

Hisham K. Ali, Ph.D.

US Citizen

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EDUCATION

Graduate Institution:	Georgia Institute of Technology, MS 2015, PhD 2019
Graduate Degrees:	Doctor of Philosophy in Aerospace Engineering, May 2019 (Awarded August 2019) Master of Science in Aerospace Engineering, Awarded May 2015
Graduate GPA:	3.91/4.0
Doctoral Dissertation:	" <i>Magnetohydrodynamic Energy Generation and Flow Control for Planetary Entry Vehicles,</i> " August 2019
Dissertation Advisors:	Professor Robert D. Braun (Advisor) and Professor Mitchell L.R. Walker (Co-Advisor)
Undergraduate Institution:	The University of Alabama, BS 2013, <i>summa cum laude</i>
Undergraduate Degree:	Bachelor of Science in Aerospace Engineering, Awarded May 2013
Undergraduate Minors:	Mathematics, Computer Based Honors
Undergraduate GPA:	4.0/4.0 un-weighted (4.209/4.0 weighted)

RESEARCH OBJECTIVE AND INTERESTS

Research Objective: Investigation of magnetoaerodynamic interaction in aerospace plasmas for hypersonic challenges such as planetary entry
Research Interests: Space Systems and Technology, Magnetohydrodynamics, Planetary Entry, Hypersonics, Plasma Physics, and Mission Design

RESEARCH GRANTS AWARDED

Ali H.K. (Co-PI) and Walker, M. (PI), "*Magnetohydrodynamic Energy Generation and Flow Control for Planetary Entry Systems,*" NASA FY19 Unsolicited Proposal, August 2018 – September 2020, Awarded August 2018, Grant Number 80NSSC18K1429. Total funding \$191,000.

Ali H.K. and Braun, R.D., "*Magnetohydrodynamic Energy Generation and In Situ Resource Utilization During Planetary Entry,*" NASA Space Technology Research Fellowship, Awarded August 2013 – August 2017, Grant Number NNX13AL82H.

HONORS AND AWARDS

Awards:

Black Engineer of the Year Awards – Modern Day Technology Leader, 2022
 1st Place, 16th International Planetary Probe Workshop Oral Competition, 2019
 2nd Place, 14th International Planetary Probe Workshop Poster Competition, 2017
 2nd Place, 12th International Planetary Probe Workshop Poster Competition, 2015
 1st Place, 11th International Planetary Probe Workshop Poster Competition, 2014
 3rd Place, AIAA Region II Undergraduate Technical Competition, 2013
 3rd Place, AIAA Region II Regional Design Competition, 2013
 AIAA Outstanding Senior Award, The University of Alabama, 2013
 2nd Place, AIAA Region II Undergraduate Technical Competition, 2012
 3rd Place, AIAA Region II Student Open Topic Presentation Competition, 2010

Fellowships and Scholarships:

Jessie and Ralph Pries Endowed Fellowship Award, 2018
 Alfred P. Sloan Foundation Minority PhD Fellow, 2015 – 2018
 NASA Space Technology Research Fellow, 2013 – 2017
 Georgia Institute of Technology Presidential Fellow, 2013 – 2017
 Barry M. Goldwater Scholar, 2012
 Charles L. Seebeck Endowed Scholarship Award, 2012
 Tau Beta Pi Engineering Honor Society Scholarship, 2012
 Alabama Space Grant Consortium Scholarship, 2012
 University of Alabama National Merit Scholarship, 2009 - 2013

TEACHING AND MENTORING EXPERIENCE

Teaching Experience:

Instructor of Record, Introduction to Aerospace (AE1601), Spring 2020

Aerospace Engineering, Georgia Institute of Technology

- Instructor of record for two sections, 93 students total
- Course included lectures, assignments, and hands-on projects

Lecturer, Electric Propulsion (AE6451), Fall 2017

Aerospace Engineering, Georgia Institute of Technology

- Taught three graduate-level lectures on behalf of Prof. Mitchell Walker
- Topics in plasma physics including motion of charged particles and ionization
- Utilized in-depth conceptual knowledge for class discussion and questions

Lecturer, Space Flight Mechanics (AE4310), Fall 2015

Aerospace Engineering, Georgia Institute of Technology

- Taught four undergraduate-level lectures on behalf of Prof. Robert Braun
- Topics in orbital mechanics including N-body problem and conic orbits
- Utilized written and oral communication skills to enhance student engagement

Mentoring Experience:

Undergraduate Research Advisor, Fall 2017 – Spring 2020

Aerospace Engineering, Georgia Institute of Technology

- Mentored undergraduate students in the High-Power Electric Propulsion Laboratory as a graduate student (Fall 2017 – Spring 2019), postdoctoral fellow (Summer 2019) and currently as a research faculty member in the Space Systems Design Laboratory (Fall 2020 – Spring 2020)
- Facilitate student involvement in research, manufacturing techniques, and design in experimental magnetoaerodynamics research projects under my direction.
- Outcomes include final reports, research tools, and professional development, such as one student successfully able to secure full-time employment after graduation, and another pursuing graduate education, citing these research experiences as a factor

RESEARCH EXPERIENCE

Space Systems Design Lab, High Power Electric Propulsion Lab, Georgia Institute of Technology (Fall 2013-Summer 2020)

NASA Space Technology Research Fellowship Topic: Magnetohydrodynamics (MHD) and Planetary entry

- Conducted as a student (Fall 2013 – Spring 2019), Postdoctoral Fellow (Summer 2019), and Research Faculty Member (Fall 2019 – Summer 2020)
- Evaluate system implications of MHD energy generation and drag augmentation during planetary entry
- Develop and implement computational analysis tools and algorithms for MHD interaction during planetary entry
- Design and conduct experimental investigations for MHD and planetary entry with custom continuous, low-density, supersonic plasma wind-tunnel
- Wrote, and serve as Co-PI on \$85,000 NASA Sponsored Grant Supporting Work, Awarded August 28th, 2018, Grant Number 80NSSC18K1429
- Successfully proposed and awarded \$106,000 supplement to NASA grant 80NSSC18K1429 to support new experimental work, for total of \$191,000

NASA Jet Propulsion Laboratory Visiting Space Technologist (Summer 2017)

- Worked within the electric propulsion group to further development of magnetohydrodynamic energy generators for planetary entry
- Created an inductively coupled supersonic plasma jet testing facility to facilitate performance characterization for Martian entry conditions
- Drafted and executed inter-agency equipment loan agreement for experiment transfer between NASA and Georgia Tech, Agreement No. 051-18

NASA Innovative Advanced Concepts (NIAC) (Fall 2016 – Spring 2017)

- Collaborated on Phase I NIAC award entitled, “*Mars Molniya Orbit Atmospheric Resource Mining*”
- Performed architecture trade studies involving manufacturing of propellant from the Martian atmosphere using in-situ MHD energy generation.
- Co-author of International Astronautical Conference Paper Entitled, “*Mars Molniya Orbit Atmospheric Resource Mining*”

NASA Jet Propulsion Laboratory Visiting Space Technologist (Summer 2016)

- Collaborated with Dr. James E. Polk of the electric propulsion research group
- Created a supersonic inductively coupled radio frequency plasma to simulate Martian entry plasma conditions

Keck Institute for Space Studies Workshop (August 2015)

- Invited collaborator to workshop entitled, “Three Dimensional (3D) Additive Construction for Space using In-Situ Resources”
- Presented low-gravity technology demonstration mission concept
- Coauthor on Earth and Space 2016 Paper entitled, “*Automated Additive Construction (AAC) for Earth and Space Using In-Situ Resources*”

NASA Langley Research Center Visiting Space Technologist (Summer 2015)

- Worked within Atmospheric Flight and Entry Systems Branch at NASA Langley Research Center (LARC-D205)
- Performed design and modeling work towards flight dynamics influences of magnetohydrodynamic energy generation and flow control

NASA George C. Marshall Space Flight Center Visiting Space Technologist (Summer 2014)

- Collaborated with Dr. Kurt A. Polzin in the high power electric propulsion group at Marshall Space Flight Center (MSFC-ER24)
- Performed design and modeling work towards experimental demonstration of flight capable Magnetohydrodynamic Generator
- First author of NASA TM entitled, “*Proof of Concept Experiments on a Gallium Based Ignitron for Pulsed Power Applications*”

NASA George C. Marshall Space Flight Center

Identification and Testing of Candidate Parts for Rapid Prototyping in Microgravity (Summer 2012)

- Collaborated with human factors, materials testing, and NASA Marshall Rapid Prototyping Center
- Identified, designed, and prototyped candidate parts for rapid prototyping in microgravity.
- Stress tested rapidly prototyped parts using photoelastic imaging techniques
- Worked to support development towards first 3D printer in space aboard the International Space Station by miniaturizing 3D printer to fit
- Presented final report paper entitled, “*Identifying and Testing Candidate Parts and Tools for Rapid Prototyping in Microgravity*”

Luminescent Imaging Lab, The University of Alabama

Luminescent Photoelastic Coating Measurements in Rapid Prototyping (Fall 2011 – Fall 2012)

- Characterized rapid prototyping material properties (Dimension ABS Plus Thermoplastic)
- Demonstrated applicability of LPC technique to rapid prototypes

Designing and Implementing Instrumentation for Full-Field Dynamic Strain Measurement (Summer 2011)

- Successfully implemented and improved a trigger circuit for dynamic LPC measurement
- Created numerous LabVIEW virtual instruments for data acquisition and instrumentation control
- Captured our first full field dynamic LPC images, prompting AMRDEC to fund us in applying our technique to helicopter blades

Measuring the Dynamic Response of a Luminescent Photoelastic Coating (LPC) (Fall 2010 – Spring 2011)

- Designed and conducted a coating response test for frequency dependence that verified coating response up to dynamic loading of 10 Hz

SERVICE EXPERIENCE

Co-Program Coordinator, Georgia Tech University Center for Exemplary Mentoring (UCEM) (September 2019 – August 2020)

- Goal was to provide resources and professional development targeting under-represented minority graduate students in STEM at Georgia Tech
- Led, planned, and coordinated professional development opportunities, including community development and enrichment seminar programming
- Coordinated with executive steering committee for the Alfred P. Sloan Minority Ph.D. Fellowship Program at Georgia Tech
- Worked to sustainably integrate and independently fund within Georgia Tech programs currently supported by the Alfred P. Sloan foundation

PROFESSIONAL EXPERIENCE

Assistant Professor, The University of Colorado Boulder, Boulder, CO (July 2022–Present)

- Assistant Professor in the Ann and H.J. Smead Department of Aerospace Engineering Sciences, effective January 2022
- Director of the Magnetoaerodynamics and Aerospace Plasmas Laboratory
- Research expertise in experimental plasma physics, hypersonics, planetary entry, and space systems engineering

Visiting Assistant Professor, The University of Colorado Boulder, Boulder, CO (July 2021–January 2022)

- Incoming Assistant Professor in the Ann and H.J. Smead Department of Aerospace Engineering Sciences, effective January 2022
- Initiated laboratory startup and PhD student recruitment for the Magnetoaerodynamics and Aerospace Plasmas Laboratory
- Provided input and guidance on thermal fluids graduate curriculum in the Ann and H.J. Smead Department of Aerospace Engineering Sciences

Member of Technical Staff, The Aerospace Corporation, Colorado Springs, CO (September 2020–January 2022)

- Member of Technical Staff in the Space Tactics and Orbit Analysis Section, Astrodynamics Department
- Mission design and astrodynamics analyst supporting a variety of missions, modeling efforts, and design tools
- Provide expertise related to hypersonics, planetary entry, and space systems engineering

Research Engineer II, Georgia Institute of Technology, Atlanta, GA (September 2019–August 2020)

- Research Engineer II (Research Faculty Member) in the Daniel Guggenheim School of Aerospace Engineering
- Co-PI of \$191k NASA grant investigating magnetohydrodynamic drag augmentation for planetary entry, NASA Grant No. 80NSSC18K1429
- Co-Program Coordinator for the Georgia Tech University Center of Exemplary Mentoring funded by the Alfred P. Sloan Foundation
- Instructor of record for two sections of AE1601, *Introduction to Aerospace*, in Spring 2020 academic semester

Postdoctoral Fellow, Georgia Institute of Technology, Atlanta, GA (June 2019–August 2019)

- Postdoctoral research fellow in the Daniel Guggenheim School of Aerospace Engineering
- Awarded best overall presentation at the 16th International Planetary Probe Workshop at The University of Oxford, United Kingdom
- Co-PI of NASA grant investigating magnetohydrodynamic energy generation and flow control for planetary entry
- Proposed and awarded \$106,090 extension to NASA grant 80NSSC18K1429 experimentally investigating magnetohydrodynamic drag

Graduate Research Assistant, Georgia Institute of Technology, Atlanta, GA (August 2013–May 2019)

- Thesis advisors: Dr. Robert D. Braun and Dr. Mitchell L.R. Walker in the Daniel Guggenheim School of Aerospace Engineering
- NASA Space Technology Research Fellow from August 2013 – August 2017, leading research in magnetohydrodynamics and planetary entry
- Collaborator on 2016 NIAC Phase I award entitled, “*Mars Molniya Orbit Atmospheric Resource Mining*,” as energy generation specialist
- Wrote, and served as Co-PI on \$85,000 NASA Sponsored Grant Supporting Work, Awarded August 28th, 2018, Grant Number 80NSSC18K1429

Undergraduate Research Assistant, The University of Alabama, Tuscaloosa, AL (August 2012– 2013)

- Worked with Dr. James Paul Hubner in applications of the LPC technique to rapidly prototyped specimens
- Developed an integrated rapid manufacturing approach to create an LPC

NASA George C. Marshall Space Flight Center Intern, Huntsville, AL (Summer 2012)

- Worked with Systems Engineering and the National Center for Advanced Manufacturing to develop an in-space rapid prototyping capability
- Created and tested rapidly prototyped parts for end-use applications

Computer Based Honors Program Lab Manager, The University of Alabama, Tuscaloosa, AL (January 2010 – August 2013)

- Manage the Computer Based Honors Undergraduate Research lab, including software purchasing, server maintenance, and lab development
- Lead 3D Printing Lab Manager: Selected, researched, and acquired a rapid prototyping system currently used in active research

NSF REU Undergraduate Research Assistant, The University of Alabama, Tuscaloosa, AL (Summer 2011)

- Solved problems related to Luminescent Photoelastic Coating Measurements in dynamic loading conditions

Computer Helpdesk Consultant, The University of Alabama, Tuscaloosa, AL (Sep – Dec 2009)

- Serviced student computers and provided support on a variety of issues, ranging from virus removal to website publishing and design

SKILLS AND EXPERTISE

Skills:

Multi-institution Research, Collaboration and Grants
 Engineering Team Leadership and Project Management
 Technical Reports, Problem Solving, and Analysis
 Computer Programming (C++, FORTRAN, MATLAB)
 Experimental Design and Validation
 Computer Hardware Integration, System Administration

Expertise:

Advanced Aerospace Systems Engineering, Optimization
 Computational Fluid Dynamics, Algorithms, Numerical Methods
 Planetary Entry, Descent, and Landing Vehicles
 Hypersonic Aerothermodynamics, Trajectory Design
 Plasma Physics, Magnetohydrodynamics, Electric Propulsion
 Non-Equilibrium Gas Dynamics and Chemical Kinetics

PAPERS AND PRESENTATIONS

Oral Presentations

Ali H.K., “*Experimental Investigation of Magnetohydrodynamic Energy Generation in Conditions and Configurations Relevant to Planetary Entry Vehicles*,” 16th International Planetary Probe Workshop, Oxford, UK, July 2019.

Ali H.K., “*Magnetohydrodynamics for Planetary Entry Systems*,” 2018 Symposium on Space Innovations, Georgia Institute of Technology, Atlanta, Georgia, November 2018

Ali H.K., “*Magnetohydrodynamic Energy Generation and Flow Control for Planetary Entry Systems*,” Invited Lecture, University of Queensland Centre for Hypersonics, Brisbane, Australia, May 2018

PAPERS AND PRESENTATIONS CONTINUED

Theses and Dissertations

Ali H.K., “[*Magnetohydrodynamic Energy Generation and Flow Control for Planetary Entry Vehicles*](#),” Doctoral Dissertation, Georgia Tech, 2019

Ali H.K., “[*In Situ Magnetohydrodynamic Energy Generation for Planetary Entry Systems*](#),” Master’s Special Project, Georgia Tech, 2015

Technical Reports

Ali H.K., Hanson V.S., Polzin, K.A., and Pearson, J.B., “[*Proof of Concept Experiments on a Gallium Based Ignitron for Pulsed Power Applications*](#),” NASA TM-2015-218202, April 2015.

Peer-Reviewed Journal Articles

Ali H.K., and Braun R.D., “*Effects of Magnetohydrodynamic Drag Augmentation on Mars Hypersonic Entry*,” AIAA Journal of Spacecraft and Rockets, *In Review*, September 2020.

Ali H.K., and Braun R.D., “[*Modeling Magnetohydrodynamic Energy Generation and Storage in Planetary Entry System Conceptual Design*](#),” AIAA Journal of Spacecraft and Rockets, Vol. 55, No. 2, pp. 356-364, 2018

Conference Papers

Mueller, R.P., Braun, R.D., Sforzo B., Sibille, L., Gonyea, K., and **Ali H. K.**, “[*Mars Molniya Orbit Atmospheric Resource Mining*](#),” in 68th International Astronautical Congress, Adelaide, Australia, September 2017

R Mueller; S Howe; D Kochmann; **H Ali**; et al., “[*Automated Additive Construction \(AAC\) for Earth and Space Using In-situ Resources*](#),” Proc. of the Fifteenth Biennial ASCE Aerospace Division International Conference on Engineering, Science, Construction, and Operations in Challenging Environments (Earth & Space 2016). Orlando, Florida, USA, 11 - 15 Apr 2016. Reston, Virginia, USA: American Society of Civil Engineers.

Ali H.K., and Braun R.D., “[*Effects of Magnetohydrodynamic Energy Generation on Planetary Entry Vehicle Flight Dynamics*](#),” in 2015 AIAA Propulsion and Energy Forum, Orlando, Florida July 2015.

Ali H.K., and Braun R.D., “[*Application of Magnetohydrodynamic Energy Generation to Planetary Entry Vehicles*](#),” in 2014 AIAA Propulsion and Energy Forum, Cleveland, Ohio, July 2014.

Conway, ML, **H Ali**, and JP Hubner, “*Determining the Dynamic Response of a Luminescent Photoelastic Coating*,” SEM XII International Congress & Exposition on Experimental & Applied Mechanics, Paper 110, June 2012.

Gerber, DR, **HK Ali** and JP Hubner, “*Dynamic Strain Measurements with a Luminescent Photoelastic Coating*,” Proceedings of SPIE Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2011, ed. M Tomizuka, 7981:Paper 214, March 2011.

Poster Presentations

Ali H.K., Polk, J.E., and Braun R.D., “[*Experimental Demonstration of Magnetohydrodynamic Energy Generation in Conditions and Configurations Relevant to Planetary Entry Vehicles*](#),” in 14th International Planetary Probe Workshop, The Hague, The Netherlands June 2017.

Gonyea, K.C., Mueller R.P., Sforzo B., Sibille, L., **Ali H.K.**, and Braun R.D., “[*Sustained Mars Exploration Through Mars Atmospheric and Surface Resource Utilization*](#),” in 14th International Planetary Probe Workshop, The Hague, The Netherlands June 2017.

Ali H.K., and Braun R.D., “[*Magnetohydrodynamically Enhanced Deceleration for Planetary Entry Vehicles*](#),” in 13th International Planetary Probe Workshop, Laurel, Maryland, June 2016.

Gonyea, K.C., **Ali H.K.**, and Braun R.D., “[*Magnetohydrodynamic energy Generation and Atmospheric Breathing Supersonic Retropropulsion for Mars Descent*](#),” in 13th International Planetary Probe Workshop, Laurel, Maryland, June 2016.

Ali H.K., and Braun R.D., “[*System Performance Assessment for Magnetohydrodynamic Energy Generation During Planetary Entry*](#),” in 12th International Planetary Probe Workshop, Cologne, Germany, June 2015.

Ali H.K., and Braun R.D., “[*In Situ Magnetohydrodynamic Energy Generation for Planetary Entry Vehicles*](#),” in 11th International Planetary Probe Workshop, Pasadena, California, June 2014.