

# Derek Nichols

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## EDUCATION

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**Georgia Institute of Technology, Atlanta, GA** 2024

*Ph.D. Mechanical Engineering*

- Thesis: Characterization and Control of Inlet Nacelle Flow in the Presence of Crosswind and Ground Effects
- Graduate Research Advisor: Professor Ari Glezer
- Minor Concentration: Teaching in Higher Education

**Georgia Institute of Technology, Atlanta, GA** 2021

*M.S. Mechanical Engineering*

- Minor Concentration: Environmental Fluid Mechanics

**University of Pittsburgh, Pittsburgh, PA** 2017

*B.S. Mechanical Engineering, Summa Cum Laude*

- Minor Degrees: Bioengineering; Mathematics

## RESEARCH EXPERIENCE

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**Naval Surface Warfare Center, Carderock Division** 2024 – Present

*West Bethesda, MD*

- Project lead testing the impact of an airfoil's leading edge shape on unsteady lift response in Carderock's Anechoic Flow Facility
- Designing test hardware to incorporate large sensor counts, resolve small-amplitude and high frequency forces, and allow for affordable reconfigurability of test foil geometries
- Training to perform large eddy simulations to characterize propulsor acoustic sources
- Active security clearance

**Fluid Mechanics Research Laboratory, Professor Ari Glezer** 2017 – 2024

*Georgia Institute of Technology, Atlanta, GA*

- Funded by The Boeing Company, Georgia Tech, and the NSF GRFP
- Designed and conducted wind tunnel experiments to study commercial aircraft nacelle performance in crosswinds close to the ground
- Characterized the flow into and around the nacelle using pressure, temperature, and velocity measurements and surface oil flow visualization
- Developed flow control techniques to negate the adverse effects of inlet separation
- Reduced inlet flow distortion by up to 60% in 30 knot crosswind using optimized flow control
- Investigated the effect of the presence of a ground surface and the possible formation of a ground vortex
- Reconstructed ground vortex 3D flow field using slices of stereo PIV
- Delayed vortex formation by over 3x that of the uncontrolled thrust value

**Computational Biofluid Mechanics Laboratory, Dr. Riccardo Gottardi** 2014 – 2018

*University of Pittsburgh, Pittsburgh, PA*

- Developed microfluidic bioreactor prototypes used to test drugs for osteoarthritis
- Simulated fluid flow and 3D printed models tested in a laboratory to compare results
- Optimized model to maximize drug exposure to the test cells achieving 2.4x delivery versus original design

## JOURNAL PUBLICATIONS

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**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “On the Formation of a Ground Vortex in Crossflow,” *Journal of Fluid Mechanics*, Vol. 1012, 2025.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Control of a Nacelle Inlet Ground Vortex in Crossflow,” *AIAA Journal*, Vol. 63, No. 6, 2025.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., and Rafferty, B., “Aerodynamic Control of an Inlet Flow in Crosswind using Peripheral Bleed Actuation,” *Journal of Propulsion and Power*, Vol. 40, No. 1, 2024.

**Nichols, D.A.**, Sondh, I., Little, S., Zunino, P., and Gottardi R., “Design and Validation of an Osteochondral Bioreactor for the Screening of Treatments for Osteoarthritis,” *Biomedical Microdevices*, Vol. 20, No. 18, 2018.

## PATENTS

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“Adaptable Flow Control for Engine Nacelles,” Rafferty, B., DeFore, M., Glezer, A., Vukasinovic, B., **Nichols, D.A.**, *US Patent 11,542,866*, January 3, 2023.

## CONFERENCE PAPERS

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Toth, B., **Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M.C., Chun, P., Butler, B., and Harris, C.A., “The Evolution of Streamwise Vortices Formed by Inclined and Swept Round Jet Within a Turbulent Boundary Layer,” AIAA Paper 2024-3634, July 2024.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Control of a Nacelle Inlet Ground Vortex,” AIAA Paper 2024-2138, January 2024.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “The Formation, Evolution, and Sustainment of Inlet Ground Vortices,” AIAA Paper 2023-3891, June 2023.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Scaling Characteristics of Ground Vortices in a Nacelle Inlet Flow Field,” AIAA Paper 2023-1981, January 2023.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., and Rafferty, B., “Formation of a Nacelle Inlet Ground Vortex in Crosswind,” AIAA Paper 2022-1698, January 2022.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M., and Rafferty, B., “Steady and Unsteady Control of Nacelle Inlet Flow in Crosswind,” AIAA Paper 2021-1556, January 2021.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M., and Rafferty, B., “Fluidic Control of Nacelle Inlet Flow in Crosswind,” AIAA Paper 2020-2955, June 2020.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M., Rafferty, B., and Palacios, F., “Characterization and Control of a Nacelle Inlet Flow in Crosswind” AIAA Paper 2019-3685, June 2019.

## CONFERENCE PRESENTATIONS

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**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Regulated Formation of a Ground Vortex in Suction Flow Over a Surface,” *77th Annual Meeting of the APS Division of Fluid Dynamics*, November 25, 2024.

Toth, B., Vukasinovic, B., **Nichols, D.A.**, Glezer, A., DeFore, M.C., and Harris, C.A., “Evolution of Streamwise Vortices Formed by an Inclined, Yawed Round Surface Jet within a Turbulent Boundary Layer,” *77th Annual Meeting of the APS Division of Fluid Dynamics*, November 24, 2024.

Yraguen, B.F., Arkhurst, B.K., Montgomery, S., **Nichols, D.A.**, and Molnar, J., “Promotion of Student Well-being via Successful Navigation Through Conflict Resolution Pathways,” *CoNECD 2024*, February 27, 2024.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Formation of Ground Vortices in the Cross Flow over an Axisymmetric Inlet Above a Plane,” *76th Annual Meeting of the APS Division of Fluid Dynamics*, November 19, 2023.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Formation and Stability of a Ground Vortex in the Cross Flow over an Axisymmetric Inlet,” *75th Annual Meeting of the APS Division of Fluid Dynamics*, November 21, 2022.

**Nichols, D.A.**, Vukasinovic, B., and Glezer, A., “Vortex Dynamics in Axisymmetric Inlet Over a Plane in a Cross Flow,” *74th Annual Meeting of the APS Division of Fluid Dynamics*, November 21, 2021.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M., and Rafferty, B., “Adaptable Fluidic Control of Round Inlet Flow in Cross Flow,” *73rd Annual Meeting of the APS Division of Fluid Dynamics*, November 22, 2020.

**Nichols, D.A.**, Vukasinovic, B., Glezer, A., DeFore, M., and Rafferty, B., “Fluidic Control of Round Inlet Flow in a Crosswind,” *72nd Annual Meeting of the APS Division of Fluid Dynamics*, November 25, 2019.

Gottardi, R., Riccardis, G., Avolio, M., **Nichols, D.A.**, et al., “A 3D Printed Microfluidic Bioreactor to Engineer Biphasic Construct,” *2018 AIChE*, November 1, 2018.

Gottardi, R., Riccardis, G., Avolio, M., **Nichols, D.A.**, et al., “A 3D Printed Microfluidic Bioreactor to Engineer Biphasic Musculoskeletal Construct,” *Tissue Engineering and Regenerative Medicine International Society – World Annual Meeting*, September 6, 2018.

## POSTERS

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Donnaloja, F., Riccardis, G., **Nichols, D.A.**, et al., “Biphasic Bioreactor for Osteochondral Drug Screening and Toxicity Assessments,” *6th TERMIS World Congress*, November 15, 2021.

Donnaloja, F., Riccardis, G., **Nichols, D.A.**, et al., “Osteochondral Bioreactor for Drug Screening and Toxicity Assessments,” *26th Congress of the European Society of Biomechanics*, July 13, 2021.

Gottardi, R., Riccardis, G., Avolio, M., **Nichols, D.A.**, et al., “A 3D Printed Microfluidic Bioreactor to Engineer Biphasic Musculoskeletal Construct,” *Biomedical Engineering Society Annual Meeting*, Atlanta, GA, October 18, 2018.

Gottardi, R., Riccardis, G., **Nichols, D.A.**, et al., “A 3D Printed Microfluidic Bioreactor to Engineering Biphasic Musculoskeletal Construct,” *Orthopedic Research Society Annual Meeting*, New Orleans, LA, March 2018.

**Nichols, D.A.**, Sondh, I., Zunino, P., and Gottardi, R., “Optimizing an Osteochondral Bioreactor for the Screening of Treatments for Osteoarthritis,” *Science 2016*, Pittsburgh, PA, October 2016.

Sondh, I., **Nichols, D.A.**, Bayer, E., Gottardi, R., and Little, S.R., “Development of a Bioreactor Aimed at Designing Spatial and Temporal Drug Delivery Profiles for Bone Regeneration Protocols,” *Biomedical Engineering Society Annual Meeting*, Minneapolis, MN, October 2016.

## TEACHING EXPERIENCE

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**Thermodynamics Instructor of Record** Spring 2023

*Georgia Institute of Technology, Atlanta, GA*

- Developed and delivered all course material with ASME Graduate Teaching Fellowship
- Heavy emphasis on in class demonstrations to make abstract concepts more tangible
- Class size of 52 students
- Average CIOS score of 4.7/5 measuring overall teaching effectiveness

**Fluid Mechanics Teaching Associate** Fall 2019-2021, 2023

*Georgia Institute of Technology, Atlanta, GA*

- Average CIOS score of 4.9/5 measuring overall teaching effectiveness

**Georgia Tech’s Tech to Teaching Certificate** Fall 2020

*Georgia Institute of Technology, Atlanta, GA*

- Completed three graduate-level courses to prepare future faculty in teaching pedagogy and course design

**CIRTL Certificate** Spring 2020

*Georgia Institute of Technology, Atlanta, GA*

- Center for the Integration of Research, Teaching, and Learning associate level certificate

**MEMS Senior Design Undergraduate Teaching Assistant** Spring 2017

*University of Pittsburgh, Pittsburgh, PA*

**MEMS Fundamentals of Engineering Projects Undergraduate Teaching Assistant** Spring 2017

*University of Pittsburgh, Pittsburgh, PA*

## SKILLS

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### Programming Languages

- Advanced: Matlab, HTML, CSS
- Proficient: Python, L<sup>A</sup>T<sub>E</sub>X
- Beginner: C/C++, Assembly, UNIX, Mathematica

### Software

- ANSYS, AutoDesk, EES, Excel, Git, LabVIEW, LaVision DaVis, OpenFOAM, Power Automate, Siemens NX, SolidWorks, Tecplot

### Laboratory

- Particle image velocimetry (stereo and planar), experimental flow visualization, experimental design, thermal and fluid sensors, laser and camera optics, acoustic measurements

## LEADERSHIP AND SERVICE

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**FMRL Lab Manager** 2021 – 2024

*Georgia Institute of Technology, Atlanta, GA*

- Manage lab operations, oversee lab/laser inspections, and schedule preventative maintenance on equipment
- Redesigned and maintain lab website (<https://fmrl.gatech.edu>)

**Woodruff School Graduate Mental Health and Wellness Committee Member** 2021 – 2024

*Georgia Institute of Technology, Atlanta, GA*

- Advocate for graduate student rights and protective policies within the department
- Redesigned and maintain group website (<https://memhc.me.gatech.edu/>)
- Project/hiring manager for tool aimed at providing graduate students with resources for conflict resolution

**APS DFD 2023 Session Chair** November 19, 2023

*Georgia Institute of Technology, Atlanta, GA*

- Vortex Dynamics and Vortex Flows: Boundary Interactions

**ME Rising Stars Workshop** October 2023

*University of California, Berkeley, CA*

**Georgia Tech President's Undergraduate Research Award (PURA) Reviewer** 2019 – 2023

*Georgia Institute of Technology, Atlanta, GA*

**Georgia Tech Muay Thai Senior Member - Officer** 2017 – 2020

*Georgia Institute of Technology, Atlanta, GA*

**Georgia Tech NASA Robotic Mining Team - Mechanical Engineering Lead** 2018

*Georgia Institute of Technology, Atlanta, GA*

**Pitt MEMS Senior Design Project Sponsor** Spring 2017

*University of Pittsburgh, Pittsburgh, PA*

**Pitt Makerspace Volunteer** 2015 – 2017

*University of Pittsburgh, Pittsburgh, PA*

**Altoona Public Access Channel Cameraman and Editor** 2010 – 2013

*Altoona Public Access Channel, Altoona, PA*

## AWARDS AND HONORS

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**Woodruff School Award - Best Graduate Instructor** Spring 2024

*Georgia Institute of Technology, Atlanta, GA*

**Webb-Donnell Graduate Quick Talk Finalist - 3rd Place** Spring 2024

*Georgia Institute of Technology, Atlanta, GA*

**Student Recognition of Excellence in Teaching: CIOS Honor Roll** Spring 2023

*Georgia Institute of Technology, Atlanta, GA*

**ASME Graduate Teaching Fellowship** 2022

*Georgia Institute of Technology, Atlanta, GA*

<b>Best Paper, Fluid Dynamics, AIAA SciTech 2022</b> <i>Georgia Institute of Technology, Atlanta, GA</i>	2022
<b>National Science Foundation Graduate Research Fellow</b> <i>Georgia Institute of Technology, Atlanta, GA</i>	2019 – 2022
<b>Georgia Tech President’s Fellowship</b> <i>Georgia Institute of Technology, Atlanta, GA</i>	2017 – 2020
<b>AIAA Orville and Wilbur Wright Graduate Award</b> <i>Georgia Institute of Technology, Atlanta, GA</i>	2019
<b>Pitt Mobile App Challenge - Finalist</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2017
<b>MEMS Senior Design - Best Presentation</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2016
<b>Pitt SSOE Design Expo - 2nd Overall MEMS Design</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2016
<b>Pitt SSOE Design Expo - 2nd Overall ECE Design</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2016
<b>SSOE Summer Research Fellowship</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2016
<b>Freshman Engineering Conference Best Poster</b> <i>University of Pittsburgh, Pittsburgh, PA</i>	2014

## OTHER INTERESTS

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**Athletics:** kickboxing, cycling

**Other hobbies:** cooking, hiking, reading, watching my cat Sonny exist

**Unrelated skills:** Photoshop, videography and video editing, podcasting, trained in CPR and QPR