EMILY WILLIAMS

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EDUCATION

Massachusetts Institute of Technology
Sep 2021 – June 2026

Master of Science/Doctor of Philosophy in Aeronautics and Astronautics — GPA: TBD
Specialization in Computational Science and Engineering

University of Illinois at Urbana-Champaign
Aug 2017 – May 2021

Bachelor of Science with Highest Honors in Aerospace Engineering — GPA: 3.94 / 4.00
Minor in Atmospheric Sciences, Concentration in Computational Science and Engineering

RESEARCH EXPERIENCE

Computational Turbulence Group
Fall 2021 – Present

Advisor: Adrián Lozano-Durán, PhD — Cambridge, MA

- Using machine learning for computational fluid dynamics of hypersonic turbulent boundary layers
- Physics and data-driven modeling using information theory for external aerodynamic applications

Numerics and Unsteady Flows (NUF) Group
Summer 2020 – Spring 2021

Advisor: Andrés Goza, PhD — Champaign, IL

- Optimized higher order method using immersed boundary smooth extension
- Used extended forcing for continuous boundary solution for the fluid-structure interface

Center for Hypersonics & Entry Systems Studies (CHESS)
Spring 2020 – Spring 2021

Advisor: Marco Panesi, PhD — Champaign, IL

- Used neural networks to fit potential energy surfaces and acquire chemical reaction rates
- Performed optimization and regularization techniques for uncertainty quantification
- First recipient of the Scott R. White AE Visionary Scholarship for excelling in undergraduate research

TEACHING EXPERIENCE

Head Engineering Learning Assistant
Spring 2019 – Spring 2021

ENG 100: Engineering Orientation — Champaign, IL

- Instructed two ENG 100 sections of 20+ first-year aerospace undergraduate students each
- Oversaw all ENG 100 course activities for the college while providing direction, guidance, and mentorship

Course Developer & Instructor
Spring 2020

AE 199 SAT: Introduction to CubeSat Design & Development — Champaign, IL

- Created engineering technical elective to introduce underclassmen to satellite development
- Served as primary instructor and wrote course curriculum for 25+ undergraduate students

Course Developer & Teaching Assistant
Spring 2020 – Spring 2021

ENG 177: Grainger Engineering First-Year Experience (GFX) Leadership Scholars — Champaign, IL

- Provided a forum for strengthening leadership skills for underrepresented minorities in engineering
- Led in restructuring course to align with learning and leadership objectives

TECHNICAL PROJECTS

Compressible Turbulent Channel Flow
Summer 2021

16.THG: Graduate Thesis — Cambridge, MA

- Investigating statistical quantities of interest such as mean velocity, wall stress, skin friction, and heat transfer
- Comparing direct numerical simulation results to wall-modeled large-eddy simulation results using charLES solver
- Characterizing error scaling properties of large-eddy simulation of compressible wall-bounded turbulent flows
- Using uncertainty quantification to demonstrate level of convergence for different grid resolutions
- Future work focuses on supersonic and hypersonic turbulent boundary layers for zero-pressure-gradient plate flows

AIAA Design Competition: Austere Field Light Attack Aircraft
Spring 2021

AE 443: Aircraft Systems Design — Champaign, IL

- Led preliminary design and sizing of light attack aircraft to meet mandatory performance and design requirements
- Oversaw configuration iterations using trade studies and derived requirements from mission objectives
- Provided cost estimates and performance evaluations for time-restrictive flight profiles
- Served as team lead overseeing disciplines in dynamics & stability, propulsion & systems, and ordnance & structures

Finite-Volume Eulerian Solver for 1D Nonlinear Simplified Navier-Stokes Equations
Spring 2021

AE 410: Computational Aerodynamics — Champaign, IL

- Derived Euler equations from 1D Navier-Stokes equations assuming vanishing viscosity and thermal conductivity
- Solved equations using Roe's method to discretize convective fluxes using finite-volume method
- Employed characteristic boundary condition for subsonic outlet and computed flux functions using Roe scheme
- Computed post-shock initial conditions using Rankine-Hugoniot equations

Finite-Difference Solver for 1D Linear Euler Equations
Spring 2021

AE 410: Computational Aerodynamics — Champaign, IL

- Derived 1D linear acoustic equations from linearized Euler equations neglecting energy equation
- Solved equations using 2nd-order central, 3rd-order biased, and 6th-order finite-difference methods
- Considered layered medium with bulk modulus of compressibility and background density as piecewise constants
- Imposed non-reflection at left boundary and specular reflection at right boundary using characteristic variables

Multi-Dimensional Linear and Nonlinear Advection
Spring 2021

CSE 566: Numerical Fluid Dynamics — Champaign, IL

- Solved 1D linear and nonlinear transport equation on 1D mesh with forward time and centered space differencing
- Solved 2D linear advection via fractional (directional) step splitting with zero gradient boundary conditions
- Considered sine wave or circular field initial conditions for 1D or 2D grid
- Integrated using Lax-Wendroff, Takacs, and Crowley numerical methods on staggered C-grid

Compressible Boundary Layer over Flat Plate
Fall 2020

AE 598: Hypersonic Aerothermodynamics — Champaign, IL

- Integrated compressible boundary layer over flat plate with zero pressure gradient for calorically perfect gas
- Used shooting technique to solve governing equations subjected to wall and edge boundary conditions
- Computed self-similar temperature and velocity profiles for adiabatic and isothermal walls
- Developed Python script with Mach number, Prandtl number, and Chapman-Rubesin parameter as inputs

PROFESSIONAL EXPERIENCE

Boeing Defense, Space & Security
Summer 2020, Summer 2021

Space Electronics Product Design Automation Intern
El Segundo, CA (Remote)

- Hired through the Engineering Accelerated Hiring Initiative (EAHI) program
- Automated process to interface between integrated PCB layout application and ANSYS for thermal analysis
- Streamlined data forensics of thermal parameters for product design and defect origins for mitigating risk
- Developed database workflow to parse and categorize various defects resulting from fabrication techniques

GE Aviation
Summer 2018

Product Operations Intern
Cincinnati, OH

- Hired through the Early Identification (EID) program
- Executed technical solutions for changes in design of turbofan jet engine hardware
- Reallocated 300+ fan blades for product development, expediting the development of 20 affected engines
- Proactively identified maintenance, repair, and overhaul issues through tracking forecasted commits

PUBLICATIONS & PRESENTATIONS

Williams, E., Lozano-Durán, A., “Error Scaling of Wall-Modeled Large-Eddy Simulation of Compressible Wall Turbulence," American Physical Society Division of Fluid Dynamics, November 2021.

Williams, E., Ling, Y., Arranz, G., and Lozano-Durán, A., “Numerical Schlieren of the X-59 QueSST," American Physical Society Division of Fluid Dynamics Gallery of Fluid Motion, November 2021.

Ling, Y., **Williams, E.**, Arranz, G., and Lozano-Durán, A., “Can the X-Wing Survive the Reentry to Dagobah?" American Physical Society Division of Fluid Dynamics Gallery of Fluid Motion, November 2021.

Williams, E., Sharma, M.P., Venturi, S., and Panesi, M., “Relation of Dissociation Rates to the Centrifugal Barrier," Undergraduate Research Symposium (URS), University of Illinois at Urbana-Champaign, April 2020.

HONORS & AWARDS

AIAA Aviation Week Network 20 Twenties	2021	Boeing Women in Engineering Scholarship	2018
James Scholar Honors Program	2017 - 2021	Illinois Space Grant (ISGC) Scholarship	2018
University of Illinois Dean’s List	2017 - 2021	GE Women’s Network Scholarship	2018
Grainger Engineering Knight of St. Patrick	2021	AE Dept Academic Scholarship	2018
University of Illinois Tutor of the Year	2021	Hayward Tau Beta Pi Scholarship	2018
Senior 100 Honorary	2021	Grainger Scholarship for Continuing Students	2018
NSF GRFP Honorable Mention	2021	H.S. Stillwell Memorial Scholarship	2018
Scott R. White AE Visionary Scholarship	2020	Illinois Engineering Achievement Scholarship	2017
Dale Margerum Memorial Award	2020	Turley Scholarship	2017
Philip Lazzara Memorial Scholarship	2020	MSCI Central States Chapter Scholarship	2017