

01/07/2021

Elihu Deneke  
1728 N 9<sup>th</sup> St.  
Lafayette, IN 47904

Black Trailblazers in Engineering Fellowship

Dear Members of the Selection Committee,

I am writing to express my interest in the Black Trailblazers in Engineering Fellowship at Purdue University. So often, black students feel they will not succeed in engineering disciplines or are setback due to socioeconomic hurdles. BTE is a program that directly counters these challenges in higher-level academics by preparing future black faculty with tools for success in academia that students are rarely exposed to. The effects of the program will likely trickle down the pipeline to young black undergraduate students where well-equipped black faculty, thanks in part to this program, are able to impact future generations while contributing to innovative and cutting-edge research. It is for this reason I hope to be a participant in this year's BTE program.

As a researcher in artificial intelligence, I am often one of the few black scholars in the room. Though it might seem alienating, I have always made connections with those around me through our shared passion for AI and STEM. Additionally, the diversity in my work, from flight software development to swarm robotics to machine learning in energy systems, has given me a solid foundation in scientific principles and confidence to be the student that stands out in a room. I hope to share this message with other young students, that confidence in your abilities and a shared passion for STEM will help you succeed, and as that passion and confidence grow in our communities, so will the diversity we see in our classrooms and office spaces.

To propel this message forward, I will be mentoring two minority undergraduate students from historically black universities to expose them to high impact research and equip them with AI technical experience they can take to graduate school or industry. As a black faculty member, I can do more. My goals are to 1. establish myself as a leader in my field to set an example of success for young black students 2. equip students with fundamentals and critical thinking skills so they are confident in their abilities and 3. develop STEM programs for underrepresented youth to cultivate an interest in less marketed avenues for success.

I hope you find that my past experiences and future goals express my commitment to elevating black leaders in academia. I believe my strong technical background combined with my desire to increase diversity in STEM education at all levels will make me an impactful leader, researcher, and faculty member, and hopefully a strong candidate for this fellowship. Thank you for your consideration.

Sincerely,

Elihu Deneke

## **Research and Education Plan**

It is imperative to acknowledge my parent's journey when I credit my own successes and triumphs in academia. My earliest memories recall their adamant belief that education is a ticket to a better life. I witnessed both my mother and father work multiple jobs while attending university. Through hard work and perseverance, they attained university degrees that promised upward economic mobility reflecting the ideals of the elusive American dream. It was this move that laid the groundwork for my current success. The example set before me provided the key evidence that success is possible, regardless of the odds stacked against you. With perseverance, which cannot be stressed enough, and hard work, one can accomplish their goals. In a world abundant with information, there still lacks a presence of positive influence on how education can better one's life. This is especially true for underrepresented communities that have historically been excluded from educational institutions and financial prospects. Granted the opportunity to become a faculty member I hope to be the same example that has had a profound impact on my life to help others realize their potential. I seek to be a leader in the scientific community to foster growth in diversity in a community that often seems remarkably out of reach for those that look like me. Through exceptional work and achievements, I hope to change this reality and encourage minorities to occupy high levels of academia.

My research goals as a faculty member will look to leverage big data in traditional mechanical engineering practices and vice versa. Often in complex problems, the application of machine learning may be utilized to achieve closure to open-ended problems or function as surrogate models to alleviate computational burdens. Alternatively, traditional engineering areas founded in physics, such as fluid mechanics, thermodynamics, heat transfer, etc., can provide insight into data-driven problems. Such insight is in the form of physical variables that help characterize systems or states. This insight turns data-driven problems from black-box approaches to grey-box approaches. Meaning, data-driven tasks that once did not have any intermediate insight now have interworking information from the physics portion of the hybrid physics-based data-driven approach. This knowledge allows users to understand the decision-making process of the data-driven approach. Leveraging the combined information gained from physics and data, I seek to make strides in establishing clean reliable energy, improve combustion processes, and develop reliable data-driven techniques. My approach to teaching will be to establish an open environment,

accepting of differences, and encouraging diverse thoughts. With such liberal dialog, students will develop their ability to critically reason and understand different perspectives. These skills translate well outside of the classroom and will help develop well-rounded empathetic individuals. Personally, I actively seek fundamentals in high-level applications when reviewing literature or new technology. This allows me to quickly gain an understanding of the functionality of such novelties. Through tying the fundamentals of mechanical engineering to real-world applications, I seek to develop the students' ability to understand abstract concepts and apply them to their daily lives.

I see the campus community as a consortium of scholars who seek to change the world through cooperation and integrity. By being a faculty member, I hope to be a part of something much greater than myself or any collective group of people. To make great strides in the fields of engineering and research requires both foundation and commitment. Throughout my academic career, I have built my foundation through my experiences and will continue to mold together the blueprint for my future through the resources, opportunities, and interactions I encounter. As a student of engineering, I see how the application of both mathematics and the sciences shape the very confounds of human development. Through my education thus far, research experiences, and real-world interactions, I have developed a passion for the efficiency of science and technology and desire to pursue a career in academia to help shape this world for future generations. I am honored to be considered for the Black Trailblazer Fellowship and would like to thank you for your time.

Sincerely,

Elihu Deneke

# Elihu Deneke

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**EDUCATION:** **Purdue University; West Lafayette, Indiana**  
Pursuing: Ph.D. Mechanical Engineering  
**Prairie View A&M University; Prairie View, TX**  
M.S. Engineering (Thesis based)  
B.S. Mechanical Engineering

**Graduation Date: Aug 2021**  
GPA: 3.52  
**Graduation Date: August 2017**  
GPA: 3.88  
GPA: 3.46

## EXPERIENCE:

### **Sandia National Laboratory**

**Graduate Year-Round Intern**

**Dec. 2020 – Current**

- Current research focuses on using computational molecular dynamics to understand the development of gas-phase nanoparticle sintering for counter-proliferation R&D.

### **Research: Artificial Neural Network for Power System**

**DOE: Gore Research Group**

**May 2018 – Current**

- Research focuses on the development, testing, and employment of a hybrid physics and data-based model to evaluate the thermo-economic performance of industrial boilers to reduce operation cost and improve plant financial feasibility.
- Exergy-based cost balance, degradation science, and machine learning are employed to project plant cycling cost and project system components life span based on sequential operation. The model will be utilized forecast performance of the system and aid in dispatching commitment decisions.

### **Research: Unburned Pocket Statistics of Turbulent Flames**

**Gore Research Group**

**Jan. 2020 – Dec. 2020**

- Contributed to the Development of an application to conduct image post processing to characterize turbulent reacting flows based on unburnt pocket formation. The method uses convolutional neural network (CNN) to analyze sequential frames and identify and track unburnt pockets.
- Using this information our goal is to then characterize the turbulent reacting flow and determine the heat release rate and hydrocarbon emissions.

### **Research: Machine Learning for Hot Surface Ignition Prediction**

**Gore Research Group**

**Nov. 2019 – Dec. 2020**

- Aviation fluids were investigated to determine the minimum hot surface temperature required for ignition. Using the data gathered from experiments conducted by Air Force Research Laboratory (Johnson et al 1988), an artificial neural network (ANN) model was developed to predict the probability of ignition given fuel and surrounding area properties.

### **Research: Flame Spread Measurements of Alternative Aviation Fuels**

**FAA: Gore Research Group**

**Aug. 2017 – Dec. 2019**

- Investigated fire-safety property flame spread rate of alternative aviation fuels (Jet-A, Fischer-Tropsch-S8, Synthetic Iso-Paraffin, and Hydro-processed esters and fatty acids).
- Experiments were conducted for a range of liquid fuel temperatures. K-type thermocouples and a high-speed camera were used to measure flame spread rates.

### **NASA CACI, Houston, TX: Swarm Robotics**

**PVAMU Employment Program**

**Jan. 2016 – Aug. 2017**

- Applied numerical optimization techniques such as Ant Colony Optimization and Particle Swarm Optimization to effectively conduct search patterns and identify targets using a robotic swarm system. Conducted simulations to test performance of developed algorithms.
- Developed software using C/C++ and used Robotic Operating System (ROS) as the framework of communication.
- Accomplishments present an approach that decentralizes a robotic unit to a cohesive self-optimizing system capable of adapting when experiencing disturbances.

### **Research: Flex Multi-Body Dynamic Simulation (Parallel Processing)**

**Conference Research Paper**

**Aug. 2016 – May 2017**

- Developed and analyzed the performance of a flexible multiple body simulation which models International Space Station's manipulator arm by using the method of Divide and Conquer Algorithm (DCA). The computational performance was compared to the traditional means of describing bodies and their motion.
- DCA breaks down a system to elementary components then assigns a CPU to compute the assigned bodies' motion, a step-by-step recursive process describing the entire system. This method of computing the system motion is an alternative to the traditional mass matrix approach.

### **NASA L-3 NSS, Houston, TX**

**PVAMU Employment Program**

**Dec. 2014 – Dec. 2015**

- Conducted oversight on the Orion Multi-Purpose Crew Vehicle's Flight Software development. Using a Unix/Linux platform to produce programs that accurately simulate orbital courses around Earth for the Orion Multi-Purpose Crew Vehicle.
- Completed Python, C++, and Java components used in simulations for verification and validation of the Orion Multi-Purpose Crew Vehicle Flight Software.
- Developed a graphical user interface (GUI) that simplifies user commands by constructing and executing flight test scripts. The GUI minimizes risk of human error and increases efficiency in command execution.
- Accomplished Verification and Validation documentation for the graphical user interface's installment.

### **Research: Building Systems- 0% Energy Loss; Prairie View, TX**

**Feasibility Analysis**

**Aug. 2014 – Dec. 2014**

- Lead research for a capable program to conduct energy analysis, cost analysis and emission analysis throughout the duration of a 0% energy loss building system project's life span. End goal was to use the software in support of a project's installment proposition.
- Research lead to the decision to use RETScreen in a Building Energy Efficiency project proposition and is now the basis of a new technical elective engineering class at Prairie View A&M University.

## LEADERSHIP:

### Teaching Assistant

Purdue University

Spring 2018 – Spring 2019

- **Introduction to Machine Design:** Facilitated a Machine Design laboratory where students were introduced to the product design process. Lead students through the following steps: development of product design specifications using customer inputs, benchmarking, product/market research and patent review, concept generation and evaluation, functional decomposition, modeling and decision matrices. Resulting in a detailed product design including assembly, economic analysis, CAD, and bill of materials
- **Thermodynamics:** Assisted students in addressing challenging questions by problem solving with an engineering approach. Covered topics such as conservation of mass, first and second laws of thermodynamics, analyses of individual devices, systems and cyclic devices, and reversible vs irreversible processes

### National Society of Black Engineers

Public Relations Officer

Aug. 2013 – Dec. 2013

- Increased member participation by utilizing various social media, email, and webpage outlets to enhance communication efforts

### Student Enrichment Program

Tutor Facilitator

Aug. 2011 – Dec. 2013

- Lead students to master challenging science and mathematical concepts. Covered Subjects: Calculus 1,2&3, and University Physics I & II

## ACTIVITIES & AWARDS:

### Purdue Doctoral Fellow

Fall 2017

- Awarded the distinguished Purdue Doctoral Fellowship

### Partners for the Advancement of Collaborative Engineering Education Competition

Fall 2014

- 3<sup>rd</sup> Place Achievement in PACE Kinematic Course Competition Competition Sponsors: GM, AUTODESK, HP, ORACLE, SIEMENS

## TECHNICAL SKILLS:

- Tensorflow, CEA, Ansys, EES, ProE, MATLAB, Java, Python, C/C++, Linux, Eclipse, Excel, ROS, Raspberry Pi, Beaglebone Black, Arduino

## Publications:

### 1. Research: Artificial Neural Network for Power System

E. Deneke, V. R. Hasti, and J. P. Gore, "Cyclic load analysis of a steam generator in a coal-burning power plant," (Submitted Jan. 2021)

### 2. Research: Artificial Neural Network for Power System

A. Navarkar, V. R. Hasti, E. Deneke, and J. P. Gore, "A data-driven model for thermodynamic properties of a steam generator under cycling operation," *Energy*, 2020.

### 3. Research: Flex Multi-Body Dynamic Simulation

L. A. Nguyen, E. Deneke, and T. L. Harman, "Multithreading/Multiprocessing Simulation of The International Space Station Multibody System Using A Divide and Conquer Dynamics Formulation with Flexible Bodies," in *ICARA 2017: International Conference on Autonomous Robots and Agents*, 2017.

### 4. Research: Artificial Neural Network for Power System

E. Deneke, V. R. Hasti, and J. P. Gore, "Exergy-based cost analysis of a coal-fired steam generator under cyclic loading," (In Progress for 2021)



# PRAIRIE VIEW A&M UNIVERSITY

A Member of the Texas A&M University System

January 8, 2021

To: The Reviewers of Black Trailblazers in Engineering Program

Re: Mr. Elihu Deneke's Application

Dear Sir/Madam:

I am delighted to write a letter of recommendation in support for Mr. Elihu Deneke's application for your program. Eli (as I called him) had worked with me as an Undergraduate Research Assistant for a year and an half, and as my Graduate Research Assistant of a MS degree at Prairie View A&M University before he went to Purdue pursuing the study of a Ph.D. degree.

Eli is my best Research Student Assistant for the past 10 years. As the Principal Investigator, I have supervised contractual projects funded through L-3 Communications and CACI company for NASA Johnson Space Center (JSC) originated tasks since 2008. The purpose of the project is to train engineering and computer science students in software development process, software simulation technology, and software tools used in support of the US Space Program. More than 40 students have participated in the project and gained summer internship in NASA.

Eli was selected to join the project after he participated in a week-long software simulation training workshop hosted by L-3 Communications and NASA JSC. He has shown his ability of working on assigned tasks and obtained excellent results. As a busy undergraduate student, Eli worked project tasks between classes or after classes during the regular semesters and submitted weekly reports to me and to a technical mentor at L-3 Communications. In the summer, he worked as an intern at NASA JSC. The technical mentor and I were highly satisfied with Eli's work.

As a MS graduate student, Eli's thesis is in the area of swarm robotics applications on Mars. An ex-NASA expert in swarm robotics, currently a faculty at University of Houston, Clear Lake, was invited to serve on his Thesis Advisory Committee at Prairie View A&M. Eli completed his MS thesis in the summer of 2017.

Eli is very pleasant to work with. He is considerate, responsible, and hard-working. His interaction with other students in my project reflects the kind of skills required of an individual effectively working within the context of a professional team. In summary, I highly recommend Mr. Elihu Deneke to your program without any reservation. I believe he would become an excellent professor and be able to serve as a great role model for many future students. If you need more information, please feel free to contact me by email at [shlin@pvamu.edu](mailto:shlin@pvamu.edu).

Sincerely Yours,

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Shield B. Lin, Ph.D., P.E.  
Professor in Mechanical Engineering

[www.pvamu.edu](http://www.pvamu.edu)

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Roy G. Perry College of Engineering  
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January 15, 2021

To whom this may concern:

It is a pleasure to write this reference letter in support of Mr. Elihu Deneke's application for the Black Trailblazers in Engineering Program at Purdue Engineering. I got a chance to meet Elihu during his visit to Purdue University in Spring 2017 as a mechanical engineering prospective Ph.D. student and recruited him to our research group. He joined our research group in Fall 2017 and since then he is pursuing his Ph.D under my co-supervision along with Prof. Jay P.Gore.

Mr. Elihu has successfully completed the required course work with a GPA of 3.53 and his dissertation preliminary examination in Fall 2020. He is expected to complete his Ph.D.in December 2021. As part of dissertation, he is working on a project Cost of Operations and Cycling Optimization (Coco) of a steam generation system in a coal power plant utilizing the principles of thermodynamics, power plant engineering and machine learning. He helped on this project to complete the major technical milestones along with other team members. Elihu contributed to the completion of a manuscript for a possible publication in the prestigious journal Applied Energy and currently supporting on the two other journal manuscripts.

I have found him to be a friendly, soft-spoken, calm, humble, extremely sincere, and hard-working individual. He has good oral and written communication skills. I also found him to be highly self-motivated, very punctual, and dedicated to his research work. His willingness to help others is very clear when I expressed my plan to take two students this summer 2021 from an HBCU to help them learn machine learning fundamentals. Elihu accepted the responsibility to function as their graduate student mentor and help students with the summer projects.

I highly recommend Elihu for Black Trailblazers in Engineering Program at Purdue Engineering. Please feel free to contact me if there are any questions.

Sincerely



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