounter
    - ☐Icing
    - ☐Obstacle/terrain issues with that altitude
    - ☐Nighttime environment
- ☐Incorrect response: (Please enter altitude) (0)

Behavioral Observation

Goal: Capture complete behavioral process of participants examining the preflight weather.

Data included screen recordings of entire time pilots used Fauxflight:

- Self-briefing condition
- Self-briefing + FSS Brief condition

Coding process captured the information accessed by each participant.

- What weather products accessed
- How much time they spent on each product
- “Bread crumb” trail

Rating process

- 2 research assistants observed each Ps video and coded using the Coding sheet
- Consensus meetings resolved discrepancies

Results

How did the Briefing types compare?

Interview Results

- All briefing types gave pilots better understanding of the weather conditions in comparison to the control group (Main effects and Interaction effect)
- Icing scenario showed more differences between briefing types than did the fog scenario
- Overall, Interview data was sensitive to between group differences

Interview Scores (Percentage Correct) Means and Standard Deviations for all study conditions

	Self-Briefing		No Self-Briefing	
	Flight Services *M (SD)* *n* = 20	No Flight Services *M (SD)* *n* = 19	Flight Services *M (SD)* *n* = 18	No Flight Services *M (SD)* *n* = 19
Ice Score	74.38 (15.43)	66.12 (27.74)	86.81 (12.66)	25.33 (19.60)
Fog Score	65.41 (18.94)	69.93 (13.16)	69.44 (21.89)	51.50 (15.35)

Mental Model Results

- Results were mixed
- *Some MM measures* showed that briefing groups (in particular FSS and SB only groups) did have better understanding of weather conditions than did control group. (Some main effects, some interactions).
- Overall, this measurement technique needs more research.

Behavioral Results

- Participants' use of Fauxflight followed the structure of the interface.
- Pilots' choice of weather products did not match the expert's recommendations.

- Fog; M(SD) = 12(8) minutes

Frequency of Participants Viewing Expert Recommended Products (Fog Scenario)

Product	Frequency (%)
AIRMETS (IFR)	35/37 (94.6%)
TAF	36/37 (97.3%)
Graphical AIRMETS	12/37 (32.4%)
Prognostic Chart	22/37 (59.5%)
Graphical Aviation Forecast	6/37 (16.2%)

Ice; M(SD) = 15(10) minutes

Frequency of Participants Viewing Expert Recommended Products (Ice Scenario)

Product	Frequency (%)
AIRMETS (Icing)	36/37 (97.3%)
METARs	36/37 (97.3%)
TAF	36/37 (97.3%)
Graphical AIRMETS	9/37 (24.3%)
Graphical Aviation Forecast	6/37 (16.2%)
Infrared Satellite	2/37 (5.4%)

Summary & Conclusions

- Controlled, laboratory study using authentic weather products, scenarios, and simulated app
- All briefing strategies (other than control) fostered some understanding of weather conditions.
- When Self-briefing, pilots focused primarily on AIRMET, TAF, and METAR; and usage was highly App driven (as opposed to a strategic, knowledge-based approach)
- Scenario selection is tricky; Challenging weather, yet legal for flight
- Follow-up analyses may parse out other differences between pilots with varying experience
- Limitations: Young pilots; only two scenarios; variability in scores

Thank you!

Beth Blickensderfer, Ph.D.
blick488@erau.edu