Mason Bane

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Summary: Computer Science and Engineering student working across embedded firmware, high-performance simulations, and Linux systems. Builds secure STM32-based telemetry, optimizes CUDA/C++ models for research, and maintains reliable HPC lab environments through automation and documentation. Combines hands-on hardware troubleshooting with clear communication to support research and production teams.

Education

Tarleton State University — Stephenville, TX

Bachelor of Science in Computer Science, Concentration in Computer Engineering — *Aug. 2022 – May 2026 (Expected)*

Minor in Mathematics

GPA: 3.94/4.00 (Institutional) — Cumulative: 3.75/4.00

Hill College — Hillsboro, TX

Associate of Arts in Liberal Arts — *Aug. 2019 – Sept. 2023*

Experience

Undergraduate Research Assistant - Lead Programmer — May 2024 – Present

Tarleton State University — *Stephenville, TX*

- Developed and optimized of various N-Body simulations utilizing C/C++, enhancing computational efficiency and accuracy through advanced algorithms and parallel processing with CUDA.
- Collaborated with interdisciplinary teams to create digital twins to model complex problems using OpenGL and Blender, translating scientific concepts into interactive simulations and improving data interpretation.
- Conducted rigorous testing and debugging of simulation software, ensuring robust performance and reliability while documenting processes to facilitate knowledge transfer and future research initiatives.

Undergraduate Technology Specialist - HPC Lab Manager — Aug. 2024 – Present

Tarleton State University — *Stephenville, TX*

- Managed 15+ Linux systems in production-like research environment, ensuring 99%+ uptime through proactive maintenance, hardware diagnostics, and rapid incident response
- Diagnosed and resolved complex hardware/software issues including memory failures, storage degradation, and OS configuration problems, minimizing system downtime and maintaining optimal performance
- Developed and maintained comprehensive documentation for system configurations, troubleshooting procedures, and lab protocols, enabling knowledge sharing and process standardization

Undergraduate Lab Instructor, Texas Government — January 2023 – December 2023

Tarleton State University — *Stephenville, TX*

- Guided and supported students in policy research and analysis, facilitating the exploration of bills and regulations to enhance critical thinking and analytical skills.
- Conducted regular meetings and collaborated with the lecture professor and fellow lab leaders to align objectives and improve instructional methodologies, ensuring a cohesive educational experience.

Projects

N-body Digital Twin of the Left Atrium | *NIH Grant #1R15HL179671-01* | *C, CUDA* — Aug. 2024 – Present

- Engineered a parallel N-body model of the left atrium using CUDA, with a 20,000+ node mesh to simulate atrial arrhythmias in near real-time.
- Developed an intuitive C++/ImGui interface to control simulation parameters and visualize outputs, bridging the gap between complex computational models and end-user (research/clinical) requirements.
- Presented findings at academic conferences, demonstrating the tool's potential to improve clinical decision-making and transform training for medical professionals.

Secure IoT Sensor Node with Hardware TrustZone | *C, STM32CubeIDE/HAL, I2C/SPI* — Dec. 2025 – Present

- Implementing a secure data pipeline on an STM32H5 MCU, utilizing Arm TrustZone and the Secure Manager to create a hardware-rooted chain of trust for environmental sensor data.
- Developing drivers and application logic to interface with a Bosch BME280 temperature, humidity, and pressure sensor via I2C communication protocol.

- Structuring firmware to cryptographically sign sensor readings within the secure processing environment for tamper-evident logging.
- Utilizing STM32CubeIDE and the HAL for peripheral configuration and hardware security module (HSM) management as a foundation for secure telemetry systems.

N-Body Simulation of Microplastic Coagulation | *C/C++, CUDA, Linux, OpenGL* May 2024 – Aug. 2024

- Contributed to the development and optimization a CUDA-based N-body simulation of micro-plastic removal from water using plant polymers – leveraging NVIDIA's CUDA technology for parallel processing and OpenGL for real-time 3D visualization, enhancing computational efficiency and user experience.
- Crafted a user-friendly interface for toggling simulation features, providing enhanced visual cues and aiding in the understanding of complex phenomena.
- Collaborated with a multidisciplinary team to define requirements, design features, and refine the simulation tool, ensuring alignment with project goals and user needs.

Analog Pink Noise Generator Circuit | *LTSpice, Python, MATLAB, Breadboarding* Aug. 2025 – Dec. 2025

- Designed and prototyped a BJT-based pink noise generator with active filter stage using LTSpice for simulation and breadboarding for physical implementation.
- Developed Python scripts to quantitatively compare simulation results with an ideal pink noise spectrum, guiding component selection and filter tuning for improved accuracy.
- Built a physical demonstration circuit with audio output, successfully verifying simulation models against real-world performance.
- Collaborated in a two-person team to present comprehensive design methodology, results, and data-driven decision process to peers and professors.

In Progress

STM32H5 Secure IoT Environmental Sensor Node | *STM32, C/C++, Security, IoT* 2026

- Developing a secure embedded sensor node using STM32H573I-DK, leveraging TrustZone and cryptographic accelerators for hardware-rooted telemetry.
- Implements secure boot, HSM, and trusted execution for authenticated environmental data logging.

DARPA Lift Challenge Drone | *Autonomous Systems, Robotics, Control* 2026

- Designing autonomous drone system for DARPA Lift Challenge, focusing on aerial load-lifting, control algorithms, and navigation.

Publications

- **Studying Left Atrial Arrhythmias Using a Real-Time Interactive Digital Twin**
  Journal: Heart Rhythm O2 6(9):S2, Sept 2025
  Authors: Bryant Wyatt, Gavin McIntosh, Avery Campbell, Milanie Little, Brandon Wyatt, Mason Bane, Leah Rogers, Kyla Moore, Conner Homrighaus, Charles Puelz
  Presents a real-time digital twin of the human left atrium for clinical simulation and education.
  Read Paper

- **"Offloading" Undergraduate Research to the Graphics Processing Unit for Acceleration**
  Conference: EduHPC-25 Workshop, Supercomputing Conference, Nov 2025
  Authors: Bryant Wyatt, Mason Bane
  Demonstrates GPU parallel processing for accelerating scientific computing in undergraduate research.
  Read Paper

Awards & Recognition

- **President's List** (All Semesters, 2022–2026), except Fall 2025 & Spring 2024: **Dean's List**
- **1st Place Poster** — SIAM Texas/Louisiana Chapter 2024
- **1st Place Undergraduate Poster** — Tarleton REID Conference 2025
- **1st Place Graduate Poster** — Tarleton REID Conference 2025
- **Accepted Poster** — NVIDIA GTC 2026

Professional Memberships

- SIAM (Society for Industrial and Applied Mathematics)
- SAMPE (Society for the Advancement of Material and Process Engineering)
- IEEE (Institute of Electrical and Electronics Engineers)
- AIAA (American Institute of Aeronautics and Astronautics)
- Tarleton Computer Society

Technical Skills

Microcontroller Platforms: STM32 (H5/Cortex-M33), TIVA-C (TM4C), Arduino, Raspberry Pi, ARM Cortex-M
Firmware & Languages: C, C++, ARM Assembly, Python, Java, Bash, TML/CSS/JavaScript, I^2C, SPI, UART
Hardware Tools: STM32CubeIDE, LTSpice, PCB Prototyping, Oscilloscope, Multimeter, GDB
Development & Systems: Git, Linux, CMake/Make, Visual Studio, VS Code, RTOS Concepts
Research & Simulation: MATLAB, CUDA, OpenGL, Blender, ImGui

References available upon request