William Coogan

Personal Data

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Education

2018 PhD in Mechanical and Aerospace Engineering, Princeton University
Dissertation: "Thrust Model for an Applied-Field Lorentz Force Accelerator"

2013 BS in Physics, Minor in Mathematics, Indiana University
Honors Thesis: "Analysis of Monte Carlo Comparison Methods for W + n-jet and Vector Boson Fusion Processes"
Departmental Honors, Highest Distinction

2011 and Previous Master of Music, Indiana University Jacobs School of Music
Master of Music and Bachelor of Music *cum laude*, Western Washington University

Work Experience

Graduate Researcher at Electric Propulsion and Plasma Dynamics Laboratory, Princeton, NJ — 2013–Present
Applied-Field Lorentz Force Accelerator (AF-LFA)

Working to advance the technology readiness level of the AF-LFA, a new form of plasma propulsion for spacecraft, by addressing questions of plasma reattachment to spacecraft and the thrust generating mechanism provided by the magnetic nozzle. My work has included the following tasks:

- Invention and testing of two new diagnostics, both of which outperform the previous state-of-the-art
  - Dynamic resistance probe: measures plume divergence and mass flux
  - Applied-field component thrust stand: specifically measures a single component of thrust, which is crucial for thrust model verification
- Design and fabrication of improved 30 kilowatt AF-LFA
- Theoretical and computational modeling of thrust generation mechanisms
- Compliance with safety procedures for dealing with lithium propellant (very reactive) in all phases of matter, including use of supplied-air breathing apparatus, bunny suits, fire-resistant clothing, and hydrogen detectors
- Maintenance of 2×5 m vacuum vessel and pumps, including complete pump rebuild, as well as design and construction of windows and feedthroughs
- All electrical work and plumbing for diagnostics and power supplies
- Supervision of all undergraduates (1–2 per year) working on the AF-LFA and collaboration with graduate team members

Owner at Coogan Carpentry, LLC, Bloomington, IN — 2011–2013
Contractor and Carpenter

Client-focused company willing to go above and beyond to meet the needs of homeowners. I administered all aspects of the business:

- Managed advertising
- Consulted with clients regarding their need or vision
- Drafted plans in compliance with building codes
- Produced bids, including quotation for materials and labor, which reflected the actual final cost to the client
- Constructed final product

Undergraduate Researcher at Indiana University, Bloomington, IN — 2012–2013
High Energy Physics

Researcher as part of the ATLAS experiment. My research team was particularly interested in Higgs boson events resulting from W + n-jet and vector boson fusion processes. My work included:

- Comparing different Monte Carlo methods simulating Higgs-generating processes
- Coding in a variety of languages, including Python, C++, C, and Root
- Collaboration with a large team of researchers both at Indiana University and abroad at CERN and the University of Manchester

Logistics Agent at Expeditors International of Washington, Inc., Bensenville, IL — 2008–2009
Freight Forwarding

Worked as a logistics agent for one of the most demanding clients served by the company (John Deere). My responsibilities included:

- Coordinating continuously with a team of ten employees at Expeditors
- Tracking and tracing containers internationally as they traveled by truck, train, and ship. This was accomplished via direct contact with carriers by phone or email, or by traveling to their offices if they failed to respond in a timely manner
- Ensuring all customs forms and packing declarations were appropriately prepared
- Following the appropriate procedures for any hazardous goods

Teaching Experience

As a teaching assistant, I have strengthened my own understanding of fundamental concepts and learned how to explain these concepts in terms understandable to a novice. My responsibilities have included writing and giving lectures, leading practice sessions, grading, and writing problem sets. I have assisted in instruction for the following classes:

- Engineering Design (2×)
- Thermodynamics (2×)
- Engineering Dynamics
- Mechanics of Fluids
- Space Systems Design
- Music Theory

Software Proficiencies

MATLAB, Mathematica, LabVIEW, Creo (CAD), POV-Ray (similar to C), Python, LaTeX, MS Office, Adobe Suite

Languages

English (fluent), Spanish (6 years), French (3 years), Russian (1 year)

Honors, Awards, and Affiliations

2016–Present	American Institute for Aeronautics and Astronautics Student Member
2016	2nd Place, Princeton Mechanical and Aerospace Engineering Research Day
2015–Present	Program in Plasma Science and Technology Fellowship through Princeton Plasma Physics Laboratory
2013–Present	Electric Rocket Propulsion Society Member

Publications

Coogan, W. J. and Choueri, E. Y., "Applied-Field Topology Effects on the Thrust of an MPDT," In 35th International Electric Propulsion Conference, Atlanta, GA, 8–12 Oct., 2017. IEPC-2017-182.

Coogan, W. J. and Taunay, P.-Y. C. R., "Heavy-Cargo Mars Mission Using Near-Term Technology," In 35th International Electric Propulsion Conference, Atlanta, GA, 8–12 Oct., 2017. IEPC-2017-598.

Coogan, W. J. and Choueri, E. Y., "A Critical Review of Thrust Models for Applied-Field Magnetoplasmadynamic Thrusters," In 53rd AIAA Joint Propulsion Conference, Atlanta, GA, 10–12 July, 2017. AIAA-2017-4723.

Coogan, W. J., Hepler, M. A., and Choueri, E. Y., "A Method for Measuring the Applied-Field Thrust Component of Plasma Thrusters," *Journal of Propulsion and Power*, accepted for publication.

Coogan, W. J., Hepler, M. A., and Choueri, E. Y., "Direct Measurement of the Applied-Field Component of the Thrust of a Lithium Lorentz Force Accelerator," In 52nd AIAA Joint Propulsion Conference, Salt Lake City, UT, 25–27 July, 2016. AIAA-2016-4537.

Hepler, M. A., Coogan, W. J., Ilardi, B. L., and Choueri, E. Y., "Liquid-Metal Mass-Flow Measurement by an Inductive Proximity Detector for Use in Conjunction with a $\mathbf{J} \times \mathbf{B}$ Pump," In 52nd AIAA Joint Propulsion Conference, Salt Lake City, UT, 25–27 July, 2016. AIAA-2016-4536.

Coogan, W. J., Hepler, M. A., and Choueri, E. Y., "Dynamic Resistance Probe for the Measurement of the Mass Deposition Rate from a Condensible Propellant Thruster," In 34th International Electric Propulsion Conference, Hyogo-Kobe, Japan, 4–10 July, 2015. IEPC-2015-199.