Arthur Brown

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Education

Massachusetts Institute of Technology (MIT) *Cambridge, MA*
Doctor of Philosophy in Aeronautics and Astronautics *Expected Fall 2022*
Thesis: Towards Practical Fixed-Wing Aircraft with Electroaerodynamic Propulsion

Master of Science in Aeronautics and Astronautics *June 2018*
Thesis: A Vehicle Design and Optimization Model for On-Demand Aviation

University of Toronto *Toronto, ON, Canada*
Bachelor of Applied Science in Engineering Science *June 2016*
Aerospace Engineering major

Research Experience

Laboratory for Aviation and the Environment (LAE), MIT *Cambridge, MA*
Advisor: Prof. Steven Barrett
Electroaerodynamic (EAD) Propulsion *September 2018-present*

- Developed a design and optimization framework for EAD-powered aircraft using Signomial Programming (SP), including detailed aerodynamic, structural, propulsion, and performance sub-models
- Used the framework, along with thruster, high-voltage power-converter (HVPC), and structural experimental results, to design a next-generation EAD aircraft with a practical payload and endurance
- Worked with a team of graduate and undergraduate students to build the aircraft, and flight test it with a substitute propulsion system
- Co-authored two provisional patents: for multi-staged ducted (MSD) EAD thrusters, and for multi-staged surface-integrated (MSI) EAD thrusters
- Currently leading a NASA Innovative Advanced Concepts (NIAC) project to design an EAD VTOL aircraft with MSD thrusters for silent package delivery

Urban Air Mobility (UAM) *September 2019-August 2021*

- Worked with collaborators to develop a coupled vehicle & market optimization tool for the UAM air taxi market in several US cities, in which the vehicle and market characteristics are optimized simultaneously to maximize market size
- Developed tools to predict the noise signature of UAM air taxis, including community noise and climate change

Aerospace Computational Design Laboratory (ACDL), MIT *Cambridge, MA*
Advisor: Prof. Wesley L. Harris
Urban Air Mobility *September 2016-June 2018*

- Developed a design and optimization model for electric vertical-takeoff-and-landing (eVTOL) air taxis using Geometric Programming
- Used the tool to obtain vehicle mass, flight performance, cost, and noise estimates, as part of a trade study between proposed eVTOL aircraft configurations
- Presented the results at the AIAA SciTech conference in January 2018

Computational Aerodynamics Lab, University of Toronto *Toronto, ON, Canada*
Advisor: Prof. David W. Zingg *Summer 2015*

- Employed Reynolds-Averaged Navier-Stokes (RANS) aerodynamic shape optimization to design and analyze aircraft wings
- Redesigned a regional airliner wing to save fuel by flying lower and more slowly

Publications

Arthur Brown, Haofeng Xu, Christopher K. Gilmore, and Steven R. H. Barrett. "Solid-State Electroaerodynamic Aircraft Design Using Signomial Programming," Journal of Aircraft, 2022 (under review by co-authors)

Nicolas Gomez-Vega, **Arthur Brown**, Haofeng Xu, and Steven R. H. Barrett. "Multi-Staged Ducted Thrusters for High-Thrust-Density Electroaerodynamic Propulsion," AIAA Journal, 2022 (accepted for publication)

Arthur Brown and Wesley L. Harris. "Vehicle Design and Optimization Model for Urban Air Mobility," Journal of Aircraft 2020 57:6, 1003-1013.

Arthur Brown and Wesley Harris. "A Vehicle Design and Optimization Model for On-Demand Aviation," AIAA 2018-0105. 2018 AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference. January 2018.

Arthur Brown, Shahriar Khosravi, and David W. Zingg. "Aerodynamic Shape Optimization of an Aircraft Wing for Reduced Fuel Consumption," Galbraith Society Undergraduate Engineering Journal 2016 1:2, 9-14.

Patents

Steven Barrett, Haofeng Xu, **Arthur Brown** and Nicolas Gomez-Vega, "Multi-Staged Ducted Electroaerodynamic System". United States Patent 63/252,390 (provisional), 5 October 2021.

Steven Barrett, Haofeng Xu, **Arthur Brown**, Nicolas Gomez-Vega and Nicholas Perovich, "Multi-Staged Surface-Integrated (MSI) Electroaerodynamic Thrusters". United States Patent 63/288,731 (provisional), 13 December 2021.

Grants

NASA Innovative Advanced Concepts (NIAC) – Phase I, May 2022, "Silent, Solid-State Propulsion for Advanced Air Mobility Vehicles."

Teaching Experience

Department of Aeronautics and Astronautics, MIT *Cambridge, MA*

Teaching Assistant (TA), Unified Engineering: Fluid Dynamics *Spring 2021 & 2022*

- Served as a TA for the Flight Competition portion of the course, in which student teams had to design, build and fly their own RC aircraft to maximize an objective
- Rewrote a set of aircraft design & optimization codes in Python for students to use
- Updated assignments: selected objective, generated solution keys, graded reports
- Helped run check-in meetings with all student teams, to verify their understanding
- Supervised students' design process: designed and built an example aircraft, ran office hours, answered student questions on the online forum Piazza
- Prepared build documentation, including an instructional video for the foam cutter
- Supervised students in the lab throughout the week-long build period: distributed materials & supplies, answered questions, gave advice, fixed errors
- Conducted flight readiness reviews with each team's aircraft

Diversity & Inclusion

AeroAfro, MIT *Cambridge, MA*

Co-founder *August 2018-present*

- Co-founded AeroAfro, a group of Black doctoral students within the Department of Aeronautics and Astronautics
- Advised prospective Black MIT AeroAstro graduate students on department culture, application requirements, tips for success, etc.
- Organized and ran the annual underrepresented minority (URM) coffee chat for newly admitted graduate students, coordinating with the Open House committee
- Organized and ran AeroAfro meetings with the AeroAstro department chair, to coordinate on diversity & inclusion culture and initiatives
- Coordinated with the AeroAstro Diversity Officer and Graduate Diversity Fellows
- Organized casual group social events with AeroAfro and other affinity groups

Office of Graduate Education, MIT *Cambridge, MA*

Graduate Diversity Ambassador *September 2017-present*

- Served as a mentor to prospective and admitted MIT graduate students of color
- Held 1:1 virtual meetings with students to advise on graduate school applications, edit personal statements, and answer questions about student life
- Served as an application reviewer for the 2019 cohort of the MIT Summer Research Program (MSRP), which brings undergraduate students from underrepresented backgrounds to do research at MIT during the summer
- Represented MIT at the National Society of Black Engineers (NSBE) annual convention in March 2019, to recruit and advise prospective graduate students

Graduate Students of Color Advisory Council, MIT *Cambridge, MA*

Co-founder *September 2017-May 2020*

- Advised the Vice Chancellor and other members of MIT's senior leadership on issues pertaining to graduate students of color at MIT

Diversity, Outreach, Culture (DOC) team, LAE, MIT *Cambridge, MA*
Founder and Student Host *September-December 2020*

- Organized and ran bi-weekly meetings with the DOC team
- Edited and published the LAE Statement on Diversity & Inclusion
- Co-organized a presentation to the LAE given by AeroAstro dREFS (Department Resources for Easing Friction and Stress), a volunteer group of graduate students trained in conflict management
- Organized the LAE response to an MIT requirement that all graduate students return to the US by January 2021 (during the pandemic), a significant hardship for international students. This included leading discussions with the DOC team and with the LAE at large, and signing (on behalf of the DOC team) an open letter demanding that MIT rescind the policy

Graduate Student Council Diversity, Equity, Inclusion (GSC-DEI) committee, MIT
Co-founder *August 2017-May 2020*

- Served as the Underrepresented Minorities (URM) Constituency Representative from 2017-2020, and as Treasurer from September 2018 through August 2019
- Helped run the yearly Graduate Students of Color Welcome Receptions, the purpose of which are to "welcome new and continuing graduate students, staff, faculty and other community members to campus and to develop connections in a supportive environment".
- Recruited conduits (student representatives) to provide feedback on the diversity & inclusion environment in their respective departments, as part of DEI's Department and Classroom Inclusion (DCI) initiative

Academy of Courageous Minority Engineers (ACME), MIT *Cambridge, MA*
Secretary and Communications Director May 2017-May 2018

- Ran the ACME Weekly Accountability Meetings for minority graduate students
- Recruited new ACME members, sent weekly reminder emails, and ordered food for each accountability meeting

Professional Experience

Advanced Vehicle Research Division, Aurora Flight Sciences *Cambridge, MA*
Conceptual Design Engineer *June 2018-August 2018*

- Developed sizing and analysis models to support design trades for an electric VTOL urban air taxi
- Developed a vehicle drag model, and validated it using data from high-fidelity Reynolds-Averaged Navier-Stokes (RANS) simulations

Flight Vehicle Engineering (course), MIT Beaver Works *Cambridge, MA*
Aerodynamics and Manufacturing Engineer *September 2016-May 2017*

- Completed the design and construction of the Jungle Hawk Owl medium-altitude, long-endurance unmanned aerial vehicle (UAV)
- Built a custom aerodynamic model using MATLAB, XFoil, and AVL to verify the vehicle sizing model
- Performed aeroelastic analysis using ASWING, eliminating the dual risks of control reversal and flutter
- Designed and fabricated the wing-wing joiners from carbon fiber composites
- Winner of the MIT Leaders for Manufacturing Award (presented to the entire team)

Activities

Aircraft Design Group, MIT — *Cambridge, MA*
Founder — *September 2018-December 2021*

- Created a group of MIT graduate students with an interest in aircraft design research
- Organized triweekly research paper readings: selected papers, sent reminder emails, and moderated discussions

Island Air Flight School — *Toronto, ON, Canada*
Student & Pilot — *July 2011-present*

- Broke a school record by completing flight training in five weeks
- Earned Private Pilot's License in August 2011; Night Rating August 2012

Awards

MIT AeroAstro Outstanding Student Leadership Award: AeroAfro – 2022

MIT AeroAstro Outstanding Student Leadership Award: AeroAfro – 2020

MIT Black Graduate Students' Association (BGSA) Unsung Hero Award - 2020

Aviation Week 20 Twenties - Class of 2018

AIAA 2017 William T. Piper, Sr. General Aviation Systems Graduate Award

Second prize, 2015-2016 AIAA Undergraduate Individual Aircraft Design Competition

First prize, 2014-2015 AIAA Undergraduate Individual Aircraft Design Competition (first ever Canadian winner of the competition)

First prize, 2015 University of Toronto Undergraduate Engineering Research Conference (uNerd), Mechanical and Aerospace Poster Category

2015 Natural Sciences and Engineering Research Council - Undergraduate Summer Research Award (NSERC-USRA)

References

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