MAHA N. HAJI

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EDUCATION

June 2017	**Massachusetts Institute of Technology** and **Woods Hole Oceanographic Institution** PhD Thesis: "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System" Advisor: Professor Alexander H. Slocum	PhD Mechanical and Oceanographic Engineering
Feb 2015	**Massachusetts Institute of Technology** and **Woods Hole Oceanographic Institution** MS Thesis: "Scattering of the Low-Mode Internal Tide at the Line Islands Ridge" Advisor: Professor Thomas Peacock	MS Oceanographic Engineering
May 2012	**University of California, Berkeley** Undergraduate Research Project: "Human Power Generation in Fitness Facilities" Research Advisor: Professor Alice M. Agogino Applied Mathematics Honors Thesis: "Proof of $O(n^2)$ complexity of Brent's Method for minimization of functions" Honors Thesis Advisor: Professor Ming Gu	BS Mechanical Engineering, BA Applied Math

PEER REVIEWED JOURNAL PUBLICATIONS

7. **M. N. Haji,** and A. H. Slocum, "An offshore solution to cobalt shortages via adsorption-based harvesting from seawater," *Renewable & Sustainable Energy Reviews*, **105**, 301-309, 2019.
6. **M. N. Haji,** J. Drysdale, K. Buesseler, and A. H. Slocum, "Results of an Ocean Trial of the Symbiotic Machine for Ocean uRanium Extraction," *Environmental Science & Technology*, **53** (4), 2229-2237, 2019.
5. **M. N. Haji,** J. Gonzalez, J. Drysdale, K. Buesseler, and A. H. Slocum, "Effects of Protective Shell Enclosures on Uranium Adsorbing Polymers," *Industrial & Engineering Chemistry Research,* **57**(45), 15534-15541, 2018.
4. **M. N. Haji,** J. M. Kluger, T. P. Sapsis, and A. H. Slocum, "A Symbiotic Approach to the Design of Offshore Wind Turbines with Other Energy Harvesting Systems," *Ocean Engineering*, **169**, 673-681, 2018.
3. M. E. Flicker Byers, **M. N. Haji,** A. H. Slocum, and E. Schneider, "Cost Optimization of a Symbiotic System to Harvest Uranium from Seawater via an Offshore Wind Turbine," *Ocean Engineering*, **169**, 227-241, 2018.
2. **M. N. Haji,** J. M. Kluger, J. W. Carrus, T. P. Sapsis, and A. H. Slocum, "Experimental Investigation of Hydrodynamic Response of a Symbiotic Machine for Ocean Uranium Extraction combined with a Floating Wind Turbine," *International Journal of Offshore and Polar Engineering*, **28**(3), 225-231, 2018.
1. A. H. Slocum, **M. N. Haji**, A. Z. Trimble, M. Ferrera, and S. J. Ghaemsaidi, "Integrated Pumped Hydro Reverse Osmosis Systems," *Sustainable Energy Technologies and Assessments,* **18**, 80-99, 2016.
   Featured on MIT News.

JOURNAL PUBLICATIONS IN PREPARATION

2. **M. N. Haji,** J. M. Kluger, and A. H. Slocum, "Power System Dynamics of a Combined Offshore Wind-Wave Energy Converter," (in prep. for *Energies,* invited for special issue: Power Systems for Offshore Renewable Energy).
1. **M. N. Haji,** M. E. Flicker Byers, A. H. Slocum, and E. Schneider, "Cost Analysis and Optimization of the Symbiotic Machine for Ocean Uranium Extraction using Shell Enclosures," (in prep. for *Renewable & Sustainable Energy Reviews*)

PEER REVIEWED CONFERENCE PUBLICATIONS

11. **M. N. Haji** and M. Filippi "Academic makerspaces as preparation for careers in industry," In *Proceedings of the 3rd International Symposium on Academic Makerspaces,* 21, Stanford, CA, August 3-5, 2018.
10. **M. N. Haji**, J. Drysdale, K. Buesseler, and A. H. Slocum, "Ocean Testing of a Symbiotic Device to Harvest Uranium from Seawater through the Use of Shell Enclosures", In *Proceedings of the Twenty-seventh (2017) International Ocean and Polar Engineering Conference*, 177-185, San Francisco, CA, June 25-30, 2017.
9. **M. N. Haji,** M. E. Flicker Byers, E. A. Schneider, and A. H. Slocum, "Cost Analysis of Wind and Uranium from Seawater Acquisition symBiotic Infrastructure using Shell Enclosures", *Transactions of the American Nuclear Society*, **116**, 89-92, 2017.

8. K. Simon and **M. N. Haji,** "Building a safety-based culture for a student-run makerspace," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 108-110, Cambridge, MA, November 13-16, 2016.
7. D. S. Dorsch, **M. N. Haji**, and J. C. Nation, "A hierarchical system for purchase management in a student-run makerspace," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 176-179, Cambridge, MA, November 13-16, 2016.
6. **M. N. Haji,** N. Petelina, and K. Smyth "Building community around a student-run makerspace: Project-based social and educational events," In *Proceedings of the 1st International Symposium on Academic Makerspaces,* 41-44, Cambridge, MA, November 13-16, 2016.
5. M. E. Flicker Byers, **M. N. Haji,** E. A. Schneider, and A. H. Slocum, "A Higher Fidelity Cost Analysis of Wind and Uranium from Seawater Acquisition symBiotic Infrastructure", *Transactions of the American Nuclear Society*, **115,** 271-274, 2016.
4. **M. N. Haji,** A. H. Slocum, "Design of a Symbiotic Device to Harvest Uranium from Seawater through the use of Shell Enclosures", *Transactions of the American Nuclear Society,* **115**, 153-156, 2016.
3. **M. N. Haji,** C. Delmy, J. Gonzalez, A. H. Slocum, "Uranium extraction from seawater using adsorbent shell enclosures via a symbiotic offshore wind turbine device", In *Proceedings of the Twenty-sixth (2016) International Ocean and Polar Engineering Conference*, 562-569, Rhodes, Greece, June 26-July 1, 2016
   Awarded **Best Student Paper** by the International Society of Offshore and Polar Engineers
2. **M. N. Haji,** C. Vitry, and A. H. Slocum, "Decoupling the functional requirements of an adsorbent for harvesting uranium from seawater through the use of shell enclosures," *Transactions of the American Nuclear Society*, **113**, 158-161, 2015.
1. **M. N. Haji,** K. Lau, and A. Agogino, "Human Power Generation in Fitness Facilities," In *Proceedings of the ASME 2010 4th International Conference on Energy Sustainability,* ES2010-90915, Phoenix, AZ, May 17-22, 2010.
   Featured on Berkeley Engineering News in 2010 and 2013.

OTHER CONFERENCE PUBLICATIONS

4. A. H. Slocum, **M. N. Haji,** J. Kluger, and A. Patel, "Offshore Platforms for Harvesting Renewable Energy and Minerals from Seawater," In *Proceedings of the Offshore Energy and Storage 2018 Conference*, Ningbo, China, July 4-6, 2018.
3. **M. N. Haji,** J. Kluger, T. Sapsis, and A. H. Slocum, "A Symbiotic Approach to the Design of Offshore Wind Turbines with Other Energy Harvesting Systems," In *Proceedings of the Offshore Energy and Storage 2017 Conference*, Cape Cod, MA, July 11-14, 2017.
2. A. H. Slocum, **M. N. Haji**, J. Kluger, and T. Sapsis, "Mechanics and materials in the design of symbiotic offshore energy harvesting systems," In *Proceedings of the 7th International Conference on Mechanics and Materials in Design*, Albufeira, Portugal, June 11-15, 2017.
1. **M. N. Haji,** K. Lau, and A. Agogino, "Harnessing Human Power for Alternative Energy in Fitness Facilities: A Case Study," In *AASHE Conference on Campus Initiatives to Catalyze a Just and Sustainably World,* Denver, CO, October 10-12, 2010.

EXPERIENCE

Feb 2018-present | **ATA Engineering** – Project Engineer — Austin, TX
- Principle investigator on Phase II USMC SBIR developing lightweight insulating shelters.
- Applying machine learning to complex mechanical system simulations for Phase II Navy SBIR.
- Developed novel, adaptable, portable gravity offloader robot as part of Phase I NASA SBIR.
- Designed and fabricated rotor testing laboratory for measurement of critical rotorcraft dynamics.

2017-2018 | **Flight Infinity** – Co-Founder — Cambridge, MA
- Designed waterproof electronics cage for autonomous, wind-powered drone.
- Selected as one of the 500 Deep-Tech Startups showcased at Hello Tomorrow in Paris, France.
- Raised $15,000 in non-dilutive seed capital from the MIT Sandbox Innovation Fund.
- Featured at MIT Startup Exchange Workshop: Robotics, Drones and Sensor Tech Innovation.

Jun-Dec 2017 | **MIT Precision Engineering Research Group** – Postdoctoral Associate — Cambridge, MA
- Adapted tools developed for harvesting uranium from seawater to harvest other seawater minerals.
- Further investigated symbiotic systems with offshore oil rigs and wave energy converters.
- Authored grant proposals for additional precision engineering research projects.

Jan 2017 | **IDEO CoLab** – Winter Fellow | Cambridge, MA
- Rapidly prototyped the viability of several startup ventures centered around Internet Of Things.
- Collaborated with team to develop products in food, home appliances, and productivity.

2014-2017 | **MIT Precision Engineering Research Group** – Graduate Research Assistant | Cambridge, MA
- Designed offshore structure to reduce the cost of harvesting uranium from seawater by ~80%.
- Managed $0.5 million in project grants to manufacture, deploy, and test 1/10th scale prototype.
- Directly advised and trained 14 undergraduate and two graduate students on various projects.

2013-2016 | **California Wave Power Technologies** – Team Member | Berkeley, CA
- Developed detailed business plans and performed market analysis for wave energy startup.
- Team selected as part of first cohort of Cyclotron Road hardware incubator at Berkeley Lab.
- Featured on ASME.org News, ASME ISHOW, and Bloomberg Businessweek.

2012-2014 | **MIT Environmental Dynamics Laboratory** – Graduate Research Assistant | Cambridge, MA
- Analyzed large ocean data sets and investigated role of wave scattering on energy distribution.
- Utilized advanced analytical tools to compare ocean data to numerical and theoretical models.
- Designed and coded algorithm GUI for determining energy content of internal wave fields.

2009-2012 | **Berkeley Energy and Sustainable Technologies Laboratory** – Lead Researcher | Berkeley, CA
- Performed case study evaluating feasibility of retrofitting gym to harness human power.
- Secured $17,000 in grants to implement retrofits at gym catering to >2,000 daily patrons.
- Managed diverse team of 12 undergraduate researchers for timely project completion.

2009-2013 | **UC Berkeley Physical Plant and Campus Services** – Designer | Berkeley, CA
- Designed new campus recycling bins that decrease cross-stream contamination by 70%.
- Collaborated closely with campus administrators, including Landscape Architect.
- Recycling bins deployed across campus as of Spring 2013.
- Featured on Berkeley News and The Daily Californian.

Summer 2011 | **MIT Marine Hydrodynamics Laboratory, Water Tunnel Facility** – Researcher | Cambridge, MA
- Investigated the effectiveness of a novel method of drag reduction on a cylinder in a cross flow.
- Constructed experimental apparatus and programmed LabVIEW controller for motor control.

Summer 2010 | **Hatfield Marine Science Center, NOAA and Oregon State University** – Researcher | Newport, OR
- Designed study to determine environmental effects on and of wave energy converters (WECs).
- Investigated effect of wave loading on WECs by strength testing moorings post-deployment.
- Determined environmental effects of WECs by identifying biological samples from moorings.

SERVICE AND TEACHING

Nov 2018-present | **Judge and Mentor, Big Ideas Contest, UC Berkeley**
- Reviewed proposals to identify the most innovative and creative ideas to solve societal problems.
- Will be serving as mentor to help winning student teams develop their ideas further.

June 2018 | **Judge, American Society of Mechanical Engineers - Innovation Showcase, USA Finalists**
- On panel of eight judges to select three showcase winners to award a total of $50,000 in prize money.
- Conducted design reviews with each of eight finalists with focus on hardware design and testing.

Fall 2017 | **Tech Advisor, 2.S983 Sports Technology: Engineering and Innovation, Mechanical Engineering, MIT**
- Mentored team of five students developing passive midsole cooling for Adidas shoes.
- Advised students as they designed, analyzed, prototyped, and tested various strategies.

2015-2017 | **President and Founding Member, MIT MakerWorkshop**
- Co-founded, with team of 30 students, the first student-run engineering maker space at MIT.
- Maintained and managed executive board; served as representative to greater MIT community
- Featured in MIT Technology Review.

2014-2017 | **Graduate Resident Tutor, MIT New House Dorm**
- Mentored diverse group of 37 undergraduates of all years in residential living group.
- Mediated conflicts and facilitated community-building efforts among student residents.

2013-2017 | **Co-Chair, Mechanical Engineering Graduate Association of Women**
- Initiated first graduate mentorship program for undergraduate women in MechE at MIT.
- Organized events to foster community between undergraduate mentees and graduate mentors.

Jan 2016	**Underwater Conservation Photographer, MIT Physics Department** • Took part in conservation photography course led by resident artist, Keith Ellenbogen. • Course ended with week-long scuba diving trip to the Glover's Reef Research Station in Belize. • Photographs exhibited at the MIT Wiesner Student Gallery to promote reef habitat conservation. • Featured on Oceans at MIT News.
Spring 2015	**Mentor, 1.016 Design for Environmental Issues, Civil and Environmental Engineering, MIT** • Mentored team of three freshman students in introductory design and engineering course. • Team successfully designed and pool-tested proof-of-concept seawater uranium harvesting machine.
Summer 2015	**Instructor, Women's Technology Program in Mechanical Engineering** • Introduced 20 high school students to engineering as part of intensive four-week program. • Carried out program development, which included lectures, demos, and lab experiments.
Aug 2013, Aug 2014	**Fluid Mechanics Project Course Instructor, Engineering Experience at MIT** • Developed and taught weeklong undergraduate level fluid mechanics to high school students. • Created final project that required students to conduct experiment in the MIT Towing Tank.
Jan-Aug 2012	**Broadening Participation Assistant Coordinator, Engineering Student Services, UC Berkeley** • Coordinated weekly engineering and leadership workshops and facilitated diversity events. • Resident Advisor for 50 incoming freshmen during intensive 11-day Pre-Engineering Program. • Oversaw daily group study sessions and aided students with transition into college life.

RESEARCH SUPERVISION

- Cedric Delmy, *Design of Integrated Pumped Hydro Reverse Osmosis Systems for Caribbean Nations,* Bachelor's thesis, MIT, Bachelor's thesis, MIT, 2018 – now Product Development Engineer at OMG, Inc.
- Arnav Y. Patel, "Assessing Offshore Oil Rigs for Seawater Mineral Extraction Purposes", Undergraduate Research Opportunity Project, MIT, 2016-2017.
- Cyndia C. Cao, *Exploration of Configurations of Wave Energy Converters to Mechanically Drive a Seawater Uranium Harvester,* Bachelor's thesis, MIT, 2017 – now graduate student in mechanical engineering at UC Berkeley.
- Amanda M Hamlet, *Uranium extraction from seawater: Investigating the hydrodynamic behavior and performance of porous shells,* Master's thesis, MIT, 2017 – now Staff Engineer at U.S. Coast Guard Marine Safety Center.
- Bo Paulsen, "Design of Chemical Systems for Use in a Symbiotic Device to Harvest Uranium from Seawater," MIT Summer Research Program, MIT, 2016 – now Reliability Engineering at Barrick Gold Corporation.
- Jorge Gonzalez, "The effects of protective shell enclosures on uranium adsorbing polymers," Undergraduate Research Opportunity Project, MIT, 2015-2016.
- Cedric Delmy, "Design optimization of a symbiotic system to harvest uranium from seawater," Undergraduate Research Opportunity Project, MIT, 2016.
- Charles Vitry, "Uranium extraction from seawater: Reduction of uranium adsorbent selectivity to vanadium," Undergraduate Research Opportunity Project, MIT, 2014-2015 – now Associate Consultant at Bain & Co.

INVITED TALKS

5. **M. N. Haji,** "Finding New Synergies between Water and Energy," Energy and Climate Partnership of Americas, Cambridge, MA, May 8, 2018 (panel).
4. **M. N. Haji,** "Symbiotic Systems for Mineral Extraction from Seawater," National Wind Technology Center, National Renewable Energy Laboratory, Boulder, CO, January 28, 2018.
3. **M. N. Haji**, "Addressing Seawater Mineral Extraction," U.S. Department of Energy Water Power Technologies Office Marine Energy Technologies Forum: Distributed and Alternate Applications, Washington, DC, December 5-7, 2017.
2. **M. N. Haji**, "Robotics, Drones and Sensor Tech Innovation," MIT Startup Exchange Workshop, Cambridge, MA, October 5, 2017 (panel).
1. **M. N. Haji**, "ISHOW Alumni – Success Stories & Raising Capital," American Society of Mechanical Engineers Innovation Showcase 2017, New York City, NY, October 17-19, 2017.

POSTER PRESENTATIONS

8. **M. N. Haji**, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," 2017 MIT deFlorez Award Competition, Cambridge, MA, May 7, 2017.

7. **M. N. Haji** and A. H. Slocum, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," 2015 C3E Women in Clean Energy Symposium, Cambridge, MA, November 4-5, 2015.
6. **M. N. Haji** and A. H. Slocum, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System," NAKFI Advanced Nuclear Technologies Mid-Cycle Grant Meeting, Chicago, IL, July 9, 2015.
5. **M. N. Haji**, T. Peacock, T. M. S. Johnston, and G. S. Carter, "Scattering of the Low-Mode Internal Tide at the Line Islands Ridge," Ocean Sciences Meeting 2014, Honolulu, HI, February 2014.
4. **M. N. Haji**, S. J. Ghaemsaidi and T. Peacock, "iModes: A Tool for Modal Decomposition of 2-D Internal Wave Fields," École de Physique des Houches Winterschool/Workshop on Waves and Instabilities in Geophysical and Astrophysical Flows, Les Houches, France, February 2013.
3. **M. N. Haji,** J. Schulmeister, J. Dahl, and M. S. Triantafyllou, "Drag Reduction through Moving Surface Boundary-Layer Control," Society for the Advancement of Chicanos/Hispanics and Native Americans in Science National Conference 2011, San Jose, CA, October 27-30, 2011.
2. **M. N. Haji**, S. Henkel, R. Emmett and A. F. T. Yokochi, "Interaction of Wave Energy Devices and the Environment: Biofouling Concerns on Mooring Systems," Society for the Advancement of Chicanos/Hispanics and Native Americans in Science National Conference 2010, Anaheim, CA, September 30-October 3, 2010.
1. **M. N. Haji,** K. Lau and A. Agogino, "Human Power Generation in Fitness Facilities," Sigma Xi Annual Meeting and Student Research Conference, The Woodlands, TX, November 12-15, 2009.

UNIVERSITY AND COMMUNITY SERVICE

Reviewer	Industrial & Engineering Chemistry Research Energies International Ocean and Polar Engineering Conference Pacific-Asia Offshore Mechanics Symposium
Grant Reviewer	National Science Foundation Phase I and II SBIR/STTR Program Department of Energy Phase I SBIR/STTR Program
Committees	MIT Graduate Resident Tutor Feedback Committee (2014-2018) MIT New House Dorm Renovation Committee (2016-2017) MIT Committee on Student Life, Graduate Member (2015-2016)
Professional Associations	American Society of Mechanical Engineers American Nuclear Society International Society of Offshore and Polar Engineers Society of Naval Architects and Mechanical Engineers

HONORS AND AWARDS

2018	Rising Stars in Mechanical Engineering at MIT Participant
2012-2017	National Science Foundation Graduate Research Fellow
2017	Earl Ewing Hays Award
2016	Path of Professorship Participant
2016	Best Student Paper, International Society of Offshore and Polar Engineers
2015	Women in Clean Energy, Education, and Empowerment (C3E) Symposium Poster Presenter
2015	MIT Graduate Women of Excellence Award
2015	ASME Innovation Showcase Winner: California Wave Power Technologies
2014	STEM Chateaubriand Fellowship (declined)
2013	Martin A. Abkowitz Award
2012-2013	American Bureau of Shipping Ocean Technology Graduate Fellowship (declined)
2009-2011	2009 NOAA Ernest F. Hollings Scholar
2009-2011	UC LEADS Scholar
2011	SACNAS Superior Research Poster Presentation in Mechanical Engineering, 2011 Annual Conference
2010	SACNAS Superior Research Poster Presentation in Mechanical Engineering, 2010 Annual Conference
2010	Eco-Friendly Stapler, Staples Global EcoEasy Challenge 2nd Place Winner