Elderson Mercado Rivera, EIT

Email: elderson.mercado1@upr.edu | ePortfolio: https://eldersonmercado1.wixsite.com/resumeelderson1

EXECUTIVE SUMMARY

Seeking opportunities in industry to acquire valuable experience and contribute my skills and expertise within the field of mechanical engineering.

EDUCATION

University of Puerto Rico – Mayagüez, Puerto Rico Graduation Date: **June 2024**
Bachelor of Science in Mechanical Engineering; Minor in Project Management General GPA: **4.00/4.00** Major GPA: **4.00/4.00**

Honors: Summa Cum Laude (Highest Honor); Luis Stefani Raffucci Grand Award; Faculty of Engineering Award; Esteban Terrats Award (awarded to the best student(s) of the Mechanical Engineering Department); Medal of Excellence Eng. Juan Bautista Rodríguez (conferred by the Society of Engineers of Puerto Rico (SIPR) to the graduated student(s) with the highest GPA from the School of Engineering)

PROFESSIONAL & RESEARCH EXPERIENCE

Medtronic Villalba, P.R. Operation Company – *Capstone Intern* **Aug '23 – Dec '23**

- **Developed** and **executed** an experimental design (DOE) model to investigate critical response variables influencing the drying process of a silicone rubber adhesive (MED-1137) used in the assembly of various Medtronic's implanted medical devices.
- **Implemented** a robust statistical methodology (Full Factorial Design) using Minitab to evaluate the impact of various factors—such as adhesive thickness, relative humidity, and temperature—on curing times and mitigate the root causes of production line bottlenecks.
- **Minimized** the average curing time of the silicone rubber adhesive by determining the optimal curing conditions through rigorous mechanical testing (hardness and pull tests) conducted under controlled temperature and humidity parameters.
- **Optimized** overall production line performance by streamlining process capacity, enhancing workflow, and improving time management, leading to increased operational efficiency within the manufacturing process.

Boeing Satellite Systems Summer Internship – *Mechanisms Engineering Intern at El Segundo, CA* **May '23 – Aug '23**

- **Supported** the development of mechanism assemblies and component designs using 3-D Computer Aided Design tools and GD&T standards.
- **Created** a MATLAB script from the ground up to process torque test data from the satellite gimbal units produced by the Direct Drive Team, the division I worked in during my internship. The script analyzed sinusoidal behavior and minimized spectral leakage from the obtained test data by incorporating the Fast Fourier Transform (FFT) function.
- **Elaborated** and **refined** a preliminary redesign plan for the tooling system used in spring preload tests of satellite gimbal units to ensure optimal spring tension and performance, thereby enhancing the stability and precision of the gimbal mechanisms under operational conditions.
- **Analyzed** and **processed** data from previous performance tests to minimize computational variance and discover critical tendencies that will improve the Mechanisms Engineering team's understanding of the actuators under testing.

Thermal Cycling Rig Design for High Heat-Flux Environment in Ox-rich Turbopump **[M.I.T. Summer Research Program (MSRP) 2022]** – *Research Assistant at the Cordero Lab* **June '22 – Dec '22**

- In collaboration with Dr. Zachary Cordero and Dr. Isha Gupta, I **designed** and **constructed** a mechanical thermal cycling rig system used as the experimental setup to replicate the extreme temperature gradients within oxygen-rich turbopumps, as part of a broader investigation into particle impact in reusable rocket engines.
- **Characterized** the delamination and crack propagation behavior in ignition-resistant, metal-glass-ceramic composite environmental barrier coatings (EBC) through detailed image processing of microstructures using Fiji's ImageJ software, yielding critical insights into the coatings' structural integrity and durability under varying thermal conditions.
- **Prepared** multiple EBC-coated IN718 samples for thermal cycling experiments and scanning electron microscopy (SEM) analysis, ensuring precise evaluation of material performance in extreme environments.
- **Developed** and **implemented** a preferential etching method to advance the understanding of the percolating nature of the EBC's metallic phases, thereby contributing to a deeper comprehension of material responses under extreme heat-flux environments.

NASA Rotorcraft Aeromechanics Spring Internship – *Aeromechanics Intern at NASA Ames Research Center* **Jan '22 – May '22**

- **Supported** the development of vertical flight vehicles to provide unlimited mobility in 3 dimensions for terrestrial and planetary science applications.
- **Designed** and **optimized** ultra-thin, low-Reynolds-number, compressible airfoils to enhance the aerodynamic efficiency of high-performance rotor blades for the Rotor Optimization for the Advancement of Mars eXploration (ROAMX) and Mars Science Helicopter (MSH) projects, improving forward flight performance in Martian atmospheric conditions.
- **Contributed** to the manufacturing and assembly of the inlet, test, diffuser, transition, and drive sections of the RAPTOR wind tunnel, a facility designed to test large rotors for next-generation Mars rotorcraft and evaluate their aerodynamic performance in a simulated Martian atmosphere.
- **Examined** and **compared** multiple additive and subtractive manufacturing methods, including metal 3D printing, Computerized Numerical Control (CNC) machining, Carbon-Fiber-Reinforced Polymer (CFRP) manufacturing, wire Electrical Discharge Machining (EDM), and Metal Injection Molding (MIM), to determine the most feasible approach for fabricating novel, thin airfoils.
- **Assessed** the mechanical properties and suitability of materials such as Aluminum 6061-T6, Zamak 3, and stainless steel for model fabrication, considering factors like weldability, corrosion resistance, vibration damping, and cost, to recommend the optimal material for manufacturing through MIM.

Remaining Useful Life (RUL) Prediction of Turbofan Engines Through Machine Learning **[Stanford University REU (SURF 2021)] –** *Assistant Researcher of the Zheng Research Group* **June '21 – Aug '21**

- As a participant of the Summer Undergraduate Research Fellowship (SURF) at Stanford School of Engineering under the mentorship of Dr. Xiaolin Zheng and Dr. Juyoung Leem, I **integrated** machine learning (ML) classification models into a Python-based binary prediction system to identify critical indicators of engine degradation and, subsequently, flag turbofan engines likely to fail within 25 operating cycles.
- **Gathered** and **analyzed** raw data from NASA Ames Prognostics Data Repository, ensuring the acquisition of comprehensive datasets that encompassed the degradation history of multiple families of simulation-generated turbofan engines.
- **Analyzed** training datasets from 21 sensors, capturing key properties such as temperature, pressure, and fan speed, to identify critical data trends and features that significantly improve the accuracy of remaining useful life (RUL) predictions for turbofan engines.
- **Conducted** extensive data preprocessing, which involved cleaning, normalization, and transformation of the data to ensure its quality and compatibility with machine learning algorithms.

Low Melting Point Metallic Suspension Nano-composite PCM as a Thermal Management Solution for More Electric Systems (sponsored by NASA Marshall Space Flight Center) **[University of Puerto Rico: Mayagüez Campus]** – *Assistant Researcher* **Aug '20 – May '23**

- Mentored by Dr. Pedro Quintero, I **conducted** an extensive literature search and **created** a detailed matrix of nano-fillers and organic composites, dissecting critical thermal properties for the development of a thermal management model.
- **Collaborated** with the research team to **identify** and **synthesize** optimal nano-filler combinations, pairing organic materials such as sorbitol, erythritol, and paraffin wax with inorganic fillers like silver and graphite, leading to the development of potential phase-change materials (PCMs) for integration into comprehensive thermal management systems.
- **Developed** a robust experimental framework for the synthesis and characterization of nano-fillers and composites, including the meticulous selection of materials, equipment, and methodologies, while also determining optimal fabrication methods, proportions, and concentrations.
- **Engaged** in interdisciplinary collaborative efforts with fellow researchers and engineers at NASA's Marshall Space Flight Center to seamlessly incorporate the newly developed thermal management solution into advanced electric systems, guaranteeing both compatibility and optimal functionality.
- **Initiated** the development of a STAR-CCM+ computational model to analyze capillary action in various geometries of hydrophilic and hydrophobic microchannels within heat pipes, aiming to optimize fluid transport mechanisms for more efficient heat dissipation in high-performance electronic systems.

Identifying the best two-dimensional channel material for the reinstatement of complexity scaling in floating gate FETs **[Penn State University REU] –** *Assistant Researcher at the Materials Research Institute* **June '20 – Aug '20**

- Participated in the 2020 Scalable Nanomanufacturing of Complex Materials REU at Penn State University, assisting Dr. Saptarshi Das in **identifying** alternative 2D materials without dangling bonds to address the scaling challenges of floating gate field-effect transistors (FG-FETs).
- **Evaluated** the potential of 2D materials such as graphene, WSe_2, and MoS_2 as channel materials in FG-FETs by analyzing their mechanical properties, compatibility with the $Al_2O_3/HfO_2/Al_2O_3$ (AHA) gate stack structure, and alignment of conduction band offsets (CBO) and valence band offsets (VBO) at the Al_2O_3 interface.
- **Calculated** the energy band gap between Al_2O_3 and each 2D material to determine the optimal channel material for FG-FETs by computing CBO and VBO values, while considering direct and Fowler-Nordheim (F-N) tunneling coefficients.
- **Collected** and **analyzed** empirical data using specialized software tools, providing valuable insights into the performance and characteristics of alternative 2D materials for use in FG-FETs.

Diffusion Soldering and Phase Change Materials for Advanced Packaging of Power Switching Technologies (sponsored by the Army Research Office) **[University of Puerto Rico: Mayagüez Campus]** –*Volunteer Researcher* **Aug '19 –May '20**

- **Analyzed** and **compared**, under the mentorship of Dr. Pedro Quintero, efficient phase change materials (PCM) capable of properly cooling electronic devices through thermal analyses and conductivity parameters.
- **Explored** the adaptability of newly developed PCMs to various electronic devices and substrates commonly employed in power switching technologies, verifying their alignment with the project's precise specifications.
- **Worked** in tandem with the research group to **enhance** the experimental configuration for thermal analyses, encompassing equipment refinement, calibration, and the establishment of consistent experiment repeatability.
- **Conducted** market research to discern commercially accessible phase change materials (PCMs) and **performed** comparative analyses against the materials investigated within the research, yielding valuable insights into potential practical utility for the developed PCMs.

EXTRACURRICULAR ACTIVITIES

UPRM Research Fair – *Logistics Team Member* **Aug '21 – May '24**

- **Contacted** professors and research groups from my campus to present their research work at the event and **coordinated** their schedules as a member of the logistics team.
- **Hosted** multiple research presentations while actively **encouraging** undergraduate students in attendance to get involved in research.

NASA's 2022 Aero Fair– *Volunteer* **April '22**

- During a week, I **helped** Christina Lim (NASA Ames Research Center's outreach leader) present lessons on the basics of aerodynamics, NASA's history, and future career opportunities to eighth graders from Marina Middle School in San Francisco, CA.
- Likewise, I **coordinated** group activities where students had the opportunity to engage and apply the fundamentals of physics and aerodynamics concepts taught in these lectures through the creation of planes and small replicas of the Ingenuity Mars Helicopter.

Transformative Vertical Flight 2022: 9th Annual Electric VTOL Symposium – *Volunteer and Attendant* **Jan '22**

- **Assisted** the TVF's organizers in registering and welcoming speakers and conference attendees throughout the duration of the Transformative Vertical Flight 2022 conference held at San Jose, CA (Jan. 25-27).

SAE UPRM Collegiate's Chapter RUM-Air Team – *Advanced Class Team Member* **May '19 – June '20**

- **Designed**, **fabricated**, and **tested** multiple prototypes of a lightweight, autonomous Colonist Delivery Aircraft (CDA) engineered for ejection from RUM-Air's Advanced Class main remote-controlled plane (El Padron) during the 2020 SAE Aero Design West Competition.
- **Enhanced** the structural stability and aerodynamic performance of the CDA through comprehensive XFRL analysis and advanced simulations using Siemens NX-12.
- **Volunteered** in STEM outreach initiatives, teaching fundamentals of physics and acoustics to kindergarten students from the *Academia de la Inmaculada Concepción* in Mayagüez, PR by crafting hand-made musical instruments from recyclable materials.
- As a key member of RUM-Air's Project Management and Business Department, I **coordinated** and **participated** in numerous fundraising activities to finance travel, membership, and manufacturing expenses, while also **liaising** with sponsors, **managing** inventory, and **supporting** administrative tasks.

NASA RASC-AL UPRM Team – *Team Member and Researcher* **Sep '18 – June '19**

- **Contributed** actively to the overall design and development of a gateway-based lunar vehicle for the 2019 NASA RASC-AL Contest, focusing on innovative solutions for lunar exploration.
- **Improved** the structural design and material composition of the landing system of the Karaya Transport Vehicle's (KTV), a key component of the Lunar Exploration and Access to Polar Regions (LEAPR) project meant to perform crewed missions across various lunar surface locations.
- **Designed** an extendable, telescope-shaped robotic arm as an add-on to the lunar lander proposed in the LEAPR project to transport injured crew members and cargo.

American Institute of Aeronautics and Astronautics (AIAA) *– Member* **May '24 – Present**

Vertical Flight Society (Philadelphia Chapter) – *Member* **Jan '22 – Dec '23**

National Society of Leadership and Success (NSLS) *– Member* **Sep '20 – May '24**

National Society of Collegiate Scholars (NSCS) – *Member* **July '19 – May '24**

American Society for Engineering Education (ASEE)-UPRM Chapter – *Member* **Aug '18 – May '24**

- **Offered** mentorship to high schoolers to help them improve their performance on their college admission tests.
- **Volunteered** as a Mechanical Engineering assistant at the third and fourth edition of *Engineering Fun Day*, an activity created by the ASEE-UPRM Chapter in where middle school and high school students from unrepresented communities can interact and learn more about the different engineering fields through conferences and STEM-based group challenges.

Come Colegial Program – *Volunteer* **Aug '18 – May '24**

- **Contributed** dynamically to the recollection and distribution of free food for undergraduates in financial need at campus.

Society of Hispanic Professional Engineers, SHPE UPRM – *Member* **Aug '18 – May '24**

- **Volunteered** as a timekeeper and staff member of the 2019 Puerto Rico Regional Science Bowl held at the University of Puerto Rico at Mayagüez.

American Society of Mechanical Engineers, ASME UPRM - *Member* **Aug '18 – May '19**

Happy Backpack Program of the Food Bank of Puerto Rico *– Volunteer* **Aug '17 – May '18**

- **Teamed up** with the Food Bank of Puerto Rico to prepare and provide backpacks full of food and necessities for low-income children.

M.I.T. LaunchX Club - *President* **Aug '17 – May '18**

- **Directed** an entrepreneurial project to create a self-rechargeable, solar-powered electric generator designed to provide electricity in underserved communities across Puerto Rico during natural disasters.

Drawing the Difference Initiative - *Founder and teacher* **June '16**

- **Provided** non-profit art classes for Down Syndrome and disabled adults as a physical and intellectual therapy that could help them ameliorate their motor skills, creativity, and self-expression.

CONFERENCE ATTENDANCE / PRESENTATIONS

AAAS S-STEM Symposium at Washington D.C. - *Invited scholar* **Sep 29th '22 – Oct 1st '22**

Great Minds in STEM (GMiS) Conference at Pasadena, CA - *Invited scholar* **Oct 6th '22 – Oct 8th '22**

E-PEARLS and IEEE Poster Session at University of Puerto Rico at Mayagüez - *Poster presenter and invited scholar* **March 31st '23**

- Poster title: *Remaining Useful Life (RUL) Prediction of Turbofan Engines Through Machine Learning*

AAAS S-STEM Scholars Meeting at Washington D.C. - *Poster presenter and invited scholar* **Sep 14th '23 – Sep 16th '23**

- Poster title: *Thermal Cycling Rig Design for High Heat-Flux Environment in Ox-rich Turbopump*

SACNAS National Diversity in STEM (NDiSTEM) Conference at Portland, Oregon - *Poster presenter* **Oct 26th '23 – Oct 28th '23**

- Poster title: *Thermal Cycling Rig Design for High Heat-Flux Environment in Ox-rich Turbopump*

AWARDS / HONORS

- NASA Group Achievement Award – Recognized for outstanding contributions to planetary flight research at NASA ARC **[2025]**
- Undergraduate Poster Presentation winner in the Engineering category at SACNAS NDiSTEM Conference **[2023]** (Click here.)
- Dominion Energy's Hispanic Higher Education Initiative Scholarship Fund Recipient **[2023]**
- HACE's Dr. Ervin "Vinny" Caraballo Scholarship Recipient **[2023]**
- Boston Scientific Scholarship Recipient **[2022]**
- Great Minds in STEM (GMiS) Scholarship [sponsored by Northrop Grumman] Recipient **[2022]** (Click here.)
- Andrés Calderón Scholarship Recipient **[2022]**
- The Boeing Company Scholarship ("Boeing Excellence Award") Recipient **[2021, 2023]**
- Hispanic Scholarship Fund (HSF) Scholar **[2021-2024]**
- Evertec Scholarship Recipient **[2021-2024]**
- First Place in the Advanced Class category at the SAE Aero Design West Competition **[2020]**
- Lockheed Martin Scholarship Recipient **[2019]**
- First Place Overall (Undergraduate), Best in Theme Award, and PEACH Award at the NASA RASC-AL Competition **[2019]**
- Scholar of the Engineering Program for Engineering Access, Retention, and LIATS Success (E-PEARLS) sponsored by the National Science Foundation (NSF) Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Program **[2018-2024]**
- Dean's List and Honor Roll of the Mechanical Engineering Department **[2018-2024]**
- Recipient of the National Altrusa International Scholarship **[2018]**
- Banco Popular's Rafael Carrión, Jr. Academic Excellence Award **[2018]**
- Recipient of the Medal of the Governor of Puerto Rico **[2018]**
- ASTRA Scholarship Recipient (sponsored by Altrusa International, Inc.) **[2018]**

SKILLS / IMPORTANT COURSES

- Notable approved courses: Fluid Mechanics, Heat Transfer, Materials Science, Design of Machine Elements, Thermodynamics (I & II), Algorithms and Computer Programming, Systems Dynamics Control, Thermal Science Laboratory, Mechatronics Laboratory
- Fluent in English and Spanish
- Lean Six Sigma Yellow Belt
- Google Project Management Certification
- Engineer In Training (EIT) Certification
- Technical Skills: Microsoft [Excel, Word, PowerPoint, MS Project] (Advanced), SolidWorks (Advanced), Siemens NX 12 / NASTRAN (Advanced), Python (Proficient), MATLAB (Proficient), CATIA (Proficient), Fusion 360 (Proficient), 3D printing (Proficient), ProjectLibre (Proficient), AutoCAD (Proficient), Rhapsody (Proficient), Jama (Proficient), Creo Pro/E (Basic), Arduino IDE (Basic), STAR-CCM+ (Basic), Programmable Logic Controller [PLC] (Basic), Particle Image Velocimetry [PIV] (Basic), Computational Fluid Dynamics [CFD] (Basic)
- Leadership, teamwork, ability to multitask, excellent communication and interpersonal skills.

PUBLICATIONS

- Ruperto, W., Rullán, A., Zapata García, A., Rodríguez Morales, A., Colon Cesani, A., …, Mercado Rivera, E., … Calcagño, B. (2019). Lunar Exploration and Access to Polar Regions (LEAPR). In AIAA Propulsion and Energy 2019 Forum. AIAA Propulsion and Energy 2019 Forum. American Institute of Aeronautics and Astronautics. https://doi.org/10.2514/6.2019-3882