Mark Hartigan

Purdue University

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Education

Purdue University, West Lafayette, IN　　　　　　　　　　Expected Graduation: May 2021

- Bachelor of Science in Aeronautics and Astronautics Engineering　　　　GPA: 3.97
- Minor in Computer Science
- Honors College

Awards and Honors

- National Merit Scholarship – Purdue University　　　　August 2017 – May 2021
- Dean's List and Semester Honors　　　　Fall 2017 – Spring 2020
- Warren G. Koerner Scholarship (AAE merit-based scholarship)　　　　July 2018, July 2019
- Northrop Grumman SPACE Award for Rocket Design　　　　April 2019

Work Experience

Northrop Grumman Corporation　　　　　　　　　　May 2020 – August 2020

GNC Analysis Intern

- Performed GNC analysis on Commercial Resupply Service missions for the International Space Station
- Conducted independent research to study pseudospectral dynamic optimization and implemented separately within a C++ and Python model to generate propellant-optimal attitude maneuvers
- Developed an accurate rotational dynamics model in Simulink to simulate spacecraft attitude slews
- Analyzed steady-state attitude error between Star Trackers and its effect on mission requirements
- Wrote mass property calculation scripts to assist Monte Carlo analysis of Human Landing System designs
- Presented results for all the above and made data-based recommendations for improving future missions

GE Aviation　　　　　　　　　　May 2019 – August 2019

Lean Six-Sigma Manufacturing Intern

- Applied lean six-sigma training to military turbine airfoil production lines to decrease lead time
- Leveraged lean practices across the manufacturing plant to improve quality and flow of the value stream
- Drafted a floorplan of the facility in AutoCAD 2018; created a system for continuous maintenance

The Fourth River Co.　　　　　　　　　　May 2018 – August 2018

Engineering Internship

- Performed IT tasks on Windows and Linux operating systems and wrote programs to automate tasks
- Aided with engineering projects, including AutoCAD drafting, proposals, and report compilation
- Worked on construction sites with power tools installing and servicing fuel tank systems and piping

Research and Projects

FEMTA Suborbital Project　　　　　　　　　　August 2019 – Present

Undergraduate Research Assistant

- Design a system to measure microNewtons of thrust produced in a vacuum by FEMTA, a novel micropropulsion device, by generating plasma in a cathode and recording ultraviolet intensity
- Deliver a system for testing on Blue Origin's New Shepard rocket, sponsored by NASA REDDI
- Utilize a modified Raspbian kernel to develop mission-critical processes and software in C
- Develop an accurate system-wide model in SOLIDWORKS and machine components
- Perform vacuum chamber experiments to verify and validate flight hardware designs

- Design (Kicad & LTSpice), test, and manufacture custom PCBs for interfacing with sensors, solenoids, and Blue Origin servers

Design and Analysis of a Spacecraft Propulsion System   August 2020 – Present
AAE 33900: Aerospace Propulsion
- Plan a deep space mission to deploy a research probe on Europa – similar to the Europa Clipper – with a focus on the design and analysis of propulsion systems used (from launch vehicle to delta-V engine)

Creating a Social Networking Platform   August 2020 – Present
CS 30700: Software Engineering
- Construct a social media site with similar functionality to Twitter, Facebook, or Reddit from the ground up
- Develop a frontend using a combination of React.js, HTML, and CSS in conjunction with a Node.js backend utilizing Google's Firebase database and hosting services

Purdue Orbital   September 2018 – August 2020
Avionics Design Lead
- Led software team creating flight computers for a Level 2 rocket launched from a balloon platform
- Developed a flight computer on a Raspberry Pi platform after prototyping using Arduinos
- Wrote software, modified Linux architecture, and integrated sensors to achieve mission specifications
- Applied signal processing techniques to clean data and achieve accurate telemetry for missions
- Worked with other subteams and the FAA to coordinate a mission test with Raven Aerostar

Mentorship Experience

Honors First Year Engineering   August 2018 – Present
Teaching Assistant
- Write autograders for Python and MATLAB assignments to deploy on remote Gradescope servers
- Help design a GUI using PyQt5 for TAs to manage and answer student questions as they pertain to projects
- Aid learning in class by providing guidance to students, assisting the professors, and grading work

Engineering Mentor Corps   August 2020 – Present
First Year Engineering Mentor
- Mentor 12 First-Year Engineering students by organizing virtual meetings, providing advice, professional development planning help, and directing them towards campus resources

Honors College Mentor   April 2018 – October 2019
- Mentored a group of freshmen in a first-year Honors College "Evolution of Ideas" course
- Encouraged collaboration, created group norms, and fostered a psychologically safe environment
- Learned leadership skills to improve group dynamics, identify implicit biases, and support diversity

Publications and Presentations

Lumpp, B., Ayhan, D., Deperna, J., **Hartigan, M.**, Hawn, E., Johnson, A., Kinsella, J., Kracke-Bock, C., Patel, J., (2020). "Zero-Gravity Testing of a FEMTA Thruster Through Plasma Spectroscopy". In *Fall 2020 Purdue Undergraduate Research Conference*. West Lafayette, IN.

Lumpp, B., Chow, J., Deperna, J., **Hartigan, M.**, Johnson, A., Kinsella, J., (2020). "Developing a Numerical Model of the FEMTA Propellant Management Experiment". In *Fall 2020 Purdue Undergraduate Research Conference*. West Lafayette, IN.

Chow, J., Czech, C., Degener, M., Franks, .N, Govindhan, A., **Hartigan, M.**, Kiddy, S., Kracke-Bock, C., Lumpp, A., Lumpp, B., Menon, A., Patel, R., Shahin, T., Soberg, J., Yu, Y., (2020). "Suborbital Testing of a Small Satellite Propulsion System". In *Spring 2020 Purdue Undergraduate Research Conference*. West Lafayette, IN.