### Overview of the Volpe Center Aviation Human Factors Division Maura Lohrenz July 2013



**Volpe** The National Transportation Systems Center Advancing transportation innovation for the public good



U.S. Department of Transportation **Research and Innovative Technology Administration** John A. Volpe National Transportation Systems Center



Overview of Volpe

- Aviation Human Factors Division
  - Research Staff
  - Current Volpe Project Teams

Questions



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 Aviation Human Factors Division
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Current Volpe Project Teams

Questions

### Transportation Professionals

- 570 Federal Employees representing a full spectrum of disciplines from engineering to physical and social sciences
- 263 Advanced Degrees
- >60 Federal Career
   Interns and Co-op
   Students
- >1,000 contractors



### Mission, Vision, Capabilities

#### 

To improve the Nation's transportation systems

#### 

 To be the leading Federal Center of Excellence for innovative transportation systems solutions

#### Capabilities

- Institutional knowledge of the global transportation system and its stakeholder perspectives
- Awareness of Federal responsibilities, objectives, and activities in the public interest
- Experience with the full spectrum of technologies and disciplines relevant to transportation system improvements

## Centers of Innovation

- RVT-20 Transportation Policy and Planning (Rachel Winkeller)
- RVT-30 Safety Management Systems (Stephen Popkin)
- RVT-40 Environmental and Energy Systems (Gregg Fleming)
- RVT-50 Transportation Logistics and Security (Michael Dinning)
- RVT-60 Infrastructure Systems and Engineering (Robert Dorer)
- RVT-70 Air Traffic Systems and Operations (Steven Lang)
- RVT-80 Human Factors Research & System App. (S. Popkin, act.)
- RVT-90 Advanced Transportation Technologies (Gary Ritter)

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### Safety Management and Human Factors (RVT-30, Stephen Popkin)

- RVT-31 Safety Information Systems (Bob Berk)
- RVT-32 Aviation Safety Management (Regina Houston)
- RVT-33 Safety Measurement and Analysis (Nancy Kennedy)
- RVT-34 Surface Transportation Human Factors (Mary Stearns)
- RVT-35 Aviation Human Factors (Maura Lohrenz)



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- Division Chief: Maura Lohrenz
- Principle Technical Advisors
  - Judith Bürki-Cohen
  - Kim Cardosi \*
  - Divya Chandra \*

#### Scientific and Technical Staff

- Alison Bisch
- Stephanie Chase
- Caroline Donohoe
- Rebecca Grayhem
- Young Jin Jo
- Andrew Kendra \*
- **Students** 
  - Emma Levitt
  - Katarina Morowsky

- Tracy Lennertz
- Amanda Mattson
- Andrea Sparko
- Alan Yost \*†
- Michael Zuschlag
- \* Licensed pilot <sup>†</sup> Former Air Traffic Controller

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Engineering Psychologist (0180)

IT Specialist (2210)

Student Trainee (0899, 0199)

Operations Research Analyst (1515)

Volpe 12



Volpe 13



- **GS-4**
- **GS-7**
- **GS-11**
- **GS-12**
- **GS-13**
- **GS-14**
- **GS-15**



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# Current Project Teams

- NextGen Instrument Procedures\*
- NextGen Low Visibility Operations (LVO) / Surface Movement Guidance and Control Systems (SMGCS)\*
- □ C/NG Automatic Dependent Surveillance-Broadcast (ADS-B)\*
- □ CORE Head-Up and Head-Mounted Displays (HUD/HMD)
- **CORE** Airport Moving Maps
- **CORE** Electronic Flight Bags (EFB)
- **CORE** General Guidance Document
- NextGen Data Communications (DataComm)
- □ **NextGen** Aural DataComm / Auxiliary Synthetic Speech

#### \*Deep-dives presented during REDAC meeting

## Instrument Procedures

### Volpe Team

Divya Chandra Rebecca Grayhem Andrew Kendra Caroline Donohoe







#### FAA program manager Dan Herschler (ANG-C1)

### □ FAA technical sponsors

Kathy Abbott (AVS), Mark Steinbicker (AFS-470)

### **Purpose**

(NextGen) Help FAA develop human factors guidelines for the design, depiction, usability, and flyability of instrument procedures and associated charts.



# LVO/SMGCS Usability

#### Volpe Team

Stephanie Chase Andrea Sparko Katarina Morowsky Young Jin Jo

FAA program manager Michelle Yeh (ANG-C1)

### □ FAA technical sponsors

Bruce McGray, Terry King (AFS-410)









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Purpose: (NextGen) Provide data to support development of best practices for current and proposed Low Visibility Operations (LVO) / Surface Movement Guidance and Control System (SMGCS) chart layout and symbology.

## ADS-B Program

### Volpe Team

Tracy Lennertz Kim Cardosi Stephanie Chase



#### **FAA program managers**

Colleen Donovan and Michelle Yeh (ANG-C1)

### □ FAA technical sponsors

Cathy Swider (AIR-120), Kathy Abbott (AVS), Don Walker (AIR-130), Paul VonHoene (AFS-410)

# ADS-B Program

### **Core Program**

- Purpose: Determine current state of Cockpit Displays of Traffic Information (CDTI), and examine CDTI symbology and display management.
- Projects: 
  → ADS-B industry survey
  - ✤ ADS-B symbology study
  - ➔ Use of color on Airport Moving-Maps and CDTIs

### NextGen Program

- Purpose: Provide support to the FAA for operational evaluations and input on relevant ADS-B literature.
- Projects: → Flight Interval Management (FIM) literature review
   → CDTI operational evaluation for Merging & Spacing
   → Support for In-Trail Procedure (ITP)

# HUD/HMD Human Factors

□ Volpe PI: Mike Zuschlag

□ FAA program manager Steve Plishka

### □ FAA technical sponsors

Kathy Abbott (AVS),

Terry King (AFS-410), Cathy Swider (AIR-120)

#### Purpose

(Core) Support the development of criteria and guidelines for approving HUDs/HMDs, focusing on flight information representation, such as symbology standardization, color coding, alerting, installation-related issues, and integration.



# Airport Moving Map

#### Volpe Team

Stephanie Chase Danielle Eon (CTR) Andrew Kendra



#### □ FAA program managers

Michelle Yeh and Colleen Donovan (ANG-C1)

#### FAA technical sponsor

Cathy Swider (AIR-120)

#### Purpose

(Core) Support development of FAA guidelines and approval criteria for Airport Moving Map displays depicting ownship and traffic information. Identify human factors issues with evolving displays.

# Electronic Flight Bags (EFB)

#### Volpe Team

Stephanie Chase Danielle Eon (CTR) Andrew Kendra



#### □ FAA program managers

Michelle Yeh and Colleen Donovan (ANG-C1)

#### □ FAA technical sponsors

Cathy Swider (AIR-120), Brad Miller (AIR-130), Ricky Chitwood (AFS-220), Brian Hint (AFS-430)

#### Purpose

(Core) Identify, understand, and help the FAA address human factors issues related to EFB technology.

### General Guidance

### Volpe Team

Young Jin Jo Stephanie Chase

**FAA program manager** Michelle Yeh (ANG-C1)



### □ FAA technical sponsors

Cathy Swider (AIR-120) and Colleen Donovan (formerly AIR-120)

#### Purpose

(Core) Identify and compile FAA HF regulatory and guidance material, industry recommendations and best practices, and other HF research on a variety of flight deck systems (e.g., EFB, GPS, electronic map displays) in one document.

### Data Communications

### **Volpe Team**

Kim Cardosi, Tracy Lennertz

#### FAA program manager Dan Herschler (ANG-C1)



### FAA technical sponsors

Trent Bigler (AFS-470), Christophe Hamel (AIR-130)

Purpose: (NextGen) Provide human factors support for the use and implementation of Data Comm, including development of the message set, crew procedures, and crew training. Support RTCA SC-214, Global Operational Data Link Document (GOLD) flight crew and ATC procedures, the Operational Data Link Panel (OPLINKP), and the Data Comm Implementation Team (DCIT, funded separately by ATO/PMO).

## Auxiliary Synthetic Speech

#### Volpe Team

Judith Bürki-Cohen, Tracy Lennertz, Andrea Sparko Andrew Kendra, Alan Yost, Amanda Mattson, Mike Zuschlag

- FAA program manager Dan Herschler (ANG-C1)
- FAA technical sponsors
   Christophe Hamel (AIR-130),
   Trent Bigler (AFS-470)
- Purpose: (NextGen) Examine suitability and recommend minimum requirements for using synthetic speech in flight-deck Data Comm as an auxiliary display modality in a NextGen environment.

















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### Questions?









## Business Model

Volpe is a unique, not-for-profit, federal agency that is 100% funded by sponsored projects:

- US DOT fee-for-service research & innovation center
- Authorized by Congress to conduct business via a Working Capital Fund
- Maintain own facility in Cambridge, MA
- Receive no Congressional appropriations, base funding, or agency support to offset facility operations and maintenance costs
- Volpe employees are compensated the same as other federal employees (labor and benefits).
- Volpe admin (e.g., HR, IT, legal services, facilities, utilities, etc.) covered through overhead charges, shared among all projects.
- □ Volpe costs compare favorably with other service providers.
  - See <u>http://www.volpe.dot.gov/withus/project\_cost.html</u> for details.

# Selected Publications (1/2)

- Bürki-Cohen, J. (2010). Technical challenges of upset recovery training: Simulating the element of surprise. *Proceedings of the AIAA Guidance, Navigation, and Control Conference,* 2-5 August, Toronto, ON, AIAA-2010-8008.
- Bürki-Cohen, J., Kendra, A., Kanki, B. & Lee, A. (2000). Realistic Radio Communications in Pilot Simulator Training. (DOT/FAA/AR-00/62, DOT-VNTSC-F-00-13).
- Bürki-Cohen, J. & Sparko, A. (2008). Airplane upset prevention research needs. *Proceedings of the AIAA Modeling & Simulation Technologies Conference*. 18-21 August, Honolulu, HI.
- Bürki-Cohen, J. & Sparko, A. (2012). Validation of loss-of-control (LOS) simulations, training programs, and systems. *Proceedings of the AIAA Guidance, Navigation, & Control Conference*. 13-16 August, Minneapolis, MN.
- Bürki-Cohen, J., Sparko, A., & Bellman, M. (2011). Flight simulator motion literature pertinent to airlinepilot recurrent training and evaluation. *Proceedings of the AIAA Modeling and Simulation Technologies Conference*, 8-11 August, Portland, OR, AIAA-2011-6320.
- Bürki-Cohen, J., Sparko, A., Go, T. H. & Jo, Y. J. (2009). Effects of visual, seat, and platform motion during flight simulator air transport pilot training and evaluation. *Proceedings of the 15th International Symposium on Aviation Psychology*. 27-30 April, Dayton, OH.
- Cardosi, K. (1995). Human Factors in the Design and Evaluation of ATC Systems. (DOT/FAA/RD-95/3.1)
- Cardosi, K. (2001). Runway Safety: Its Everybody's Business (DOT/FAA/AR-01/66)
- Cardosi, K., Chase, S., Eon, D. (2010). Runway Safety. Air Traffic Control Quarterly, 18(3), 303-328.
- **Chandra, D.** (2009). Utility and Recognition of Lines and Linear Patterns on Electronic Displays Depicting Aeronautical Charting Information. (DOT/FAA/AR-09/01, DOT-VNTSC-FAA-09-03).

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Chandra, D. & Kendra, A. (2010). Review of Safety Reports Involving Electronic Flight Bags. (DOT/FAA/AR-10/5, DOT-VNTSC-FAA-10-08).

# Selected Publications (2/2)

- **Chandra, D.** & Yeh, M. (2007). Pilot Identification of Symbols and an Exploration of Symbol Design Issues for Electronic Displays of Aeronautical Charting Info (DOT/FAA/AR-07/37, DOT-VNTSC-FAA-07-07).
- **Chandra, D.**, Yeh, M., Riley, V. & Mangold, S. (2003). Human factors considerations in the design & evaluation of EFBs, V2. DOT-VNTSC-FAA-03-07.
- Grayhem, R. (2010). Early Scotopic Dark Adaptation (Dissertation). Northeastern University, Boston, MA.
- Lennertz, T., Bürki-Cohen, J., Sparko, A., Macchiarella, N., Kring, J., Coman, M. Haritos, T. & Alvarado, J. (2012). NextGen flight deck data comm: Auxiliary synthetic speech – Phase I. *Proceedings of the Human Factors and Ergonomic Society 56th Annual Meeting*. 22-26 October, Boston, MA.
- Neiderman, E., **Popkin, S.**, Donovan, C., Philips, B., Chappell, S., Monk, C. & **Lohrenz, M.** (2012). Transportation Research into Practice: A Multi-Agency Government Perspective. *Proceedings of the Human Factors and Ergonomic Society 56th Annual Meeting*. 22-26 October, Boston, MA.
- Raudenbush, B., **Grayhem, R.**, Sears, T., & Wilson, I. (2009). Effects of peppermint and cinnamon odor administration on simulated driving alertness, mood and workload. *North American Journal of Psychology, 11.* 245-256.
- Sparko, A., Bürki-Cohen, J., & Go, T. (2010). Transfer of training from a full flight simulator versus a highlevel flight-training device with a dynamic seat. *Proceedings of the AIAA Modeling and Simulation Technologies Conference*, 2-5 August, Toronto, ON, AIAA-2010-8218.
- **Zuschlag, M.**, **Chandra, D.** & **Grayhem, R.** (2011). The use and understanding of the proximate status indication in traffic displays. Proceedings of the 30th Digital Avionics Systems Conference. 16-20 October 2011, Seattle, WA.
- Zuschlag, M., Chandra, D., Helleberg, J. & Estes, S. (2010). Symbols for Cockpit Displays of Traffic Information. (DOT/FAA/AR-10/4, DOT- DOT/FAA/AR-10/4, VNTSC-FAA-10-07).