

Aug 16th, 8:15 AM - 9:45 AM

Effects of Graphical Weather Information versus Textual Weather Information on Situation Awareness in Meteorology

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Melendez, Stefan M.S.A.; Dattel, Andrew Ph.D.; Herbster, Christopher Ph.D.; Schaum, Debbie M.A.; and Babin, Andrey, "Effects of Graphical Weather Information versus Textual Weather Information on Situation Awareness in Meteorology" (2017). *National Training Aircraft Symposium (NTAS)*. 33.
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EFFECTS OF GRAPHICAL WEATHER INFORMATION VERSUS TEXTUAL WEATHER INFORMATION ON SITUATION AWARENESS IN METEOROLOGY

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Introduction

Introduction

- ▶ Before a flight, pilots gather weather information
 - ▶ Self-briefing and/or professional weather briefer (Casner, Murphy, Neville, & Neville, 2012)
- ▶ Aviationweather.gov provides weather products in graphical and text form
 - ▶ Pilots need to interpret symbols and abbreviations
 - ▶ Would one type be better than the other?
- ▶ Kharb, Samanta, Jindal, and Singh (2013) found that people prefer visual to verbal learning
 - ▶ Could this have an effect on the way we look at weather information?



Review of Relevant Literature

Situation Awareness

- ▶ Definition
- ▶ Factors for SA:
 - ▶ Weather conditions
 - ▶ Traffic
 - ▶ Flight conditions
 - ▶ Locations for potential emergency landings
 - ▶ Navigation aids, etc.
- ▶ This study focused on the meteorological aspect of SA, or, Situation Awareness in Meteorology (SAM)

Importance of conducting research on SAM

- ▶ Continued VFR (Visual Flight Rules) flight into IMC (instrument meteorological conditions) is one leading causes of fatal accidents in the general aviation industry.
 - ▶ This accounted for 27% of fatalities in general aviation accidents. (AOPA, 1996)
- ▶ Weather-related mishaps have the highest fatality rate of any kind (AOPA, 2009)
- ▶ The NTSB mentioned “Identifying and Communicating Hazardous Weather” in their 2014 Most Wanted List.

Previous Research

- ▶ A study showed that VFR flight into IMC conditions primarily involved inexperienced pilots. (Detwiler, Holcomb, Boquet, Wiegmann, & Shappell, 2005)
- ▶ The way people learn varies from person to person.
 - ▶ VARK Model (Fleming & Mills, 1992)
 - ▶ Study showed that 61% of medical students had multimodal preferences (Kharb, Samanta, Jindal, & Singh, 2013).

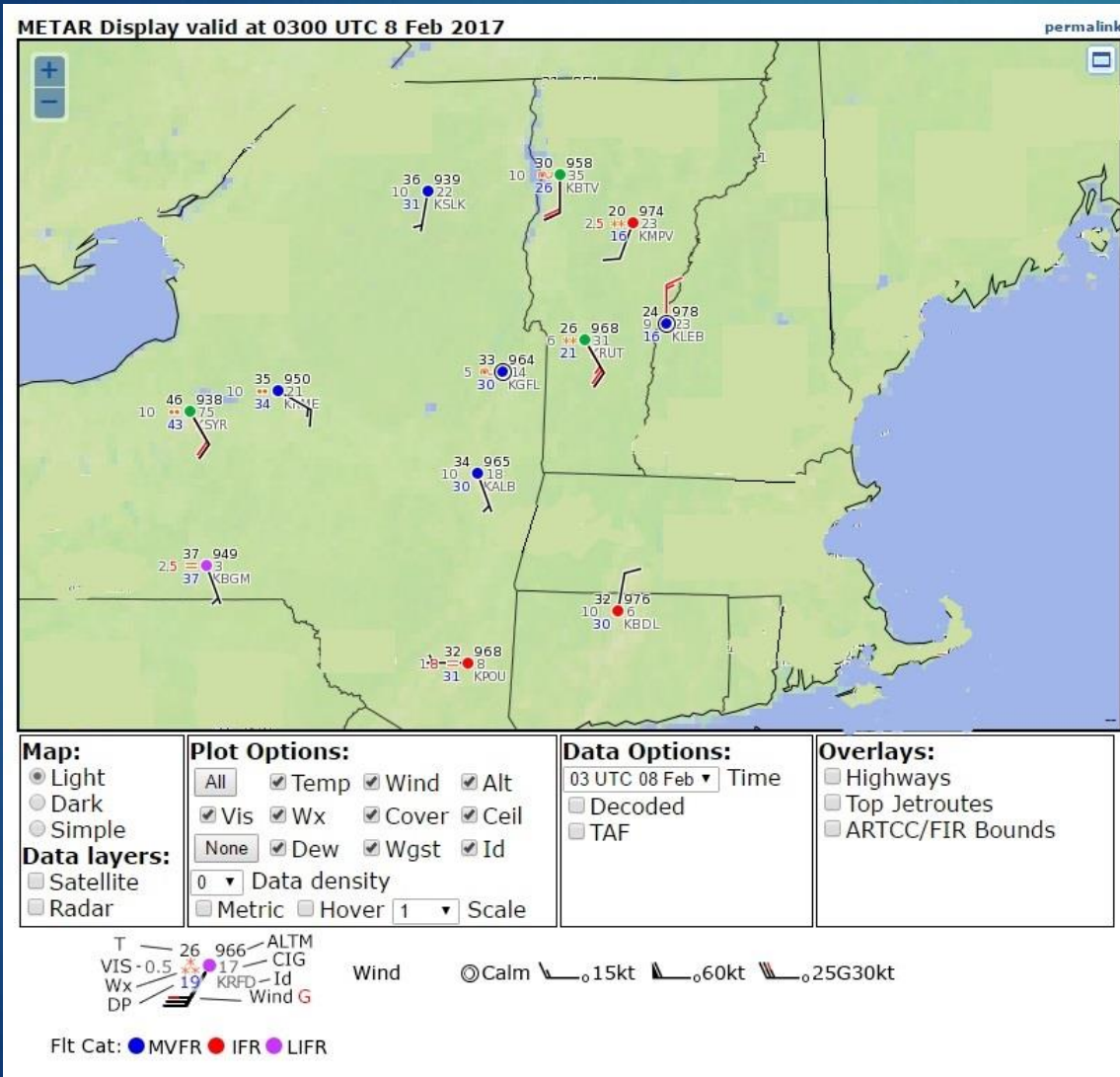
Previous Research cont.

- ▶ Endsley (1995) found that 88% of major airline accidents involved problems with lack of SA.
- ▶ Some pilots brief themselves on weather rather than contacting a professional weather briefer. (Casner, Murphy, Neville, & Neville, 2012).

Methodology



GWJ and TWI



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KRUT 150256Z 15010G25KT 6SM -SN OVC030 M03/M06 A2968
KLEB 080235Z 36000G15KT 9SM OVC023 M04/M08 A2978
KGFL 080253Z 00000KT 5SM -FZRA BKN014 01/M01 A2964
KALB 080251Z 16005KT 10SM OVC018 01/M01 A2965
KRME 080253Z 12015KT 10SM -RA BKN021 02/01 A2950
KSYR 080254Z 15010G20KT 10SM -RA OVC075 08/06 A2938
KBGM 080253Z 16005KT 2 1/2SM OVC003 03/03 A2949
KPOU 080253Z 27005KT 1 3/4SM OVC008 00/M01 A2968
KBDL 080251Z 01008KT 10SM BKN006 00/M01 A2976
KMPV 080251Z 20010KT 2 1/2SM -SN OVC023 M07/M09 A2958
KBTV 080254Z 18010G20KT 10SM -FZRA OVC035 M01/M03 A2958
KSLK 080251Z 19005KT 10SM UP OVC022 02/M01 A2939
    
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Participants

- ▶ 20 Participants
 - ▶ SONA Systems recruitment
 - ▶ E-mails (ETA messages)
 - ▶ Posted flyers

Materials

- ▶ TWI and GWI
- ▶ CERTS Lab
- ▶ Advanced flight simulator running FSX
- ▶ Modified version of SPAM to assess participants' SAM
- ▶ Headset with Audacity
- ▶ Questionnaires and Forms

Textual Weather Information	Graphical Weather Information
METARS TAFS AIRMETS/SIGMETS Winds/Temps Aloft Forecast Area Forecast	Graphical METARS TAFS AIRMETS/SIGMETS Wind Streamlines / Temps Flight Category Chart

Control

No.	Flight 1	Flight 2	No.	Flight 1	Flight 2
1	KSYR - KBUF T	KRUT - KRME G	11	KRUT - KRME T	KSYR - KBUF G
2	KSYR - KBUF T	KRUT - KRME G	12	KRUT - KRME T	KSYR - KBUF G
3	KSYR - KBUF T	KRUT - KRME G	13	KRUT - KRME T	KSYR - KBUF G
4	KSYR - KBUF T	KRUT - KRME G	14	KRUT - KRME T	KSYR - KBUF G
5	KSYR - KBUF T	KRUT - KRME G	15	KRUT - KRME T	KSYR - KBUF G
6	KSYR - KBUF G	KRUT - KRME T	16	KRUT - KRME G	KSYR - KBUF T
7	KSYR - KBUF G	KRUT - KRME T	17	KRUT - KRME G	KSYR - KBUF T
8	KSYR - KBUF G	KRUT - KRME T	18	KRUT - KRME G	KSYR - KBUF T
9	KSYR - KBUF G	KRUT - KRME T	19	KRUT - KRME G	KSYR - KBUF T
10	KSYR - KBUF G	KRUT - KRME T	20	KRUT - KRME G	KSYR - KBUF T

Procedure

- ▶ Sign consent form
- ▶ Demographics questionnaire
- ▶ VARK questionnaire
- ▶ Practice flight
- ▶ Review weather information for flight 1 (20 minutes)
- ▶ Simulate flight 1 and answer SAM questions (20 minutes)
- ▶ Review weather information for flight 2
- ▶ Simulate flight 2 and answer SAM questions
- ▶ Debrief

Treatment of Data

- ▶ Scoring

- ▶ Notes from flight plan to determine go/no-go decisions and hazard encounters
- ▶ Each correct answer for a SAM question was one point. A higher score meant higher SAM.
- ▶ Data imported to SPSS

- ▶ Analyses (SPSS)

- ▶ Chi-square
- ▶ *T*-tests
- ▶ *Correlations*

Results

TWI Versus GWI on SAM

- ▶ Accuracy of SAM questions
 - ▶ GWI group answered significantly more SAM questions correctly than those in the TWI group.
 - ▶ T-test was significant, $t(19) = -2.33$, $p = 0.03$, Cohen's $d = 0.52$

Correlations

Correlations

	GWI Score	Verbal Score	TWI Score
Visual Score	0.34	0.24	-0.46*
GWI Score		0.47*	-.54*
Verbal Score			-0.15

*Correlation is significant (two-tailed)



Discussion, Conclusions, and Recommendations

Discussion

- ▶ Go/No-Go decisions and hazard encounters
- ▶ SAM question scores
- ▶ Learning styles and SAM scores correlations
 - ▶ Using two VARK measures versus all four
 - ▶ What each VARK score represents
 - ▶ VARK Visual and TWI Score (negative)
 - ▶ VARK Verbal and GWI Score (positive)
 - ▶ TWI and GWI Score (negative)
 - ▶ Final thoughts on correlations

Conclusions and Recommendations

- ▶ Results showed GWI to be better than TWI for SAM
- ▶ Performance in flight planning
- ▶ Future direction
 - ▶ Further research for TWI vs GWI
 - ▶ Get all important information visually?
 - ▶ R&D for new products
 - ▶ Test new products
 - ▶ Vision for final product



Acknowledgements

- ▶ Dr. Alan Stolzer
- ▶ Dr. Haydee Cuevas
- ▶ Amber Davis
- ▶ Nicola O'Toole

Thanks!