Curriculum Vitae

Thomas M. C. Sears, M.A.Sc., P. Eng.
Ph.D. Candidate

Canadian Citizen

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1 Education

09/2019–Present: Ph.D. (Candidate), Electrical and Computer Engineering

Queen's University, Kingston, ON.
Research focus in Navigation and Mapping for Mobile Robots
Supervisor: Joshua A. Marshall

09/2012–08/2014: M.A.Sc., Aerospace Engineering

University of Toronto, Toronto, ON.
Research focus in Space System Design for Microsatellites
Supervisor: Robert. E. Zee

09/2007–05/2012: B.Eng., Aerospace Engineering (Co-op)

Carleton University, Ottawa, ON.
Awarded Senate Medal for Outstanding Academic Achievement

2 Industry and Research Engineering Experience

09/2019–Present: Research Assistant in Robotics, Queen's University, Kingsotn, ON

Member of **Offroad Robotics** and the **Ingenuity Labs Research Institute**.

Initiated the spatiotemporal mapping Uncrewed Surface Vessel (USV) research project for **environmental monitoring and aquatic robotic control**; areas of focus include signal analysis, machine learning, and field robotics (see publications on "spatiotemporal mapping").

Instigated the **selection and purchase** for an Otter USV to support future aquatic robotics and AI research; supported the funding application through Ingenuity Labs equipment fund.

Provided **electrical, mechanical, and software engineering** in the design and build of a custom USV research interface, which has been used by five internal research projects to-date; published architecture at the ICRA Field Robotics workshop and **open sourced** all hardware and software.

Supported engineering researchers from **Civil and Electrical engineering** in the creation of new research projects that leverage Ingenuity Labs USV equipment; supported lab growth through meetings with industry partners in maritime and environmental sectors.

02/2019–12/2024: Engineering Consultant

Provided space system engineering consulting to private companies from **Canadian and European space industries**.

Interdisciplinary expertise, including experimental high altitude balloon flights, thermal engineering for novel optical spacecraft, and materials and production support for deorbit technology.

Donated equipment, time, and expertise to **support undergraduate satellite teams** including University of Toronto and Queen's University.

08/2014–08/2019: Engineer, Sinclair Interplanetary (now Rocket Lab), Toronto, ON

Duties included **mechanical, electrical, optical, and software engineering**, for the design, testing, and production of spacecraft control and navigation systems.

Led the **automation project** for star tracker focusing and reaction wheel assembly to scale production and improve device consistency and performance.

Conducted environmental testing of designs against radiation, electrostatic discharge, temperature extremes, vacuum, and vibration with internal and external facilities, including **McMaster University**, **Toronto Metropolitan University**, and the **Canadian Space Agency**'s David Florida Laboratory.

Initiated student hiring and provided direct supervision and **mentorship of engineering students**.

Published production engineering lessons, represented company at Canadian and international venues, and supported **global customers** technical and sales inquiries.

09/2012–08/2014: Research Assistant, Space Flight Laboratory, Toronto, ON

Payload specialist of the Canadian Advanced Nanospace eXperiment 7 (**CanX-7**) team at the Space Flight Laboratory, University of Toronto Institute for Aerospace Studies.

Designed, assembled, and tested the **world's first** modular drag sail module for spacecraft; sail, booms, and deployment mechanics research spanned materials science, mechanical engineering, orbital dynamics, and non-destruction evaluation techniques.

Validated system design through ground-based testing and published analysis and results at multiple international conferences; drag sail design validated on orbit in 2017.

Revived and completed the electrical, mechanical, and software engineering for the miniature visual inspection camera when the project was abandoned due to schedule constaints; camera has since flown on multiple spacecraft missions

05/2010–08/2011: Research Assistant, National Research Council of Canada, Ottawa, ON

Member of Structures and Materials Performance Laboratory at the **Institute for Aerospace Research**.

Conducted non-contact strain sensing for structual testing of materials from sample size to **full scale aerospace systems**, e.g. a CF-18 horizontal stabilizer.

Authored internal report on an independent project about calibration techniques for digital image correlation systems; provided analysis as a coauthor on multiple studies of novel aerospace composite materials and metal alloys.

3 Honours and Awards

2023: Dean's Teaching Assistant Award ($3,000)

2022: Travel Grant to the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022) ($500).

2022: Robotics and AI Symposium 2022, Best Robotics Poster Award ($500)

2020–2022: Vanier Canada Graduate Scholarship ($50,000 per year)

2020: Engineers Canada-Manulife Scholarship ($12,500)

2019–2022: Dean's Graduate Research Award ($20,000 per year)

2019: Arthur B. McDonald Prize for Academic Excellence ($30,000)

2014: Frank J. Redd Student Competition Honorable Mention ($2,500)

2014: School of Graduate Studies Conference Grant to 4S Symposium in Mallorca, Spain ($1,200)

2013: Ontario Graduate Scholarship ($15,000)

2012: University of Toronto Fellowship ($8,000)

2012: Senate Medal for Outstanding Academic Achievement (top 3 % of graduating class)

2011: Esterline CMC Electronics Scholarship ($2,500)

2007–2012: Deans' Honour List (11.6/12.0 overall CGPA)

2007–2012: Faculty Entrance Scholarship ($4,000 per year)

2007: Governor General's Academic Medal (bronze)

4 Publications

Journal Articles

1. T. Chan, D. Backman, R. Bos, **T. Sears**, I. Brooks, and U. Erb. Temperature Changes during Deformation of Polycrystalline and Nanocrystalline Nickel. Advanced Materials Research. November 2011.

Conference Papers (Fully Refereed)

1. E. Taylor, **T. M. C. Sears**, and J. A. Marshall. Experiments in decentralized multivehicle localization using ultra-wideband transceivers. Proceedings of the 2024 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE), Kingston, Canada, August 2024.
2. **T. M. C. Sears**, M. R. Cooper, and J. A. Marshall. Mapping waves with an uncrewed surface vessel via Gaussian process regression. Proceedings of the 2023 IEEE International Conference on Robotics and Automation (ICRA), London, UK, May-June 2023.
3. **T. M. C. Sears** and J. A. Marshall. Mapping of spatiotemporal scalar fields by mobile robots using Gaussian process regression. In Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, October 2022.

Conference Workshop Papers (Fully Refereed)

1. **T. M. C. Sears**, M. R. Cooper, S. Button, and J. A. Marshall. OtterROS: Picking and programming an uncrewed surface vessel for experimental field robotics research with ROS 2. In Proceedings of the Workshop on Field Robotics at the 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, April 4, 2024.

Conference Papers (Abstract Refereed)

1. C. C. Grant, **T. M. C. Sears**, J. Gibson, N. Kerr, and D. Sinclair. Quantity and Quality: Scaling Small Business for Large Constellations. Proceedings of the AIAA/USU Conference on Small Satellites, Logan, Utah, August 2019.
2. D. Sinclair, J. Enright, T. Dzamba, and **T. M. C. Sears**. Custom Optics vs Modified COTS for Small Spacecraft: The Build vs. Rebuild Decision. Proceedings of the AIAA/USU Conference on Small Satellites, Logan, Utah, August 2015.
3. **T. M. C. Sears**, J. Newman, B. Cotten, J. Fine, J. Chung, H. Spencer, K. A. Carroll, and R. E. Zee. Proposed Design of a Microspace Mission for Near-Earth Asteroid Mining Survey and Tracking. Proceedings of the 65th International Astronautical Congress (IAC), Toronto, Canada, September 2014.
4. **T. M. C. Sears** and R. E. Zee. Sail Material, Inspection Imager, and Deployment Analysis for an End-Of-Life Disposal Drag Sail. Proceedings of the AIAA/USU Conference on Small Satellites, Logan, Utah, August 2014.
5. **T. M. C. Sears**, B. Cotten, and R. E. Zee. Performance Analysis of Thin Film Materials in a Drag Sail Deorbiting Device. Proceedings of the Small Satellite Systems and Services Symposium (4S), Majorca, Spain, May 2014.
6. B. Cotten, **T. M. C. Sears**, and R. E. Zee. The CanX-7 Nanosatellite Deorbit Mission: Demonstrating Sustainable Use of Low-Earth Orbit. Proceedings of the Small Satellite Systems and Services Symposium (4S), Majorca, Spain, May 2014.
7. G. Bonin, J. Hiemstra, **T. M. C. Sears**, and R. E. Zee. The CanX-7 Drag Sail Demonstration Mission: Enabling Environmental Stewardship for Nano- and Microsatellites. Proceedings of the AIAA/USU Conference on Small Satellites, Logan, Utah, August 2013.
8. D. Backman, G. Li, **T. Sears**. Determining the Strain Distribution in Bonded and Bolted/Bonded Composite Butt Joints Using the Digital Image Correlation Technique and Finite Element Methods. In Optical Measurements, Modeling, and Metrology, Volume 5. Conference Proceedings of the Society for Experimental Mechanics Series. Uncasville, Connecticut, June 13–16, 2011.
9. T. Chan, D. Backman, R. Bos, **T. Sears**, I. Brooks, U. Erb. In Situ Heat Generation and Strain Localization of Polycrystalline and Nanocrystalline Nickel. In Thermomechanics and Infra-Red Imaging, Volume 7. Conference Proceedings of the Society for Experimental Mechanics Series. Uncasville, Connecticut, June 13–16, 2011.
10. D. Backman, **T. Sears**, E. A. Patterson. Development of a New Fiber Metal Laminate Variant Optimized for Cold Expansion and Riveting of Holes. In ICAF 2011 Structural Integrity: Influence of Efficiency and Green Imperatives. Montreal, Canada, June 1–3, 2011.

Technical Reports

1. **T. M. C. Sears**, F. Sorensen, and D. Backman. Uncertainty Determination and Evaluation of a 2-D Digital Image Correlation System. National Research Council Canada, Institute for Aerospace Research , Structures and Materials Performance Laboratory, Ottawa, 2012.

Academic Theses

1. *Sail, Deployment, and Imaging Technology for a Nanosatellite Deorbit System Demonstration on CanX-7*. M.A.Sc. Thesis. Space Flight Laboratory (SFL), University of Toronto Institute for Aerospace Studies (UTIAS), Toronto, ON, September 2014. Supervisor: **Dr. Robert E. Zee**.

2. *Satellite Attitude Determination with a Multiplicative Extended Kalman Filter*. B.Eng. Thesis, Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, ON, May 2012. Supervisor: **Dr. Anton de Ruiter** (now at Toronto Metropolitan University).

Selected Scholarly and Industry Talks

1. "Spatiotemporal Mapping: Application and Field Studies in Aquatic Mobile Robotics". **Invited talk** given at the Centre for Applied Autonomous Sensor Systems, Örebro University, Örebro, Sweden, May 27, 2025.

2. "Mapping of spatiotemporal scalar fields by mobile robots using Gaussian process regression". 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, October 24, 2022.

3. "Robots are here to help: Deploying mobile robots to observe and protect water". Graduate Summer Symposium: Science and the Sustainable Development Goals, Queen's University, Kingston, Ontario, Canada, August 5, 2022.

4. "Proposed design of a microspace mission for near-Earth asteroid mining survey and tracking". 65th International Astronautical Congress (IAC), Toronto, Ontario, Canada, September 2014.

5. "Sail, Deployment, and Imaging Technology for a Nanosatellite Deorbit System Demonstration on CanX-7." Departmental seminsar at the Institute for Aerospace Studies, University of Toronto, Ontario, Canada, October 2014.

6. "Sail material, inspection imager, and deployment analysis for an end-of-life deorbiting device". AIAA/USU Conference on Small Satellites, Logan, Utah, USA, August 2014.

Poster Presentations

1. "OtterROS: Picking and programming an uncrewed surface vessel for experimental field robotics research with ROS 2". NSERC Canadian Robotics Network (NCRN) Annual General Meeting, Toronto, Ontario, Canada, June 6, 2024; and Workshop on Field Robotics at the 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, April 4, 2024.

2. "Mapping waves with an uncrewed surface vessel via Gaussian process regression". 2023 IEEE International Conference on Robotics and Automation (ICRA), London, UK, May-June 2023.

3. "Making Waves: Spatiotemporal Mapping with Mobile Robots". [*Best Robotics Poster Award*. Robotics and AI Symposium 2022, Ingenuity Labs, Queen's University, Kingston, Ontario, October 13, 2022; and Queen's Engineering Research Networking Day, Queen's University, Kingston, Ontario, October 12, 2022.

4. “Performance Analysis of Thin Film Materials in a Drag Sail Deorbiting Device”. Small Satellite Systems and Services Symposium (4S), Majorca, Spain, May 2014.

Sample Presentation Videos

1. “Mapping waves with an uncrewed surface vessel via Gaussian process regression.” May 2023. Available online: https://youtu.be/3qXST63vVfQ.
2. “Mapping of spatiotemporal scalar fields by mobile robots using Gaussian process regression.” October 2022. Available online: https://youtu.be/ZM81jIipUCg.

5 Teaching Experience

A showcase of my teaching style is available online: https://youtu.be/alzbYmx_Epo. “CIVL 222: Numerical Methods for Civil Engineers. Root Finding using the Bisection Method, a Lightboard tutorial.”

09/2019–Present: Teaching Assistant, Smith Engineering, Queen’s University

Course developer, tutorial lead, content creator, and grading for courses in Electrical and Computer Engineering, Mechatronics and Robotics Engineering, and Civil Engineering:

1. MREN 203: Mechatronics and Robotics Design II (Lead TA, 2 years); awarded Dean’s Teaching Assistant Award
2. CIVL 222: Numerical Methods for Civil Engineers (1 year)
3. ELEC 299: Mechatronics Project (Lead TA, 1 year)
4. APSC 143: Computer Programming for Engineers (1 year)

Guest lecturer in professional practice, graduate research topics, and control theory:

1. MREN 203: Mechatronics and Robotics Design II — Two lectures: “Sustainable Robotics” and “Robotics and Sustainable Development”
2. ELEC 845: Autonomous Vehicle Control and Navigation — Two online lectures: “Introduction to SLAM” and “Multi-Vehicle EKF-SLAM”
3. ELEC 433: Linear Control Systems — Two lectures: “Lead Compensator Design” and “Lag Compensator Design”

6 Student Supervision

Undergraduate Researchers

2023–Present: Uncrewed Surface Vessel Navigation in Coastal Environments

Students: Sabrina Button (Summer 2023) and Abby Herbert (Summer 2024)
Faculty Advisor: J. A. Marshall

7 Public Engagement, Artwork, and Media Attention

1. Creator, director, and editor of the Ingenuity Labs 2024 Holiday Video "**Robotics Lab Fireplace**" with team of 12 graduate students, December 2024. Available online: https://youtu.be/HaVVu_Ae8Cc?si=oXD44K1bqA9YjeBj
2. Domain expert interviewed for online article "**InDro explores USV marine sector — and speaks with a PhD researcher on their work**" by *InDro Robotics*, November 13, 2024.
3. Creator, director, and editor of the Ingenuity Labs 2023 Halloween Video "**Trick or Treat? Spot's Grand Plan for Halloween**" with team of 10 graduate students, October 2023. Available online: https://youtu.be/8NdBNtQmzZg?si=yXKvL7Y5HbKIJe4o
4. Podcast guest on *The Diaries of Space Explorers* (Season 1 Episode 16), April 23, 2021.
5. Featured in "**Introducing Thomas Sears, PhD Candidate and 2020 Vanier Scholar**" by the Ingenuity Labs Research Institute, August 31, 2020.
6. Featured in "**Welcoming promising new researchers**" in the Queen's Gazette, July 20, 2020.

8 Volunteer Activities

Professional and University Service

2020–Present Technical Reviewer for multiple international conferences and journals: IEEE/RSJ International Conference on Intelligent Robots and Systems; IEEE Robotics and Automation Letters; Discrete Event Dynamic Systems Journal; International Conference on Robotics and Automation; IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems.

2019–Present: Advisor and Mentor for Queen's Space Engineering Team (QSET), Satellite Team, Queen's University.

2022–2024: Client for Uncrewed Surface Vessel Project in MREN 103, Queen's University.

2021–2024: Student Representative (elected), Ingenuity Labs Research Institute General Committee, Queen's University.

2021–2022: Student Representative, Queen's Engineering Graduate Studies Recruitment, Queen's University.

2021: Organizer and Host of the Thesis Competition at the Robotics and AI Symposium 2021, Ingenuity Labs Research Institute, Queen's University.

2021: Member of the Robotics and AI Symposium 2021 Organizing Committee, Ingenuity Labs Research Institute, Queen's University.

2021: Web Redevelopment Committee, Faculty of Engineering and Applied Science, Queen's University.

2012–2014: Graduate Student Union Representative (elected), Institute for Aerospace Studies, University of Toronto.

Community Service

2022–Present: Academic and Career Mentor, Zenith Pathways Canada Fellowship.

2022–2023: Reviewer, Zenith Pathways Canada Fellowship.

2020–2023: Community **Advisory Board Member**, Engineer in Residence (EIR) program, Engineers of Tomorrow. Ontario, Canada.

2018–2023: Engineer in Residence (EIR), Engineers of Tomorrow. Toronto and Kingston, Ontario, Canada.

9 Professional Affiliations

2019–Present: Student Member of the Institute for Electrical and Electronics Engineers (IEEE)

2019–Present: Student Member of the Robotics & Automation Society (RAS)

2019–2024: Member of the NSERC Canadian Robotics Network (NCRN)

2017–Present: Professional Engineer, Professional Engineers Ontario, Licence 100507438