Daniel S Drew

Assistant Professor, Electrical and Computer Engineering
Adjunct Assistant Professor, Mechanical Engineering
Core Member, Utah Robotics Center
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Research Direction

In the near future, **swarms of autonomous robots** will be vital and common tools in industrial, commercial, and personal settings. The research effort to get us there spans the full robotics stack and represents a tremendous opportunity for collaboration, for training a new generation of interdisciplinary investigators, and for forging new ties between the worlds of industry, academia, and design; I look forward to pushing it forward.

microrobotics, millisystems, swarms, human-robot interaction, wireless sensor networks/ubiquitous computing

Education

University of California, Berkeley — California, USA
PhD, Electrical Engineering and Computer Science — 2013 - 2018
Thesis Title: "The Ionocraft: Flying Microrobots with No Moving Parts"
Committee: Kristofer S. J. Pister, Michel Maharbiz, Liwei Lin

Virginia Polytechnic Institute — Virginia, USA
BSc, Materials Science and Engineering — 2009 - 2013

Appointments

The University of Utah — Utah, USA
Assistant Professor, Electrical and Computer Engineering — May 2021 -
Adjunct Assistant Professor, Mechanical Engineering
Core Member, Utah Robotics Center

Stanford University — California, USA
Postdoctoral Fellow, Mechanical Engineering — 2019 - 2021
Advisor: Sean Follmer

University of California, Berkeley — California, USA
Graduate Research Assistant, Electrical Engineering and Computer Science — 2013 - 2018
Advisor: Kristofer S. J. Pister

Massachusetts Institute of Technology — Massachusetts, USA
REU Undergraduate Research Assistant, Electrical Engineering and Computer Science — Summer 2012
Advisors: Jeffrey Lang and Vladimir Bulovic

Refereed Publications

In the fields of both MEMS and robotics, full-length paper submissions to conferences such as MEMS, Transducers, IROS, ICRA, and RSS represent the ideal publication track for the majority of researchers. In the field of human-computer interaction, top-tier ACM conferences (e.g. CHI, UIST) are highly selective venues that are comparable to or exceed many IEEE journals in their impact.

Journal Publications

J7. Nelson, C. L. & **Drew, D. S.**, (2023). High Aspect Ratio Multi-stage Ducted Electroaerodynamic Thrusters for Micro Air Vehicle Propulsion. IEEE Robotics and Automation Letters (RA-L). *Under review.*

J6. **Drew, D. S.**, (2021). Multi-agent Systems for Search and Rescue Applications. Current Robotics Reports.

J5. Lambert, N., Schindler, C., **Drew, D. S.**, & Pister, K. S.. (2020). Nonholonomic Yaw Control of an Underactuated Flying Robot with Model-based Reinforcement Learning. IEEE Robotics and Automation Letters (RA-L).

J4. Park, S., **Drew, D. S.**, Follmer, S., & Rivas-Davila, J. (2020). Lightweight High Voltage Generator for Untethered Electroadhesive Perching of Micro Air Vehicles. IEEE Robotics and Automation Letters (RA-L).

J3. Lambert, N. O., **Drew, D. S.**, Yaconelli, J., Calandra, R., Levine, S., & Pister, K. S. (2019). Low Level Control of a Quadrotor with Deep Model-Based Reinforcement Learning. IEEE Robotics and Automation Letters (RA-L). Presented at IROS2019.

J2. **Drew, D. S.**, Lambert, N. O., Schindler, C. B., & Pister, K. S. (2018). Towards Controlled Flight of the Ionocraft: A Flying Microrobot Using Electrohydrodynamic Thrust With Onboard Sensing and No Moving Parts. IEEE Robotics and Automation Letters 3 (RA-L). **Speaker, presented at IROS2018.**

J1. **Drew, D. S.**, & Pister, K. S. (2017). Geometric Optimization of Microfabricated Silicon Electrodes for Corona Discharge-Based Electrohydrodynamic Thrusters. Micromachines journal, 8(5), 141.

Conference Publications (full papers)

C15. Nations, G., Nelson, C. L., & **Drew, D. S.**(2023) Empirical Study of Ground Proximity Effects for Small-scale Electroaerodynamic Thrusters. IEEE International Conference on Robotics and Automation (ICRA) 2023. *Under review.*

C14. Leavitt, A., Lam, R., Crawford Taylor, N., **Drew, D. S.**, & Kuntz, A. (2023) Toward a Millimeter-Scale Tendon-Driven Continuum Wrist with Integrated Gripper for Microsurgical Applications. Hamlyn Symposium on Medical Robotics 2023.

C13. Selden, M., Zhou, J., Campos, F., Lambert, N., **Drew, D. S.**, & Pister, K.S. (2021). BotNet: A Simulator for Studying the Effects of Accurate Communication Models on Multi-agent and Swarm Control. In the 3rd IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS), 2021, to appear.

C12. **Drew, D. S.**, & Follmer, S. (2021). High Power Density Electrohydrodynamic Jets Using Folded Laser Microfabricated Electrodes. In 21st International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), 2021. **Speaker.**

C11. **Drew, D. S.**, Devlin, M., Hawkes, E., & Follmer, S. (2021). Acoustic Communication and Sensing for Inflatable Soft Modular Robots. IEEE International Conference on Robotics and Automation (ICRA) 2021. **Speaker.**

C10. Kim, L. H., **Drew, D. S.**, Domova, V., & Follmer, S. (2020). User-defined Swarm Robot Control. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. ACM, 2020. **Best Paper Award Honorable Mention.**

C9. Schindler, C. B., **Drew, D. S.**, Kilberg, B., Campos, F., Yanase, S., & Pister, K. S. (2019). MIMSY: The Micro Inertial Measurement System for the Internet of Things. Internet of Things (WF-IoT), IEEE 5th World Forum on. IEEE, 2019.

C8. Zoll, R. S., Schindler, C. B., Massey, T. L., **Drew, D. S.**, Maharbiz, M. M., & Pister, K. S. (2018). MEMS-Actuated Carbon Fiber Microelectrode for Neural Recording. EMBS Micro and Nanotechnology in Medicine Conference.

C7. McGrath, W., Warner, J., Karchemsky, M., Head, A., **Drew, D. S.**, & Hartmann, B. (2018). WiFrost: Bridging the Information Gap for Debugging of Networked Embedded Systems. In Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology (UIST). ACM.
acceptance rate: 21%

C6. McGrath, W., **Drew, D.**, Warner, J., Kazemitabaar, M., Karchemsky, M., Mellis, D., & Hartmann, B. (2017). Bifrost: Visualizing and Checking Behavior of Embedded Systems across Hardware and Software. In Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology (UIST). ACM.
acceptance rate: 23%

C5. **Drew, D. S.**, & Pister, K. S. (2017). First takeoff of a flying microrobot with no moving parts. In Manipulation, Automation and Robotics at Small Scales (MARSS), 2017 International Conference on (pp. 1-5). IEEE. **Plenary Speaker, Best Paper Award Honorable Mention**.

C4. **Drew, D. S.**, Kilberg, B., & Pister, K. S. (2017). Future mesh-networked pico air vehicles. In Unmanned Aircraft Systems (ICUAS), 2017 International Conference on (pp. 1075-1082). IEEE.

C3. Contreras, D. S., **Drew, D. S.**, & Pister, K. S. (2017). First steps of a millimeter-scale walking silicon robot. In Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), 2017 19th International Conference on (pp. 910-913). IEEE.
acceptance rate: 26%

C2. **Drew, D.**, Contreras, D. S., & Pister, K. S. (2017). First thrust from a microfabricated atmospheric ion engine. In Micro Electro Mechanical Systems (MEMS), 2017 IEEE 30th International Conference on (pp. 346-349). IEEE. **Speaker**.
oral presentation acceptance rate: 11%

C1. **Drew, D.**, Newcomb, J. L., McGrath, W., Maksimovic, F., Mellis, D., & Hartmann, B. (2016). The Toastboard: Ubiquitous Instrumentation and Automated Checking of Breadboarded Circuits. In Proceedings of the 29th Annual Symposium on User Interface Software and Technology (UIST). ACM. **Speaker**.
acceptance rate: 21%

Workshop Publications

W2. **Drew, D. S.**, & Pister, K. S. (2018). Takeoff of a Flying Microrobot with COTS Sensor Payload Using Electrohydrodynamic Thrust Produced by Sub-millimeter Corona Discharge. Technical Digest of Solid-State Sensors, Actuators, and Microsystems Workshop 2018 (Hilton Head 2018) **Speaker, full paper.**
oral presentation acceptance rate: 19%

W1. **Drew, D. S.**, Greenspun, J.T., & Pister, K. S. (2014). Investigation of Atmospheric Ion Thrusters using Rapid Prototyping Techniques. Robot Makers (RoMa) workshop, held in conjunction with Robotics Science and Systems (RSS) 2014. **Speaker, extended abstract.**

Support

"Robotics Certificates and Graduate Degree Programs"
Source: State of Utah System of Higher Education
PI and Co-PIs: Mark Minor (PI), Jake Abbot, Edoardo Battaglia, Daniel Brown, **Daniel Drew**, Jacob George, Tucker Hermans, John Hollerbach, Alan Kuntz, Kam Leang, Tomasso Lenzi, Steve Mascaro, Sanford Meek, Haohan Zhang
Funding amount: $545,460. *Duration:* 9/1/2022 - 8/31/2024

"Acquisition of Diode-Pumped Solid-State Laser Micromachining System"
Source: University of Utah Research Instrumentation Fund
PI: Daniel Drew
Funding amount: $71,500. *Received:* January 2022

Presentations

Invited Talks

University of Utah Robotics Seminar	Fall 2021
University of Utah ECE Seminar	Fall 2021
University of Utah Robotics Seminar	Winter 2019
Cornell ECE Special Seminar	Winter 2019
San Francisco Exploratorium After-Dark event	Winter 2019
Pentagon "Drumbeat" briefing	Fall 2019
MIT EECS Special Seminar	Winter 2018
Cornell ECE Special Seminar	Winter 2018
Stanford SystemX Seminar	Winter 2018
Berkeley Sensor and Actuator Center Seminar Series	Fall 2018
Berkeley Sensor and Actuator Center IAB	Spring 2017, Spring 2014
Berkeley Artificial Intelligence Research (BAIR) Seminar	Spring 2017
Berkeley Institute of Design (BiD) Seminar	Fall 2016
Berkeley SWARM Lab Seminar	Spring 2013

Conference Oral Presentations

High Power Density Electrohydrodynamic Actuators with Laser Microfabricated Electrodes, IEEE Int. Conference on Solid-State Sensors, Actuators and Microsystems (Transducers)	June 2021
Acoustic Communication and Sensing for Inflatable Soft Modular Robots, IEEE International Conference on Robotics and Automation (ICRA)	June 2021
Towards Controlled Flight of the Ionocraft: A Flying Microrobot Using Electrohydrodynamic Thrust With Onboard Sensing and No Moving Parts, IEEE Int. Conf. on Intelligent Robots and Systems (IROS)	October 2018
Takeoff of a Flying Microrobot with COTS Sensor Payload Using Electrohydrodynamic Thrust Produced by Sub-millimeter Corona Discharge, Solid-State Sensors, Actuators, and Microsystems Workshop (Hilton Head)	June 2018
First Takeoff of a Flying Microrobot With No Moving Parts, IEEE International Conference on Manipulation, Autonomation and Robotics at Small Scales (MARSS)	July 2017
First thrust from a microfabricated atmospheric ion engine, IEEE International Conference on Micro Electro Mechanical Systems (MEMS)	January 2017
The Toastboard: Ubiquitous Instrumentation and Automated Checking of Breadboarded Circuits, ACM Annual Symposium on User Interface Software and Technology (UIST)	October 2016

Poster Presentations

New Directions for Effective and Efficient Microrobot Mobility and Communication, Intelligence Community Academic Research Symposium	Summer 2019
The Ionocraft: A Flying Microrobot With No Moving Parts, Bay Area Robotics Symposium	Fall 2018
Applications of Future Wireless Mesh Networks, Berkeley Sensor and Actuator Center IAB	2017 - 2018
Autonomous Flying Microrobots, Berkeley Sensor and Actuator Center IAB	2013 - 2018
The Toastboard, TerraSwarm Research Seminar	2015 - 2017
A Low-Loss Voltage Actuated Switch, Ana G. Mendez University System Research Symposium	Fall 2013
A Low-Loss Voltage Actuated Switch, SACNAS National Conference	Fall 2013

Awards & Press

Awards

University of Utah ECE Department Teaching Award	2023
Intelligence Community Postdoctoral Fellowship	2019 - 2021
National Science Foundation Graduate Research Fellowship	2013 - 2018
Best Paper Honorable Mention, CHI	2020
UC Berkeley Graduate Slam Finalist, 2nd Place	2018
Best Poster, Berkeley Sensor and Actuator Center IAB	2018
Best Paper Honorable Mention, MARSS Conference	2017
UC Berkeley EECS Chair's Excellence Award	2013
Materials Science and Engineering Merit Scholarship	2011, 2012
Best in Undergraduate Poster Presentations, SACNAS Conference	2012
Best in Undergraduate Poster Session, AGMUS Conference	2012
Robert C. Morris Jr. Freshman Merit Scholarship	2009 - 2010

Selected Press

"Penny-Sized Ionocraft Flies With No Moving Parts", IEEE Spectrum	2019
"Microrobots fly, walk and jump into the future", BerkeleyENGINEER Magazine	2018
"The Same Tech Propelling Satellites in Space Could Power Tiny Robots on Earth", Futurism.com	2017
"The Sci-Fi Technology that Could Power Microrobots", Smithsonian Digital	2017
"ToastBoard", BerkeleyENGINEER Magazine	2015

Teaching

Instructor

Graduate Robotics Seminar (ECE6868/ME6892/CS7939 — University of Utah
Enrollment: 31, Evaluations: TBD — Fall 2023

Fundamentals of Robotics and Cyberphysical Systems (ECE3610) — University of Utah
Enrollment: 29, Evaluations: 19 (1) *Course 5.84/6 (1/6), Instructor 5.84/6 (4/6)* — Spring 2023

Robotic Millisystems (ECE5960/6960) — University of Utah
Enrollment: 20, Evaluations: 12 *Course 5.9/6, Instructor 5.9/6* — Fall 2022

Fundamentals of Robotics and Cyberphysical Systems (ECE3960) — University of Utah
Enrollment: 16, Evaluations: 9 *Course 5.8/6, Instructor 5.9/6* — Spring 2022

Assistant

Designing Information Devices and Systems (EE16A) — UC Berkeley
Content Development and Discussion Section Graduate Student Instructor — Fall 2018

Interactive Device Design (CS294) — UC Berkeley
Graduate Student Instructor — Summer 2017

Interactive Device Design (CS294) — UC Berkeley
Graduate Student Instructor — Spring 2017

Fundamentals of Materials Engineering (MSE2044) — Virginia Tech
Undergraduate Teaching Assistant — Spring 2012

Research Mentorship

Graduate Students (Ph.D. and MS Thesis)

C Luke Nelson (ME Ph.D. Student) Spring 2022-
Project: New directions in high efficiency electroaerodynamic actuators

William Graham (ECE Masters Thesis Student) Summer 2022-
Project: Control of heterogeneous swarms, simulation for EAD-propelled millisystems

Samuel Bosch (ECE Ph.D. Student) Fall 2023-
Project: Magnetic field manipulation of ion trajectories in highly collisional plasmas

Nicholas Schneider (ECE Masters Thesis Student) Fall 2023-
Project: Electronics for novel robotic capsule endoscopes, electroaerodynamic control electronics

Masters Project Students

Ryan Davis (ECE Masters Project Student) Spring 2023-
Project: Surplus-energy autonomous mobile robots

Varun Raveendra (ECE Masters Project Student) Spring 2023-
Project: Design and simulation of tendon-driven continuum robots for microsurgery

Krishna Ashis Chinnari (ECE Masters Project Student) Fall 2023-
Project: Persistent autonomous systems through thermal energy extraction

Undergraduate Students

Quinna Nguyen (ECE B.S. Student) Fall 2021-
Project: Silent, solid-state jet impingement cooling with electroaerodynamic actuators

Nichols Crawford Taylor (ECE/Applied Math B.S. Student) Spring 2022-
Project: Millimeter-scale tendon-driven continuum robots for microsurgery

Alexandra Leavitt (CS B.S. Student) Fall 2022-
Project: Millimeter-scale tendon-driven continuum robots for microsurgery

Ammon Rex (ECE B.S. Student) Summer 2022-Spring 2023
Project: Sound source localization for resource-constrained robot swarms

Joey Brignone (ECE B.S. Student) Summer 2022-Spring 2023
Project: Haptic feedback for control of resource-constrained robot swarms

Jacob Harris (ECE B.S. Student) Summer 2022-Spring 2023
Project: Lighthouse localization for resource-constrained robot swarms

Matthew Crump (ECE B.S. Student) Summer 2022-Spring 2023
Project: Control of resource-constrained robot swarms

Kasey Kemp (ECE B.S. Student) Fall 2022-Spring 2023
Project: Lighthouse localization for heterogeneous swarms

Wallace Wang (ECE B.S. Student) Fall 2022-Spring 2023
Project: Sound source localization for resource-constrained robot swarms

Seoin Kim (ECE B.S. Student) Spring 2023-
Project: Object manipulation with low cost mobile robots

High School Students

Dans Nguyen (Summer 2022), Lincoln Wagner (Summer 2022), Oliver Velazquez (Summer 2023), Jayden Tu (Summer 2023)

Mentees Prior To Professorship

Rachel Zoll (UC Berkeley EECS B.S.) Fall 2018
Project: MEMS-actuated carbon fibers for neural recording
Current position: Ph.D. student at Harvard University

Joseph Yaconelli (UC Berkeley SUPERB REU Student) Summer 2018
Project: Deep model-based reinforcement learning for quadrotor control

Mitchell Karchemsky (UC Berkeley EECS B.S.) Spring, Summer 2018
Project: Novel debugging and development tools for cyberphysical systems

Academic Service

University of Utah

University and College:

University of Utah Engineering Day Lab Tour	2022
University of Utah Summer Research Internship Student Mentor	2022
University of Utah Summer Research Internship Application Reviewer	2022
University of Utah ACCESS Program Application Reviewer	2022
University of Utah ACCESS Program Student Mentor	2022

Department:

ECE Engineering Scholars student mentor	2023
ECE Technical Open House Judge	2022
Electrical and Computer Engineering Diversity and Department Climate Committee	2021-
Electrical and Computer Engineering Strategic and Research Development Committee	2020-2021

PhD Student Committees:

Michael Adkins (Advisor: Jacob George)	2023-
Majid Majidi (Advisor: Masood Parvania)	2023
Devin Dalton (Advisor: Jake Abbot)	2023
Connor Olsen (Advisor: Jacob George)	2022-
Mohammed Masum Siraj Khan (Advisor: Masood Parvania)	2021-22
Luke Nelson (Advisor: Daniel Drew)	2021-

External

NSF SBIR/STTR Panel Service	2023
NSF FRR Panel Service	2022
VEX Robotics Guest Judge	2022
Program Committee Member, IEEE MARSS	2019
Session Chair, "Design and Fabrication", IEEE MARSS	2017
Application Committee, MIT Summer Research Program (MSRP)	2018, 2020
Graduate Student Panelist, Berkeley Energy Efficient Electronics and Systems (E3S) REU	2016 - 2018
Peer Advisor, Bay Area Graduate Pathways to STEM (GPS) Program	2018
Volunteer, ReNUWit Ingenuity Lab at Lawrence Hall of Science	2016 - 2018
Treasurer, Electrical Engineering Graduate Student Association	2016 - 2017
Social Chair, Electrical Engineering Graduate Student Association	2015 - 2016
IEEE Member	-
IEEE Robotics and Automation Society Member	-

Conference Reviewer: IEEE International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Robotics and Automation (ICRA), ACM Conference on Human Factors in Computing (CHI), ACM Symposium on User Interface Software and Technology (UIST), IEEE International Conference on Manipulation, Automation and Robotics at Small Scales (MARSS), IEEE International Conference on Unmanned Aircraft Systems (ICUAS)

Journal Reviewer: Springer Nature, IEEE Robotics and Automation Letters, IEEE Electron Device Letters, IEEE Transactions on Robotics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Electron Devices, Elsevier Nano Energy, MDPI Mechatronics, ACM Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), Elsevier International Journal of Human-Computer Studies