

# Volpe Center Activities Supporting FAA NextGen (Next Generation Air Transportation System)

Overview with Focus on  
Human Factors & Airline Pilot Training Tools

SERVING THE NATION AS A LEADER IN GLOBAL  
TRANSPORTATION INNOVATION SINCE 1970



# What is the Volpe Center?

## *A Federal Center of Excellence Working to Improve the Nation's Transportation System*

- Part of the U.S. Department of Transportation's Research & Innovative Technology Administration (RITA)
- A fee-for-service National Lab:
  - Budget-neutral, non-line-item operation
  - Under a working capital fund (49 U.S.C. 328)
- Sponsors include:
  - All DOT modal administrations
  - Other Federal, state, local, international agencies & entities



## In Cambridge, MA

Today's topic: Research & Technology to support the FAA NextGen



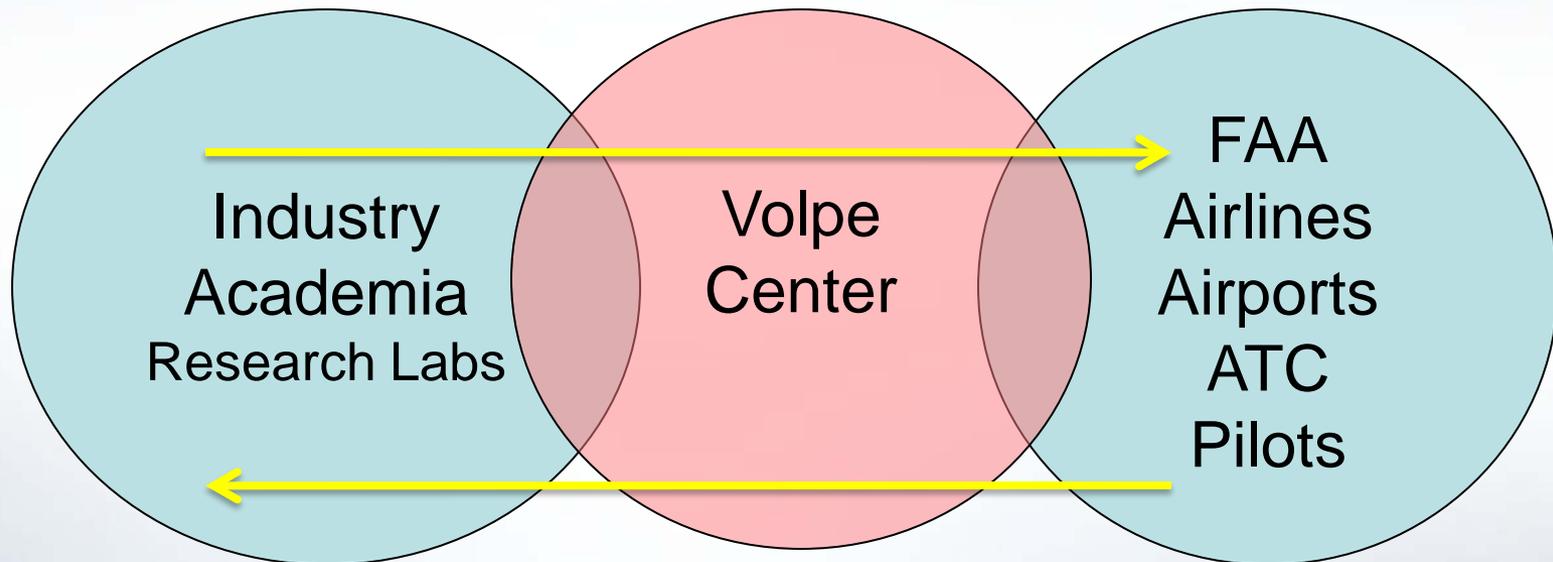
John A. Volpe National Transportation Systems Center  
U.S. Department of Transportation  
Research and Innovative Technology Administration

# What is the Next Generation Air Transportation System (NextGen)?

- Transformation & modernization of Nation's air traffic system
- Goals
  - Reduce congestion
  - Allow increase in capacity
  - Benefit environment
- Volpe Center contributes to all these goals



# Volpe's Role in NextGen

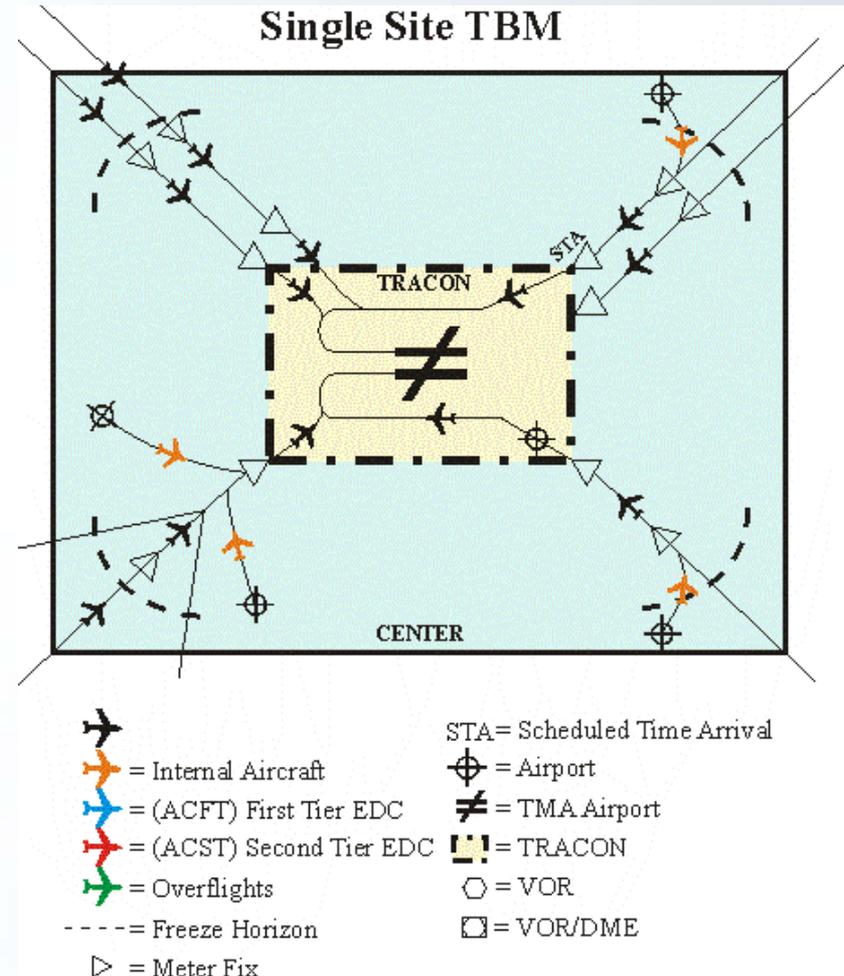


Researching, developing &  
deploying solutions



# Volpe Center Activities Reducing Congestion

- Example
  - Traffic Management Advisory (TMA)
    - Replaces miles-in-trail separation with time-based metering (TBM)
- Technology Transfer
  - Helps FAA sequence airport arrivals early
  - Saving fuel & time



# Volpe Center Activities Allowing Capacity Increase

- Example
    - Wake Vortex Program
    - Safety & capacity
  - Technology Transfer
    - FAA procedural changes
    - Implemented for arrivals
- High benefit/cost ratio

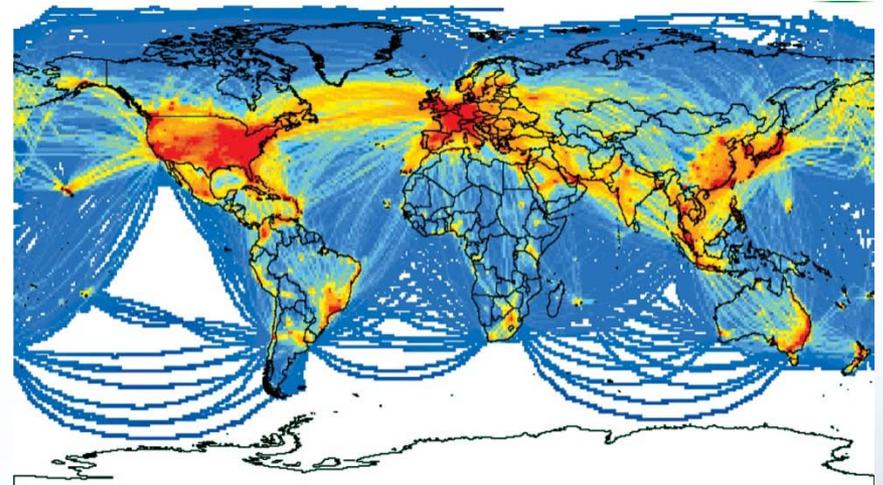


Pulsed Lidar to measure vortex



# Volpe Center Activities Benefitting Environment

- Example
  - Aviation Environmental Design Tool (AEDT)
    - Calculates noise, fuel burn, emissions
- Technology Transfer
  - Globally utilized
  - To evaluate impact of vehicle technologies



Global CO2 Emissions



# NextGen Will Profoundly Impact Roles of Human Operators & Automation

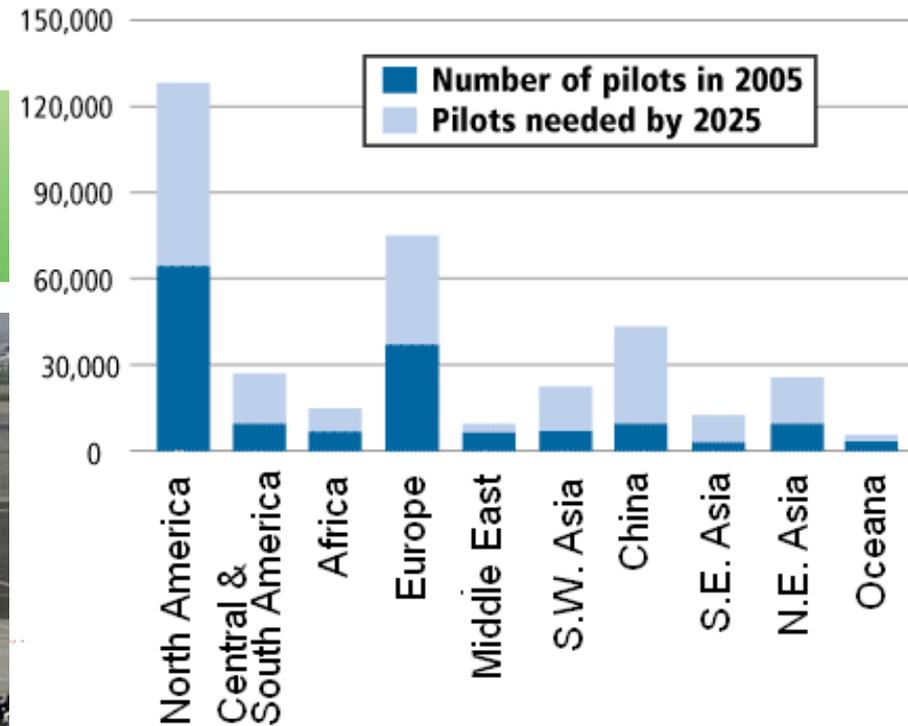
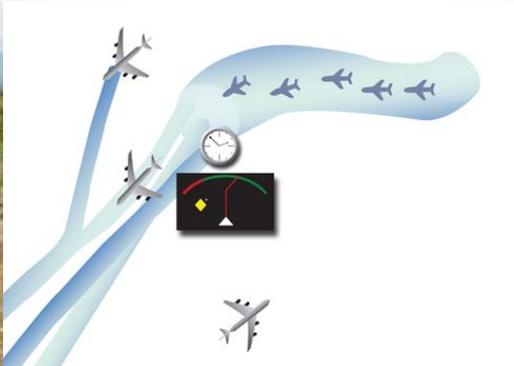
- Many opportunities for human factors, for example
  - Function allocation between human & automation
    - With retired MIT professor for Concept of Operations
  - Cockpit Display of Traffic Information
    - With MIT
  - Procedures for RNAV & RNP
    - Area Navigation & Required Navigation Performance
    - With MIT
  - Develop flight deck communication system
    - With Embry Riddle Aeronautical University
  - Flight simulators for effective training



**A** utomatic – no input required  
**D** ependent – on GPS  
**S** urveillance – where are assets  
**B** roadcast – to all ADS-B receivers



# Training Challenges: Complexity ↑ & Prior Experience ↓



Adopted from The Boeing Co.



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# Pilots Need Scenario-Based Training in Sim



RESEARCH AND INNOVATIVE TECHNOLOGY ADMINISTRATION

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Monday,  
January 12, 2009

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## Part II

# Department of Transportation

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Federal Aviation Administration  
14 CFR parts 65, 119, |121 et al.  
Qualification, Service, and Use of  
Crewmembers and Aircraft Dispatchers;  
Proposed Rule

# But: Qualified Simulators > \$10 millions

Travel to qualified simulator costs time & money

→ NAA authority allows recurrent training and checking on the aircraft

**Home base device improves safety**



# Gold Standard for Simulator Requirements

Requirements must add training value



Transfer



# Review Requirements & Existing Knowledge



- Findings
  - Little scientific basis for motion requirement
  - No requirement for realistic radio communications simulation

EndNote X (Bld 2114) - [SIMLIT2007.en]

Author	Year	Title	Journal	Ref Type	URL
Grant	2007	The effect of jerk and acceleration on...	Journal of Aircraft	Journal Arti...	
Chung	2004	Task and vehicle dynamics based as...	AIAA Modeling and...	Conference...	<a href="http://w">http://w</a>
Bürki-Cohen	1998	Simulator platform motion--The need ...	International Journa...	Journal Arti...	<a href="http://w">http://w</a>
Rolfe	1986	Flight simulation	Cambridge Aerosp...	Edited Book	
Chung	1997	Visual and roll lateral motion cues...	American Helicopt...	Conference	

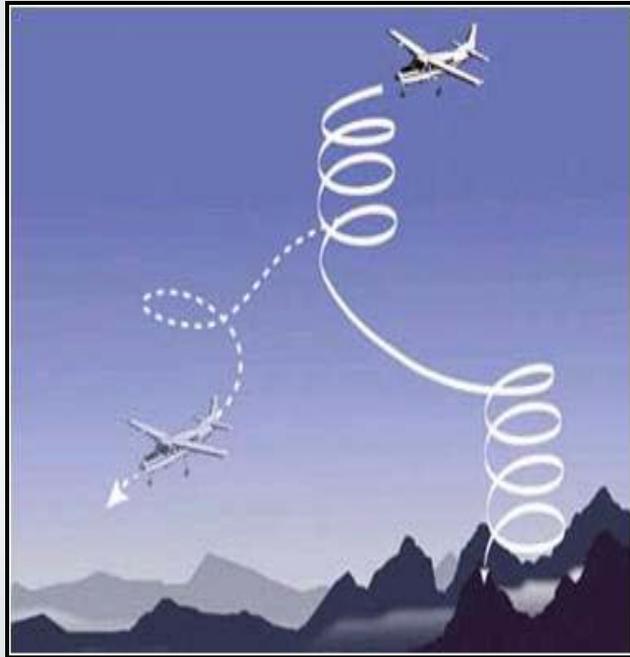
**Author's Title and Affiliation:** Bürki-Cohen: U.S. Department of Transportation-Volpe Center  
Soja: Consultant  
Longridge: Federal Aviation Administration (FAA)

**Abstract:** The need to provide increased access to flight simulator training for US regional airlines, which historically have been limited by cost considerations in the use of such equipment for pilot recurrent training, is discussed. In light of that need, that issue of whether more affordable fixed-base simulators, identical to full flight simulators in all respects except for absence of platform motion, might provide an equivalent level of safety when employed for recurrent training, is examined. Pertinent literature from the past two decades is reviewed. The paper observes that no definitive conclusion can be drawn that would warrant modification of current qualification requirements for platform motion in full flight simulators. The article concludes that this situation will remain unchanged unless new research is undertaken, which takes into account the lessons learned from past research, and the opportunities engendered by new technology. Broad guidelines for an appropriate research design are discussed.

Showing 989 out of 989 references.  
Ready

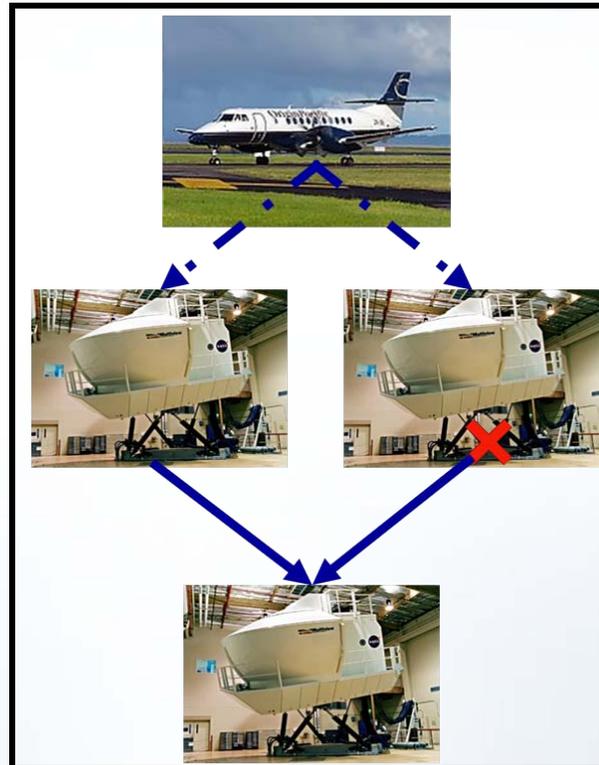


# FAA/Volpe Simulator Requirements Research Program



Upset  
Recovery  
Prevention

## Motion

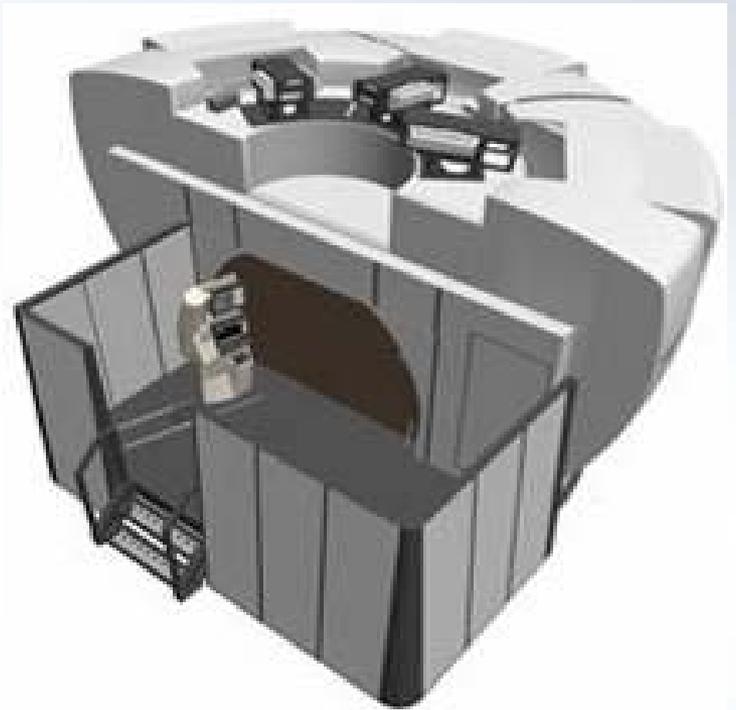


Realistic ATC  
Environment



# Motion

- Volpe Center studies find little effect of motion
  - Demonstrated power to find an effect
  - Worked with FAA AFS, NASA, MIT, airlines, training centers, manufacturers
- Technology Transfer
  - Industry develops alternative to hexapod platform motion
  - ICAO Doc. 9625 on simulator qualification allows for purpose-built devices
  - Possibility of large savings in training costs



With a dynamic seat  
=> Volpe is evaluating  
training effectiveness



# Realistic Radio Communications (RRC)

- Volpe Center studies show lack of RRC
  - reduces training opportunities
  - increases IOE incidents
- Technology Transfer
  - Industry develops automated systems
  - ICAO Doc. 9625 specifies requirement



# Upset Recovery Prevention

- Volpe Center advocates research on prevention via
  - Ground & air training
  - Flight envelope protection
  - Warning & advisory systems
- Activities include
  - Workshop @ Volpe with FAA, Navy, NASA, NTSB
  - Invited sessions at AIAA conferences with NTSB and NASA (2008 & 2010)
  - Participation in RAeS/ICATEE
    - Royal Aeronautical Society
    - International Committee on Aviation Training in Extended Envelopes



**Questions?**

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**More Information on Human Factors?**

**<http://www.volpe.dot.gov/hf/index.html>**

**More Information on RITA/Volpe Center?**

**<http://www.volpe.dot.gov/>**

