

## LAURENCE AUDENAERD



**TRAINING** in multiple engineering disciplines all with a transportation focus: Civil and Environmental, Operations Research, Industrial Engineering and Mechanical Engineering

**PERFORMING** with 20 years of professional experience across aviation, rail, transit, and highway modes, with 17 years of direct research support for US DOT/FAA, US Dept of Defense, and NASA

**PUBLISHING** Over 50 academic/industrial publications developed for aviation and surface transportation research.

**CONNECTING** Active member of various technical committees and industry groups.

**VOLUNTEERING** Active volunteer in engaging local youth in various Transportation and STEM activities.

### *EDUCATION, HONORS, AND MEMBERSHIPS*

**PH.D., [Civil and Environmental Engineering](#)** – December, 2011

**Northwestern University, Evanston, IL**

Dissertation Title: “Bringing Short-Haul Air Down to Earth: Exploring the Trade-Space of Mode Substitution for Regional Air Passenger Transport Markets”

Dissertation Committee: Joseph Schofer (chair), David Boyce, Aaron Gellman, Jeff Newman

**EXECUTIVE CERTIFICATE, [Kellogg School of Management](#)** – August, 2011

**Northwestern University, Evanston, IL**

Program: Management for Scientists and Engineers

**M.S.E. [Civil Engineering and Operations Research](#)** – May, 2000

**Princeton University, Princeton, NJ**

Thesis Title: “Reconstructing Road Edge Lines Through Curve Fitting”

Thesis Advisors: David Bernstein, Alain Kornhauser

**M.S. [Industrial and Systems Engineering](#)** – May, 1998

**Rutgers University, New Brunswick, NJ**

Thesis Title: “Logical and Physical Simulation of Heavy Vehicle Automation in the Lincoln Tunnel”

Thesis Advisors: Mohsen Jafari, Kaan Ozbay, Robert Paaswell (CUNY)

**B.E.: [Mechanical Engineering](#) / [Applied Mathematics and Statistics](#), December 1994**

**Stony Brook University, Stony Brook, NY**

### *ADVISORY AND COMMITTEE MEMBERSHIPS*

**Transportation and Environmental Policy Advisory Board** (Appointed), 2010 - 2014

IL State Senator Daniel Biss, 9<sup>th</sup> Legislative District

**Transportation Research Board of the National Academies Affiliations:**

Committee Member (Appointed), Airport/Airspace Capacity & Delay (AV060), 2008 - 2016

Panel Member (Appointed), Airport Cooperative Research Program, 2013 - 2016

Committee Friend, Aviation Economics (AV040), 2012 - present

Committee Friend, Aviation System Planning (AV020), 2014 - present

Committee Friend, Intercity Rail Committee (AR010) 2014 - present

Committee Friend, Rail Safety Committee (AR070) 2016 - present

**RTCA Member**

[RTCA Special Committee SC-206](#) [Aero. Info Services (AIS) Data Link] 2010 - present

**Transportation Research Forum**

[Vice President - Programs](#), (appointed) Chicago Chapter, 2017 – present

Member, Chicago Chapter 2013 - present

Member, Washington Chapter, 2015 – present

## ***EMPLOYMENT***

### **THE MITRE CORPORATION, McLean, VA - [Center for Advanced Aviation System Development](#)**

#### **Lead Engineer, Aviation and Transportation System, January 2015 – Present**

- Develop business strategy, engage key industry/government officials, and identify needs for MITRE's engagement of new work in non-aviation transportation, translating operational, regulatory, and technological similarities across transportation modes and related infrastructure.
- Engage key internal and external individuals on our work in safety analytics, safety-risk management, and safety management systems (SMS).
- Act as MITRE's lead for engagement in railroad and public transit domain, including coordinating work across MITRE's FFRDC centers for railroad engagement; providing subject-matter expertise for railroad and transit modes, multi-modal interaction, public policy, and traveler behavior including cyber-security, homeland security, and safety management systems.
- Coordinate strategic engagement of external industry through technical exchange meetings conceptualizing content and key attendees, managing select external contract vehicles, and coordinating across centers with the National Academies – Transportation Research Board.
- Support FAA's development of regulatory policy for airworthiness and operations of small Unmanned Aircraft Systems through the development of a risk-based analytical process.
- Continue to provide subject-matter expert for aircraft terminal area operations, wake turbulence effects, wind and weather behavior, and aircraft- and ground-based technology applications amongst the aviation research community.

#### **Lead Simulation and Modeling Engineer, June 2013 – December 2014**

- Provide subject-matter expertise internally and externally in wake turbulence, wind and weather behavior, and aircraft- and ground-based technology applications amongst the aviation research community.
- Provide trusted advising to FAA sponsors' changing needs throughout the federal acquisition management system in the development of FAA NextGen programs

#### **Senior, Simulation and Modeling Engineer, June 2003 – May 2013**

- Conduct research in wake turbulence, wind and weather behavior, and aircraft- and ground-based technology applications amongst the aviation research community.
- Support FAA sponsors' needs throughout the production of research products for federal acquisition management system elements such as cost-benefit analyses, safety analyses, and concept of operations development for a variety of FAA NextGen programs
- Manage multi-organizational teams of researchers and stakeholders for several FAA NextGen terminal area enterprise areas. Responsibilities include leading/managing research working groups, developing research needs, and conducting group and stakeholder panel meetings.
- Develop engineering models (including simulations) to support decision-making and policy.
- Develop and technology-transfer software applications for a variety of data measurement.

### **NORTHWESTERN UNIVERSITY, Evanston, IL**

#### **[Adjunct Faculty, Masters of Project Management – Transportation](#), March 2014 – Present**

- Instructor: MPM487: Management of Operations in Transportation, Spring Quarter, 2014-pres.
- Program Design Adviser

#### **Adjunct Faculty, Segal Design Institute, Spring, 2014 – Present**

- Co-Instructor: [DSGN106: Design Thinking and Communication I & II](#), Spring, 2014-pres.
- Invited Reviewer, [NUvention: Transportation](#) Final Presentations, Fall Quarter, 2016

#### **Invited Reviewer, Farley Center for Entrepreneurship and Innovation, Fall, 2016 – Present**

- [NUvention: Transportation](#) Final Presentation Review,

#### **Adjunct Faculty, Political Science, March 2014 – May 2014**

- Instructor: [POLSCI403: Introduction to Probability and Statistics](#), Fall Quarter, 2014.

#### **Teaching Assistantships, Civil and Environmental Engineering, Fall 2010 - Spring 2011**

- GEN\_ENG 205-2: Engineering Analysis 2, Winter 2010
- CIV\_ENG 302: Engineering Law, Spring 2011
- CIV\_ENG 371/479: Transportation System Planning, Fall 2011, Fall 2010

### **DEPAUL UNIVERSITY, Chicago, IL - [Chaddick Institute for Metropolitan Development](#)**

#### **[Visiting Scholar](#), June 2012 – Present**

- Routinely participate as reviewer on student final project designs, intellectually engage faculty, invited guests, students on research outcomes, and projects.
- Develop economic and cost analyses for Chicago transit system studies based on available data, existing literature and pre-existing models.
- Lecture on various transportation topics for broad audiences of industry, government, academics.

- Represent Chaddick Institute at various Chicago industry events, conferences, and student groups.

**INSTITUTE FOR DEFENSE ANALYSES, Alexandria, VA - [Cost Analysis and Research Division](#)  
Research Analyst, March 2000 – June 2003**

- Developed transportation cost analysis for Independent Cost Estimate for NASA International Space Station program and Space Shuttle support missions.
- Developed a large-scale logistics and maintenance simulation model for multiple aircraft types/multiple mission type for F-35 and Marine Corps rotary wing aircraft acquisition decisions.
- Managed and revised the Defense Department's detailed economic input/output model mapping the entire US Defense budget to industry sectors
- Developed multiple optimization analyses for military transport acquisition planning

***AEROSPACE PUBLICATIONS AND PRESENTATIONS***

- Co-Author, Breunig, J. et al. "Risk Based Approach for Small Unmanned Aircraft System (sUAS) Airworthiness Safety Certification" The MITRE Corporation. September, 2016.
- Project Panel Member on Timar, Sebastian, et al. [ACRP 03-34: NextGen for Airports – Understanding the Airport's Role in Performance Based Navigation](#). Transportation Research Board of the National Academies, 2016.
- Audenaerd, L. "Status Update for the Interval Management Paired Approach Category II Concept" MP150412 The MITRE Corporation. September, 2015.
- Audenaerd, L. "[Aviation Data: Planning for Capacity](#)" Presented in Freight Data Meets Innovative Technologies Workshop at Transportation Research Board Annual Meeting, January 10, 2015.
- Moderator, TRB Global Webinar "Wake Recategorization (RECAT)" Transportation Research Board. August 14, 2014.
- Audenaerd, L. and C. Lunsford "[Applying Improved Wind and Aircraft Performance Data in Wake Procedure Concepts](#)" 2014 ICNS Conference, Herndon, VA. April, 2014.
- Audenaerd, L. "[Estimating Approach Path Coverage of Aircraft-Derived Meteorological Data in Advanced Air Traffic Management Applications](#)" in Trans. Research Record, #2449, pp. 49-58, 2014.
- Audenaerd, L., Lunsford, C. and Schaffer, C. "Proposed System Designs for Aircraft Based Weather Input to Wake Turbulence Mitigation for Arrivals – System (WTMA-S) at San Francisco International Airport (SFO)" MTR130283, MITRE Corp, McLean, VA. June, 2013.
- Audenaerd, L. and Koch, M. "Exploration of Reduced Diagonal Separation for Dependent Arrivals to Closely Spaced Parallel Runways" MP120378, MITRE Corp, McLean, VA. July, 2012
- Co-Author, Johnson, Edward J., et al. "[Aircraft Derived Meteorological Data via Data Link for Wake Vortex, Air Traffic Management and Weather Applications – Operational Services and Environmental Definition \(OSED\)](#)" Document #DO-339, RTCA SC-206. June, 2012.
- Audenaerd, L. "[Evaluating the Impacts of Mode Substitution for Short-Haul Air Connections at Chicago O'Hare](#)" Presented at 27th Annual Transport Chicago Conference, Chicago, IL, June, 2012.
- Audenaerd, L., Schofer, J., and Boyce, D. "[Trade-Space Analysis of Surface Alternatives for Short-Haul Passenger Air Travel](#)" in Transportation Research Record, #2300, pp. 129-138, 2012.
- Audenaerd, L. "[A Characterization of Surface and Aloft Winds for Advanced Parallel Runway Operations](#)" in Transportation Research Record, #2300, pp. 49-58, 2012.
- Presentation, "[A Trade-Space Analysis of Surface Alternatives for Short-Haul Passenger Air Travel](#)" Northwestern University Transportation Center - Seminar Series. January 12, 2012.
- Cheng, J., Osburn, D. and Audenaerd, L. "Wake Turbulence Mitigation for Arrivals (WTMA) Safety Update – WTMA-Procedure (WTMA-P) Hazard Assessment and WTMA-System (WTMA-S) Safety Area Identification," MP110255, MITRE Corp, McLean, VA. August, 2011.
- Co-Author, Mundra, A. et al. "The Paired Approach Procedure to CSPR: Overview of Procedure Feasibility, Benefits, and Requirements," MP 110131, MITRE Corp, McLean, VA. March, 2011.
- Audenaerd, L. and Koch, M. "Initial Functional Architecture for the Wake Turbulence Mitigation for Arrivals – System Program" MP110068, MITRE Corp., McLean, VA. February, 2011
- Cheng, J and Audenaerd, L. "Wake Turbulence Mitigation for Closely Spaced Parallel Runways Arrivals – Procedure Operational Hazard Assessment" MTR100339, MITRE Corp., McLean, VA Sept, 2010
- Audenaerd, L. et al., "Surface Trajectory-Based Operations (STBO) Mid-Term Concept of Operations, Overview and Scenarios" MP090230R1, MITRE Corp., McLean, VA, September 2010

- Lunsford, C. and Audenaerd, L. "Recovering Airport and System Capacity Lost During Weather: Trends in Wake Turbulence Mitigation" Presented at Trans. Research Board Annual Mtg, January 10, 2010.
- Chair, Aviation Workshop "Terminal Velocity: Illuminating Realities of Achieving NextGen Capacity Gains at Airports" 89th Annual Meeting, Transportation Research Board, January 10, 2010.
- Audenaerd, L. et al. "[Increasing Airport Arrival Capacity in NextGen with Wake Turbulence Avoidance](#)" ICNS Conference, Arlington, VA. May 13, 2009.
- Co-Author, Mundra, A. et al. "[Potential benefits of a Paired Approach procedure to closely spaced parallel runways in instrument and marginal visual conditions.](#)" Paper presented at Digital Avionics Systems Conference, 2008. DASC 2008. IEEE/AIAA 27th Oct, 27, 2008
- Lunsford, C. Audenaerd, L. and Smith, A.P. "Wake Turbulence Mitigation for Departures Capacity Analysis for Ten Candidate Airports" Product F045-B08-016, MITRE Corp., McLean, VA. Sept, 2008.
- Audenaerd, L. et al., "Analysis of Potential Benefits of 2500 ft Wake Vortex Rule Change" MP060216, MITRE Corp, McLean, VA, November 2006
- Co-Author, Lunsford, C., et al. "[Wind Dependent Concepts for Wake Avoidance: A Comparative Analysis of Capacity Benefits and Implementation Risks](#)" Paper presented at the 24th Digital Avionics Systems Conference, Arlington, VA, October, 2005.
- Co-Author: Lang, S., et al. "[An Analysis of Potential Capacity Enhancements through Wind Dependent Wake Turbulence Procedures.](#)" Paper presented at the 6th USA/Europe Seminar on Air Traffic Management Research and Development, Baltimore, MD, June, 2005.
- Co-Author: Lunsford, C., et al. "Analysis of WakeVAS Procedures for Potential Benefits and Development and Implementation Risk" MTR05W0000015, MITRE Corp., McLean, VA, February 2005.
- Co-Author: Lunsford, C., et al. "[Exploration of Terminal Procedures Enabled by NASA WakeVAS Technologies.](#)" NASA/CR—2004-213023, August, 2004.
- Co-Author: Nelson, J. R. et al. "Independent Cost Estimate of the International Space Station, [UNCLASSIFIED]," Draft, August 2002.
- Co-Author: Simmons, L. D. et al. "Analysis of Alternatives for the Joint Strike Fighter, Volume V, Cost Assessments. [UNCLASSIFIED]," IDA Report R-407, August 2001.

## ***SURFACE TRANSPORTATION PUBLICATIONS AND PRESENTATIONS***

- Presentation, "[Trust and the Public-Private Partnership in Aviation Safety: Parallels for Applicability in the Railroad Industry](#)" Presented in Rail Operational Safety Research Topics in Human Factors at 96th Annual Meeting of the Transportation Research Board, January 9, 2017.
- Audenaerd, L. P. Massimini, and G. Orrell "Trust and the Public-Private Partnership in Aviation Safety: Parallels for Applicability in the Railroad Industry" MITRE Corporation, December 2016
- Presentation, "[Public-Private Partnership for Transportation Safety: Case Studies in Air & Rail](#)" Northwestern University Transportation Center - Seminar Series. October 6, 2016.
- Moderator, Transportation Research Forum's A Farewell Conversation with Chicago Tribune's Jon Hilkevitch, November 15, 2015.
- Moderator, "The Transit Future: An Initiative of the Center for Neighborhood Technology and Active Transportation Alliance" Chaddick Institute – DePaul University, September 30, 2014
- Lecture, "The Impacts of Terminals Across Modes in the Chicago Region" – a lecture introducing "[Terminal Town](#)" book by J. Schwieterman. James R. Thompson Center lobby. September 5, 2014
- Schwieterman, J., and Audenaerd, L. "[Economic Perspectives on Benefits and Costs of the CTA Red and Purple Modernization Project](#)" Chaddick Institute for Metropolitan Development, DePaul University, Chicago, IL. November, 2013
- Audenaerd, L. "[Where Does the Rubber Meet the Road? Evaluating the Investment Outcomes of Transportation Studies in the Chicago Region](#)" Presented at 28th Annual Transport Chicago Conference, Chicago, IL, June, 2013.
- Schwieterman, J., Audenaerd, L. and Schulz, M. "[Tending to Transit: The Benefits and Costs of Bringing Public Transport in the Chicago Region into Good Repair](#)" Chaddick Institute for Metropolitan Development, DePaul University, Chicago, IL. December 10, 2012
- Co-Author, Schofer, J. et al, "Des Plaines Watershed Flood-Induced Traffic Delay for Chicago Region – A Report for US Army Corps of Engineers" Northwestern University, May, 2010.

- Audenaerd, L. et al. "[Beyond Transportation: The Economic Impact of Rail in Illinois](#)" Prepared for IL Governor Pat Quinn, May 14, 2010
- Interviewer, "[How Optimal Is Optimal? Revealing the Realities of Implementing Transportation Solutions: A Discussion with Illinois State Senator Jeff Schoenberg, 9th Legislative District](#)" Northwestern University Transportation Center Seminar, December 3, 2009.
- Audenaerd, L. "[Logical and Physical Simulation of the Lincoln Tunnel: A Case Study of the Lincoln Tunnel](#)," Proceedings of SPIE - Intelligent Transportation Systems, Vol. 3207, January, 1998.
- Paaswell, R. E., L. Audenaerd, and M. Jafari: "[Application of Industrial Standards to Bus Maintenance Procedures](#)," Transportation Research Record - Public Transit # 1571, pp. 50-55, 1997.

## ***SOFTWARE TOOL/MODEL DEVELOPMENT***

- Small UAS Airworthiness Certification Model** – Sep-15, Co-Developer for risk-analysis model for classifying the airworthiness of sUAS vehicles for FAA, Platform: Visual Basic/Python/MATLAB
- Aircraft Wake 5D Model**– v 1.0 Jul-12, Model for estimating wake affected area along aircraft arrival and departure tracks, v 1.0 Jul-11 Platform: Excel/Visual Basic
- Aircraft-based Reporting in Terminal Area (ARITA)** – v 1.0 Jul-12, Model for estimating airport terminal area aircraft-based sensor measurement coverage, v 1.0 Jul-11 Platform: Excel/Visual Basic
- Mode-Substitution Model** – v 2.0 Dec-11, Model for estimating mode substitution of short-haul trips from hub airport to regional airport, v 1.0 Jul-11 Platform: Excel/Visual Basic
- LIDAR Site Placement Tool** – v 1.0 Sep-11, FAA/Volpe Center LIDAR device geospatial site planning tool for sensor deployment, v 1.0 Jul-11 Platform: Excel/Visual Basic/Google Earth
- WakeViewer** - Wake Turbulence LIDAR Data Analysis/Visualization Tool, v 1.0 Aug-05; v 2.0, Nov-05 Platform: MATLAB and PAVE (MITRE Virtual Reality Modeling Environment)
- QuizChallenge** – v 1.0 May-05; v 2.0 Oct-05 Interactive Gastroenterology Continuing Education Software Package: Platforms: v 1.0: Visual Basic 6/ v2.0 Flash
- UAV Simulation and Evaluation Model (USEM) [Unclassified]**. v1.0 Aug-02. Reliability and support model for military UAV deployment, Platform: Extend Simulation Modeling Language/C++
- TableGenerator** Jun-02 Data review tool for of academic institutional data, Platform: Excel/Visual Basic
- Vector – Defense Employment Purchases and Projection System (V-DEPPS)**, May -02. Economic Input/Output model processing tool of US Defense Budget. Platform: Excel/Visual Basic.
- Airlift Affordability and Optimization Tool [Unclassified]**. Sep-2001 Interactive optimization program to model airlift purchasing. Platform: AMPL. September, 2001.
- IDA – Manpower Utilization and Sortie Evaluation (IMUSE) [Unclassified]**. v2.0 Dec-02 Large-scale simulation for multiple military aviation missions. Platform: Extend Simulation Language

## ***VOLUNTEERISM***

- Advisor, IL Jr Academy of Science Fair Entry/Sr Capstone Project**, Niles West Twp HS, 2015 - 2016  
Directly advising Niles West high school senior with project "Designing Wake Turbulence Avoidance Systems for Unmanned Aerial Vehicles" Awarded "[Best in Category](#)"
- Advisor, Student Science Olympiad Projects**, Pope John XXIII, 2015 - present  
Work directly with middle school students developing their Science Olympiad competition entries.
- Adult Leader, Boy Scouts of America**, Troop 929 - Evanston, IL, 2014 – present.
- Adult Leader, Girl Scouts of America**, Troop 44098 - Evanston, IL, 2014 – present.
- Co-Developer, City of Portville Airport Design Challenge**, 2009 - present  
A simulated, multi-stakeholder, airport site planning design challenge course immersing students to learn urban design and civil engineering through classroom learning and interactive site visits.
- Founding Member, Icarus Society**, Northwestern University Transportation Center, 2011 - present  
A group dedicated to providing a forum for aviation related intellectual pursuits
- Member, Board of Advisors** (Appointed), Evanston Environmental Association, 2011 - 2015
- Chair, Annual Science Fair**, Willard Elementary School, 2010 - 2015