

# Victoria Preston

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## Education

### **Ph.D. Candidate in Aeronautics and Astronautics and Applied Ocean Physics and Engineering**

sept. 2019 - present

*Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program*, Advisors: Anna Michel (WHOI), Nicholas Roy (MIT), Thesis Committee: Anna Michel, Nicholas Roy, Youssef Marzouk, Adam Soule, GPA: 5.0/5.0

### **S.M. in Aeronautics and Astronautics**

june 2017 - aug. 2019

*Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program*, Advisors: Anna Michel (WHOI), Nicholas Roy (MIT), GPA: 5.0/5.0

### **B.S. in Robotics Engineering**

sept. 2012 - may 2016

*Olin College of Engineering*, Cross-Registration at Wellesley College for Education Psychology and Policy, Advisor: Andrew Benett, GPA: 3.93/4.0

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## Research and Employment Experience

### **Present | *Robust Robotics Laboratory – MIT***

Graduate Researcher | Robotics, Representation Learning

Advised by Nicholas Roy, I develop strategies for learning representations of natural phenomena from online, streaming observations taken by robots in order to inform models that can be subsequently exploited for planning. Application areas of interest include deep sea hydrothermal plume mapping and greenhouse gas emission sampling.

### **Present | *Chemical Sensing Laboratory – WHOI***

Graduate Researcher | Field Robotics, Adaptive Sampling

Advised by Anna Michel, I design field-ready robotic platforms which integrate novel spectroscopic instruments for *in situ* observation of geochemical compounds in air and marine environments with the ultimate goal of deploying these vehicles for long-term adaptive monitoring. Field work in the Arctic, Cascadia Margin, Sea of Cortez, and local estuaries complement this development.

### **2016-2017 | *Centre for Biorobotics – Tallinn University of Technology***

Visiting Student Researcher | Field Robotics, Autonomy

Advised by Maarja Kruusmaa and funded by the Fulbright Program, I developed control schemes for a biomimetic turtle robot for visual-servoing and target tracking, autonomous behaviors for examining unknown and enclosed spaces (for marine

archaeological applications) assuming severe sensing limitations, and assisted in a large multi-institution project (FP7 SUNRISE) for underwater vehicle coordination.

**2016 | *Uber Advanced Technologies Center – Pittsburgh, PA***

Software Engineering Intern | Mapping, System Safety, and Tooling

Developed mapping, visualization, and interface tools related to data transmission and remote system safety diagnosis.

**2015-2016 | *Ivani LLC – Dardenne Prairie, MO***

Research Intern | Wireless Sensing and IoT

Co-developed a novel strategy for occupancy sensing using distributed, wireless nodes for industrial building resource management.

**2014-2016 | *Olin Robotics Laboratory – Olin College***

Undergraduate Researcher | Field Robotics and Autonomy

Developed physical platforms and simple autonomous systems to allow ground, surface, and flying robots to conduct long-term long-range remote sensing and exploratory missions for scientists, including *SnotBot*, a drone for cetacean study.

**2014-2015 | *Indico Data Solutions – Boston, MA***

Occasional Blogspot | Machine Learning

Wrote two blog posts on broader applications of data analysis and machine learning for robotics and conservation/sustainability/development.

**2014 | *Locus Robotics – Devens, MA***

Robotics Intern | Platform Development and Autonomy

Responsible for development of the first prototype of a collaborative warehouse fulfillment robot for the company while in stealth mode, including autonomous navigation and simple behaviors.

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## Field Work and Robotic Deployments

**R/V Roger Revelle, Guaymas Basin Hydrothermal Vents Cruise**

Guaymas Basin, Gulf of California | Nov 9-Dec 4, 2021

Graduate researcher responsible for developing probabilistic forecasts of hydrothermal plume phenomenon for trajectory planning of AUV SENTRY. Utilized data streams from ROV JASON, ship-owned CTD Rosette, and experimental sensing equipment.

**Pilot-in-Command for MIT-DCIST Flights**

Medfield MA | Nov 6, 2020; May 20, 2021

Assisted in an Army Research Laboratory (ARL) Distributed and Collaborative Intelligent Systems and Technology (DCIST) project as a Part 107 certified pilot-in-command.

### **Platform for Environment Sensing Technology (PEST) Field Tests**

Falmouth MA | Jun 5, 2019

Operated as a Graduate PI for an undergraduate research student on a project to develop a small, low-cost, automated boat for geochemical sensing. Deployed the vehicle in a tidal estuary (Little Sippewissett Marsh) for proof-of-concept data collection.

### **Schmidt Ocean Institute's R/V Falkor, Hunting Bubbles Cruise**

Cascadia Margin | Sep 10-21, 2018

Graduate researcher on-point for operation of and data analysis from the ChemYak geochemical monitoring kayak used to detect whether sublimating methane from hydrate ridges was reaching the surface ocean.

### **Cambridge Bay Spring Freshet Sampling**

Cambridge Bay, Nunavut, Canada | Jun 26-Jul 8, 2018

Graduate researcher on-point for operation of and data analysis from the ChemYak for a multi-day deployment in a recently ice-free Arctic estuary. Spatiotemporal measurements of CO<sub>2</sub> and CH<sub>4</sub> in surface waters demonstrated strong freshet outgassing.

### **Wastewater Sampling in New Bedford Harbor**

New Bedford MA | Mar 29, 2018

Graduate researcher on-point for operation of and data analysis from the ChemYak for deployment near wastewater outfalls in the New Bedford Harbor. Measurements map greenhouse gas distribution near wastewater outfalls in the harbor.

### **Wastewater Sampling in Wareham River**

Wareham MA | Jul 12, 2017

Graduate researcher on-point for operation of and data analysis from the ChemYak for deployment in a tidal river near a wastewater outfall. Measurements monitor greenhouse gas distribution throughout a tidal cycle.

### **Exploration of Unknown, Enclosed Underwater Archeological Sites**

Rummu, Estonia | May 23-June 2, 2017

Lead software engineer on a project for autonomous exploration of enclosed spaces with a small, biomimetic, underwater rover, the U-CAT. Deployed and analyzed performance data of U-CAT at Rummu Quarry Lake, in which several buildings are underwater.

### **Heterogeneous Fleet Coordination Demonstration**

La Spezia, Italy | Feb 22-25, 2017

Assisting software engineer on a project for autonomous coordination of underwater and/or marine heterogeneous robotic fleets. This was the final demonstration for MANgO, a sub-project under the European Commission's FP7 SUNRISE effort.

### **Visual Tracking and Control with Biomimetic Underwater Rover**

Montpellier and La Seyne-sur-Mer, France | Dec 4-17, 2016

Lead software engineer on a project for controller development and visual tracking control of a biomimetic, underwater rover, the U-CAT. Utilized facilities at the University of Montpellier and IFREMER for testing and development.

## **Heterogeneous Fleet Coordination Development**

Lochearnhead, Scotland | Nov 23-29, 2016

Assisting software engineer on a project for autonomous coordination of underwater and/or marine heterogeneous robotic fleets. This was a major field trial, conducted alongside partners at Heriot Wat University.

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## **Grants, Honors, and Awards**

**Martin Family Society of Fellows for Sustainability** | *MIT Environmental Solutions Initiative*, 2021-2022

**Ocean Ventures Fund** | “*The intent of the Ocean Ventures Fund is to promote research and innovation by encouraging graduate students to take chances for their thesis research or for developing their thesis project.*” Project funds will support work on the development of mobile geochemical observatories (drone platform and in situ sensors), a prototype for accessible early-warning and environmental monitoring infrastructure. *WHOI*, 2020

**National Defense Science and Engineering Graduate Fellowship** | 2017

**National Science Foundation Graduate Fellowship** | 2017, declined

**Fulbright Student Grant** | “*The program facilitates cultural exchange through direct interaction on an individual basis in the classroom, field, home, and in routine tasks, allowing the grantee to gain an appreciation of others’ viewpoints and beliefs, the way they do things, and the way they think.*” Hosted by the US Embassy in Estonia, 2016

**Innovating Curriculum Grant** | Provided to support summer work developing workshop materials and qualitative analysis of the Olin curriculum for internal faculty development. *Olin College*, 2013

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## **Publications and Works**

\* indicates equal contribution

### **THESES**

**Adaptive Sampling of Transient Environmental Phenomena with Autonomous Mobile Platforms.** Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. *S.M. Aeronautics and Astronautics*. 2019.

### **PEER-REVIEWED JOURNAL ARTICLES**

A.P.M. Michel, **V. Preston**, K.E. Fauria, D.P. Nicholson. “Observations of Shallow Methane Bubble Emissions from Cascadia Margin” *Frontiers in Earth Science*, 2021.

A.P.M. Michel, A.E. Morrison, **V. Preston**, C.T. Marx, B.C. Colson, H.K. White. “Rapid Identification of Plastics via Spectroscopic Techniques and Classification Methods” *Environmental Science and Technology*, 2020.

C. Manning, **V. Preston**, S. Jones, A.P.M. Michel, D.P. Nicholson, P. Duke, M. Ahmed, K. Manganini, B. Else, P. Tortell. “River Inflow Dominates Methane Emissions in an Arctic Coastal System” *Geophysical Research Letters*, 2020.

**V. Preston\***, G. Flaspohler\*, A.P.M. Michel, Y. Girdhar, N. Roy. “Information-Guided Maximum Seek-and-Sample in Partially Observable Continuous Environments” *IEEE Robotics and Automation Letters* (additionally presented at IROS Macau), 2019.

**V. Preston**, T. Salumäe, M. Kruusmaa. “Underwater Confined Space Mapping by Resource-Constrained Autonomous Vehicle” *Journal of Field Robotics*, 35(7) 1122-1148, 2018.

#### CONFERENCE PAPERS

G.J. Stein\*, C. Bradley\*, **V. Preston\***, N. Roy. “Enabling Topological Planning with Monocular Vision” *IEEE Conference on Robotics and Automation*, 2020.

N. Yoder, **V. Preston**, A.P.M. Michel. “The PEST: Platform for Environmental Sensing Technology” *IEEE/MTS OCEANS Marseilles*, 2019.

G. Frost, D.M. Lane, N. Tsiogkas, D. Spaccini, M. Kruusmaa, **V. Preston**, T. Salumäe. “MANgO: federated world Model using an underwater Acoustic NetwOrk” *IEEE/MTS OCEANS Aberdeen*, 2017.

S. Chandra\*, R. Chapman\*, R. DiVerdi\*, J. Woo\*, **V. Preston\***, A. Bennett, D. Barrett. “Protocol for Autonomous Landing of Unmanned Air Vehicles on Research Vessels” *IEEE/MTS OCEANS Monterey*, 2016.

**V. Preston\***, J. Woo\*, S. Chandra\*, D. Diggins\*, R. Chapman\*, A. Wee\*, Z. Wang\*, M. Rush\*, A. Bennett, I. Kerr. “Autonomous Vehicles for Remote Sample Collection: Enabling Marine Research” *IEEE/MTS OCEANS Genova*, 2015.

**V. Preston\***, J. Woo\*, S. Chandra\*, D. Diggins\*, R. Chapman\*, A. Wee\*, Z. Wang\*, M. Rush\*, L. Lye\*, S. Hughes\*, M. Tieu\*, A. Bennett, I. Kerr. “Autonomous Vehicles for Remote Sample Collection in Difficult Conditions: Enabling Remote Sample Collection by Marine Biologists” *IEEE Technologies for Practical Robot Applications*, 2015.

## PRESENTATIONS

**V. Preston**, “AI, Robots, and the Environment: Enabling Autonomous Science” *Martin Fellows Introduction Seminar*, 2021.

**V. Preston**, G. Flaspohler. “Robotic Inference for Environmental Science” *MIT Energy Initiative Fellows Seminar*, 2020.

**V. Preston**. “Physically Informed Kernel Learning in Natural Environments” *Doctoral Consortium on Computational Sustainability*, 2020.

A.P.M. Michel, A.S. Johnson, K. Fauria, **V. Preston**, D.P. Nicholson, D. Hoer, P.R. Girguis, S.D. Wankel. “From the Seafloor to the Surface: In situ Chemical Analysis of Rising Bubbles along the Cascadia Margin” *Ocean Science Meeting of the American Geophysical Union*, 2020.

**V. Preston\***, G. Flaspohler\*, N. Roy, J.W. Fisher III, A. Soule, A.P.M. Michel. “Autonomous Sensing with Scientific Machine Learning for Monitoring Greenhouse Gas Emissions” *NeurIPS Workshop Tackling Climate Change with Machine Learning*, 2019.

C. Manning, Z. Zheng, **V. Preston**, A. Bourbonnais, K. Manganini, A.P.M. Michel, D.P. Nicholson, S.D. Wankel, P. Tortell. “Repeat Measurements of Methane and Nitrous Oxide Distributions Across the North American Arctic Ocean from 2015-2018” *Geophysical Research Abstracts*, 2019.

D.P. Nicholson, A.P.M. Michel, S.D. Wankel, K. Manganini, **V. Preston**, R. Sugrue, Z. Sandwith. “Rapid Mapping of Dissolved Greenhouse Gases in Two New England Estuaries Using the ChemYak Autonomous Surface Vehicle” *Ocean Sciences Meeting of the American Geophysical Union*, 2018.

A.P.M. Michel, D.P. Nicholson, S.D. Wankel, K. Manganini, **V. Preston**, L.A. Catipovic, R. Sugrue, Z. Sandwith, S. Monk. “The ChemYak: An Advanced Autonomous Surface Platform for Chemical Mapping” *Ocean Sciences Meeting of the American Geophysical Union*, 2018.

L.A. Catipovic, A.P.M. Michel, D.P. Nicholson, S.D. Wankel, K. Manganini, **V. Preston**, S. Monk. “Advancing a JetYak Autonomous Surface Vehicle for Vertical Chemical Profiling” *Ocean Sciences Meeting of the American Geophysical Union*, 2018.

## REVIEWS

C. Bradley\*, **V. Preston\***. “A Self-Driving License: Ensuring Autonomous Vehicles Deliver on the Promise of Safer Roads” *MIT Science Policy Review*, 2020.

## PATENTS

J. Wootton, M. Wootton, C. Nissman, **V. Preston**, J. Clark, J. McKinney, C. Barnes. “Detecting Location within a Network” *US Patent Numbers 10667086, 10397742, 10064013, 9693195, 9474042.*

M. Wootton, J. McKinney, M. Crowell-Ingram, E. Dorsky, S. Mehrotra, E. Pierce, **V. Preston**, J. Clark, Z. Wei. “Electrical monitoring and network enabled electrical faceplate” *US Patent Numbers 10627253, 10072942.*

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## Activities and Service

### Professional Leadership and Committee Roles

2020 | Conference on Robotic Learning (CoRL) 2020 Organizing Committee Inclusion@CoRL Chair; coordinated speaker engagement and scheduling for diversity and inclusion events (one research panel session, one career panel session, one social event and an affinity group roundtables event) for CoRL 2020 (held virtually). Also coordinated registration waivers and engagement feedback.

2018-present | Departmental Resource for Easing Friction and Stress (dREFS); trained peer mediator for Aeronautics and Astronautics graduate students; Vice President (2020-present)

2019-20 | MIT-WHOI Joint Program Applied Ocean Science and Engineering Graduate Student Representative

2015-16 | Olin College Sexual Respect Team member

2013-16 | Olin Honor Board member (2013-14), Chair (2014-15), Vice Chair (2015-16)

2013-14 | Olin College Curriculum Innovation Committee Student Member

2012-13 | Olin Honor Code Review Committee First Year Representative

### Professional Mentorship

2018-present | MIT Undergraduate Research Opportunities Program (UROP) Graduate Mentor through the Robust Robotics Group; directly supervised 7 undergraduates

2018-present | MIT UROP Graduate Mentor through the Chemical Sensing Laboratory; directly supervised 3 undergraduates

2018, present | Woods Hole Partnership in Education Program (PEP) Graduate Student Mentor; directly supervised 2 undergraduates

present | WHOI Summer Student Fellow Mentor; directly supervised 1 undergraduate

2020-present | MIT-WHOI Joint Program Applicant Support and Knowledgebase mentor

2020-present | Aeronautics and Astronautics Peer Mentor

**Professional Teaching Activities**

Olin College | Course Assistant for: ENGR 1125 Introduction to Sensors, Instrumentation and Measurement, SCI 1130 Mechanics, ENGR 2199B Regional Analysis for Development, ENGR 2210 Principles of Engineering, ENGR 3370 Controls, experimental course Quantitative Engineering Analysis

**Professional Membership**

2014-present | Marine Technology Society (MTS) student member

2019-present | IEEE student member

2022-present | The Oceanography Society (TOS) student member

**Review Activities**

1. Journal of Field Robotics
2. IEEE International Conference on Robotics and Automation
3. IEEE Robotics and Automation Letters
4. IEEE International Conference on Intelligent Robots and Systems
5. International Journal of Robotics Research
6. International Conference on Machine Learning
7. Neural Information Processing Systems
8. Applied Sciences

**Volunteer and Other Activities**

2022 | Cambridge School Volunteers NetPals Mentor

2016-present | Olin College Alumni Interviewer for prospective applicants and selected candidates; alumni postgraduate panel member

2016-19 | Virtual Mentor for IB Engineering Course at Del Mar High School, CA

2016-17 | EducationUSA Tallinn American English Conversation Club Coordinator

2013-16 | STEM enrichment coordinator for local Public Housing Authority childcare

2013-14 | Olin College Residential Resource (equivalent to residential advisor)

2012-14 | FIRST Robotics Lego League (grades 3-8) and Robotics Challenge (grades 9-12) mentor