



Capstone Design Project Abstract

Project Title: ASTM Upper Body Exoskeleton

Partner/ Client: ASTM International

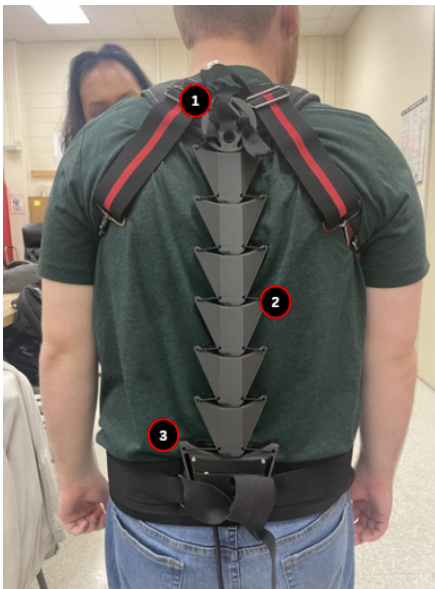
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Project Supervisor: Kevin Wu

Instructor: Dr. Jorge Rodriguez

ASTM International is a leading voice in developing safety standards for exoskeletons and is focused on establishing trust, safety, and performance metrics across diverse applications. The team has been tasked designing and prototyping a functional upper-body exoskeleton following these standards for first responders. Due to the wide, variability within this category, the team chose to focus the exoskeleton on reducing fatigue and assisting firefighters in their routine responsibilities. The objective for this project is to reduce the risk for acute injuries, chronic musculoskeletal disorders, and long-term disabilities. The exoskeleton must address varying environments, user comfort and fit, material durability, and effective load reduction. A primary challenge in this project is minimizing interference between the exoskeleton and the user's natural movement. Additional challenges include ease of manufacturability, ensuring user safety in the event of system failure, and preventing interference with required personal protective equipment (PPE). These challenges led the team to collaborate directly with the Athens Downtown Fire Department to gather feedback from active servicemen and better inform the design process.

Through an iterative design process, the team selected a passive upper-body exoskeleton that prioritizes user adaptability and comfort while maintaining meaningful load reduction. The final design incorporates 3D-printed components and durable materials to balance performance with manufacturability. The project deliverables include detailed CAD models, engineering drawings, and a functional prototype. Testing procedures were developed to evaluate performance and verify that the system fails safely if necessary. The design is guided by ASTM International F48 safety standards to ensure reliability and real-world applicability.



- 1) Top Connection Piece to Harness
- 2) Spinal Support Pieces
- 3) Bottom Connection Piece to Belt
- 4) H Style Harness
- 5) Large Buckle to close Belt
- 6) Leg Loops

