Capstone Design Expo
Fall 2017

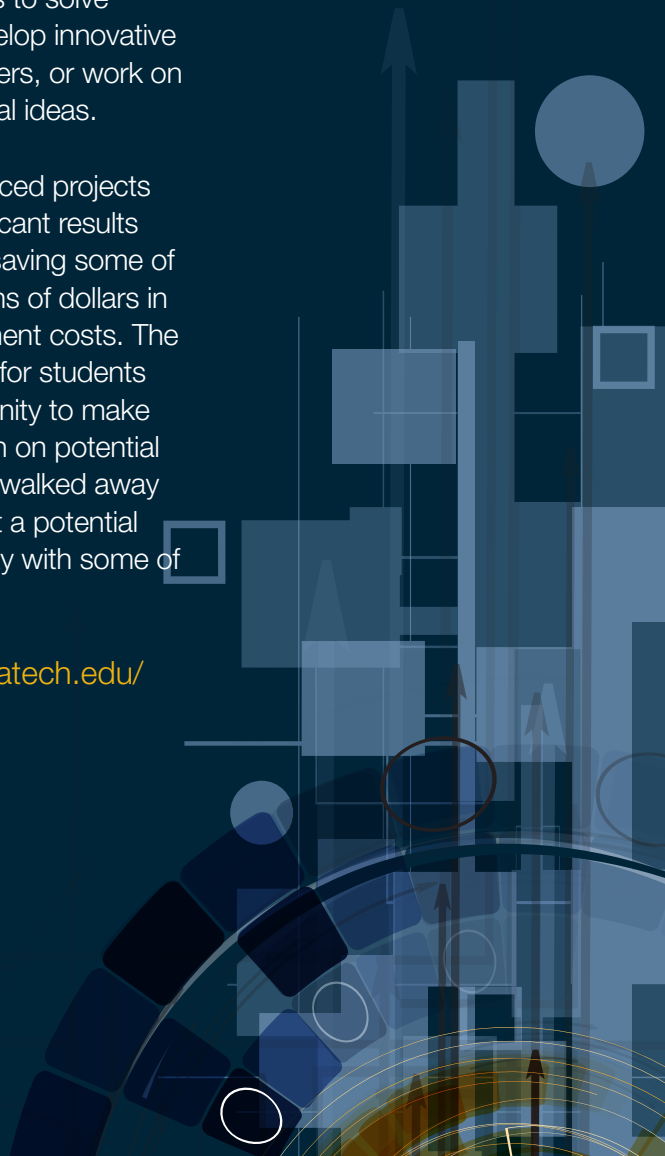
Georgia Tech Mechanical Engineering
The George W. Woodruff School of Mechanical Engineering

Capstone Design Expo

The Capstone Design Expo is one of the largest student design expos in the U.S., showcasing Georgia Tech's graduating seniors as they present innovative projects designed and built during the Capstone Design Course. Students work in teams to solve industry problems, develop innovative tools to assist researchers, or work on their own entrepreneurial ideas.

Past expos have produced projects that have yielded significant results for industry sponsors, saving some of them upwards of millions of dollars in research and development costs. The networking experience for students gives them the opportunity to make a lasting first impression on potential employers; some have walked away with an invitation to visit a potential employment opportunity with some of the sponsors.

http://mecapstone.gatech.edu/



Letter from the School Chair

Dear Capstone Design Expo Judges and Guests:

Georgia Tech opened its doors in 1888 with mechanical engineering being its only degree-granting program during the Institute's first eight years. Mechanical Engineering has grown over the years from the original shop or trade culture to a professional curriculum with experimental laboratories and multi-disciplinary challenges. Today, we are the largest-enrollment academic unit on campus. The Woodruff School has the largest enrollment mechanical engineering program in the US, graduating over 600 bachelor's degrees, 200 master's degrees, and 65+ doctoral degrees each year.

Throughout our history one thing has always remained constant: **excellence in creating and building products, devices, and systems that make the world a better place!**

Over the past eight years, the Woodruff School has embarked on an ambitious journey to make its undergraduate program among the very best in the world. Leveraging both the NAE's *Educating the Engineering of 2020* and *ASME's Vision 2030 Roadmap*, the Woodruff School launched two specific initiatives.

The first initiative focused on a curriculum revision, which maintained the fundamental engineering science pillars upon which the profession is built. This initiative freed up the curriculum by allowing students a significant number of free electives, thereby enabling Georgia Tech students to enroll in any approved Georgia Tech minor. Among the most popular minors are Industrial Design, Computer Science, Business, and Aerospace Engineering. The flexible curriculum enables students a far greater degree of ownership of their educational journey and significantly contributes to the development of the "T-shaped" graduate as espoused in the NAE 2020 report.

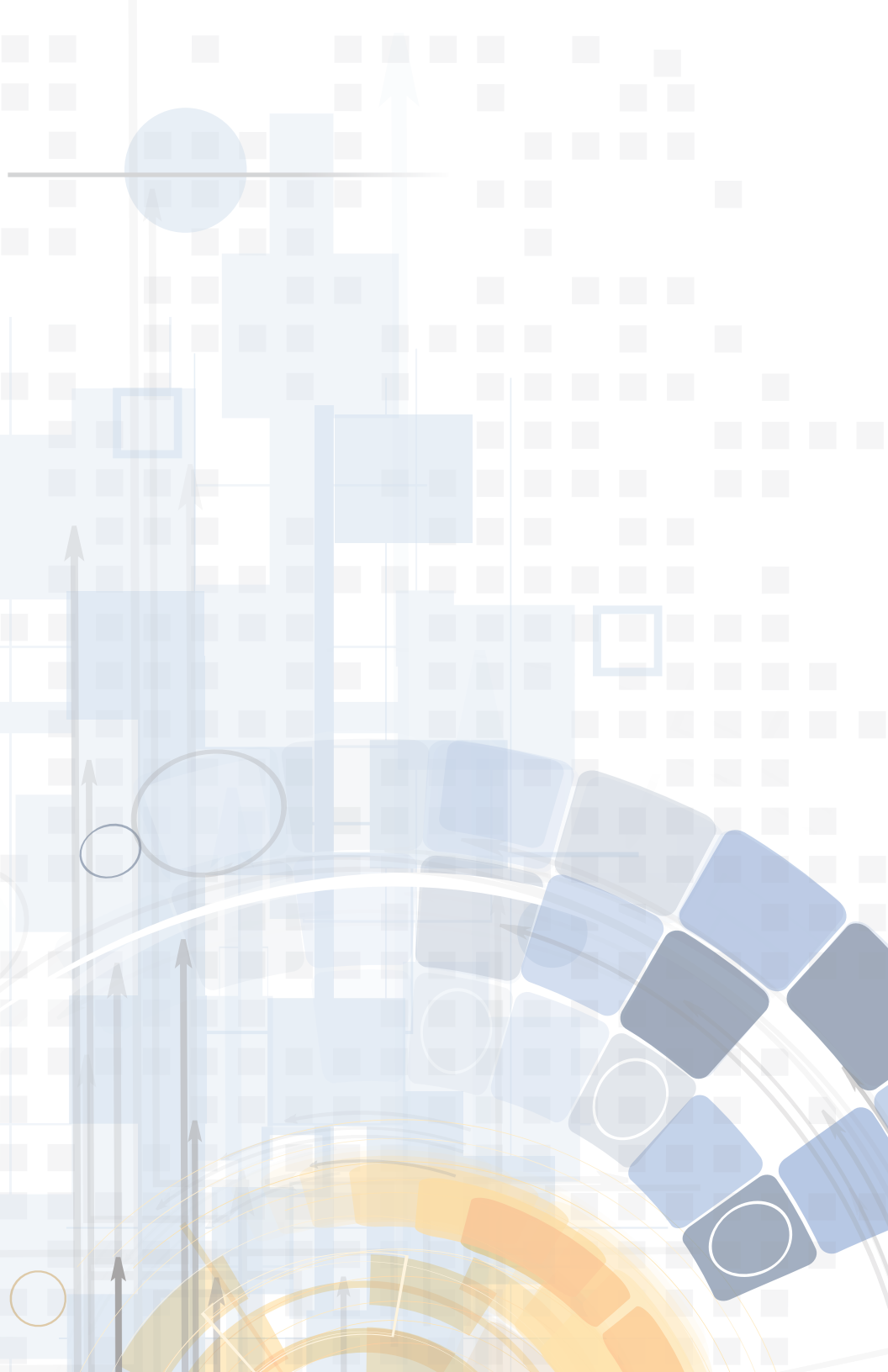
The second initiative was to reintegrate and supercharge the "create-innovate-design-build" stem of the curriculum. In 2007, virtually all of the Capstone Design projects were simulation-driven paper studies. Immediately thereafter the Woodruff School began to encourage proto-typing projects for Capstone Design by providing resources to the nascent Maker Movement, and reallocating space to our student makers and for the Capstone Design course. Over time and with relentless effort, all Woodruff School Capstone students now engage in projects, which require the fabrication of a prototype. The Woodruff School has led the drive for multi-disciplinary Capstone teams, and we can point with pride to strong partnerships with Industrial Design, Biomedical Engineering, and Electrical Engineering. The Capstone Design Expo is now held twice per year and attracts several thousand attendees to Midtown Atlanta to evaluate and celebrate our students' accomplishments.

A critical element of the "create-innovate-design-build" initiative was the steady reallocation of space to expand our Invention Studio, which now occupies ~5000sf of the MRDC building's second floor in five separate rooms. The adjacent MRDC pod houses design studio space for our ME 2110 Creative Decisions & Design course as well as for our Capstone Design students. In March 2016 the Woodruff School dedicated the Montgomery Machining Mall (MMM), a major renovation that created a unified 6717sf professional and student-friendly machining work space through the removal of walls, installation of LED lighting and equipment configurations that greatly enhance work efforts, training and safety. Since the MMM's opening, several other Georgia Tech academic units have signed service-level agreements to allow their students access to this state-of-the-art facility.

Going forward we seek to build on this vision and proven record of accomplishment to advance engineering education and to significantly enhance the quality of our graduates as they enter the workforce. We thank you profoundly for joining us on this journey and helping us to continuously educate mechanical engineering graduates who will have great impact for positive change in our world.

Bill Wepfer

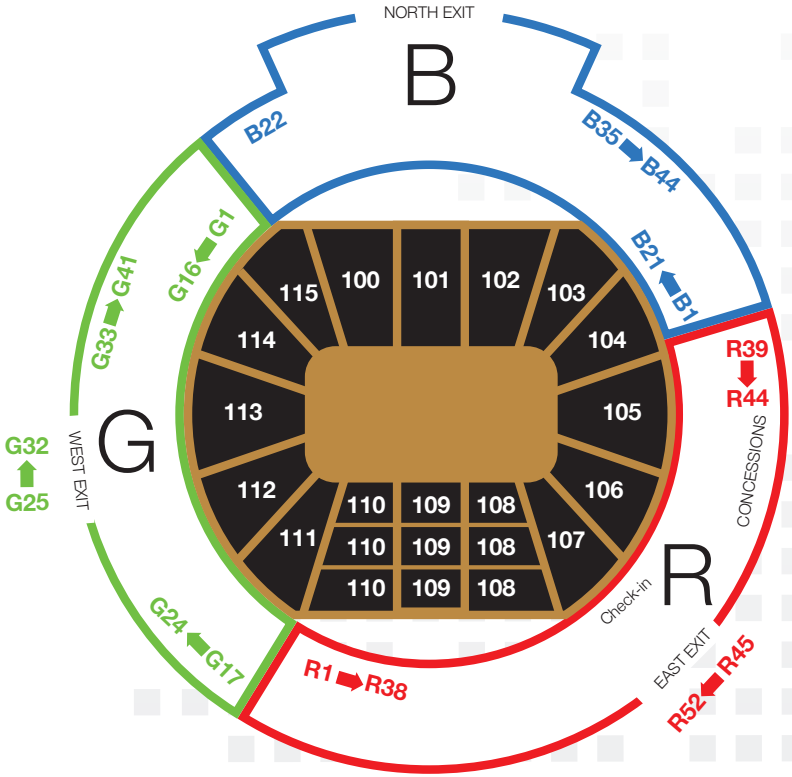
Eugene C. Gwaltney, Jr. Chair of the Woodruff School and Professor



Georgia Tech Mechanical Engineering

The George W. Woodruff School of Mechanical Engineering

Expo Layout Map

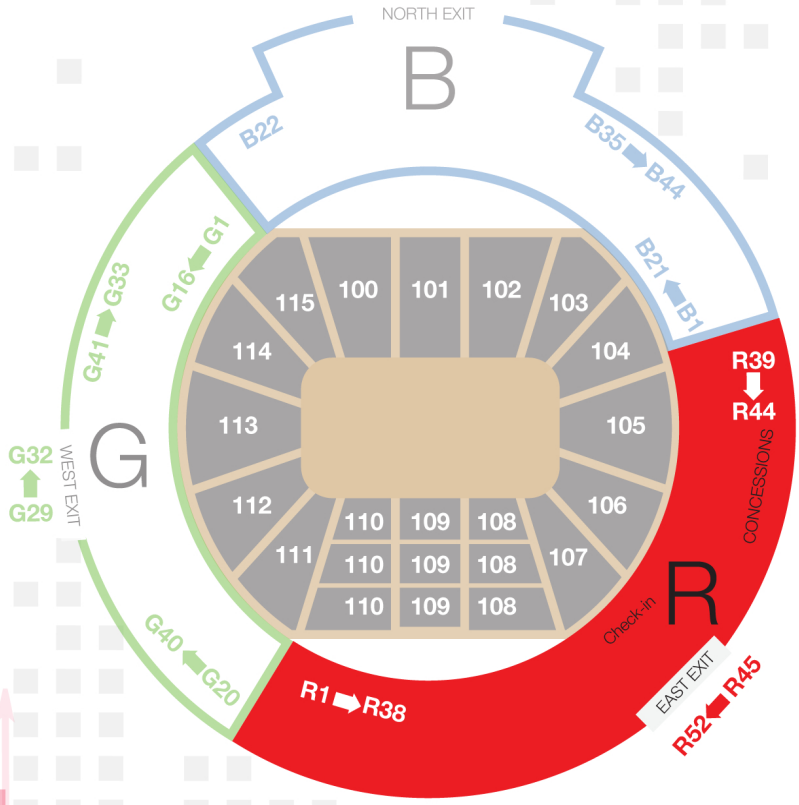


Note for Prospective Sponsors

Capstone Design is a culminating course offered to all graduating seniors from the George W. Woodruff School of Mechanical Engineering. In this class, students work in multidisciplinary teams to design, build, and test prototypes for real world applications. Students apply theoretical background in topics related to design, manufacturing, and business/entrepreneurial topics proposed by experts in industry and academia. Their efforts are showcased at an end-of-semester Capstone Design Expo. More information about the course is available at http://www.mecapstone.gatech.edu/

Past industry sponsors have received innovative solutions to their challenging design problems, resulting in enormous cost savings and increasing profitability. Sponsors receive branding and visibility within the Georgia Tech Invention Studio, on course materials and at the Capstone Design Expo. For more information on how to submit your design project for the class, please contact Dr. Amit S. Jariwala. (amit.jariwala@gatech.edu; 404-894-3931).

List of Projects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EAST EXIT
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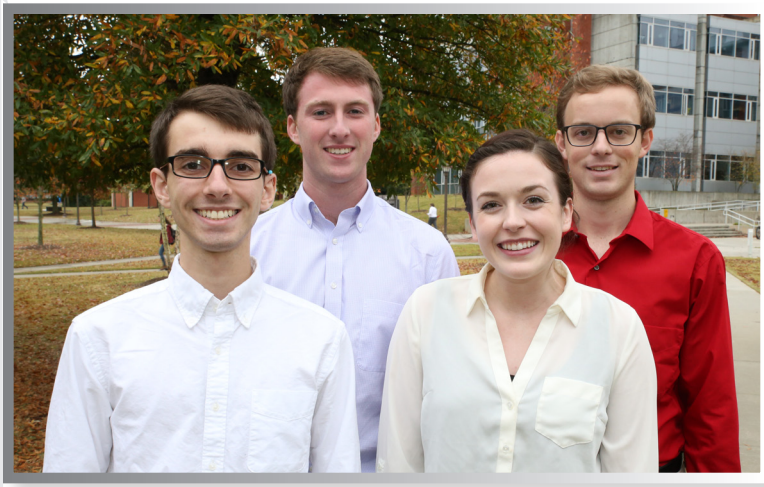
eValved

R01

AUTOMOTIVE

eValved



Advisor

Dr. Peter Hesketh

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Members

Ryan Dutra

Alexander Rizzo

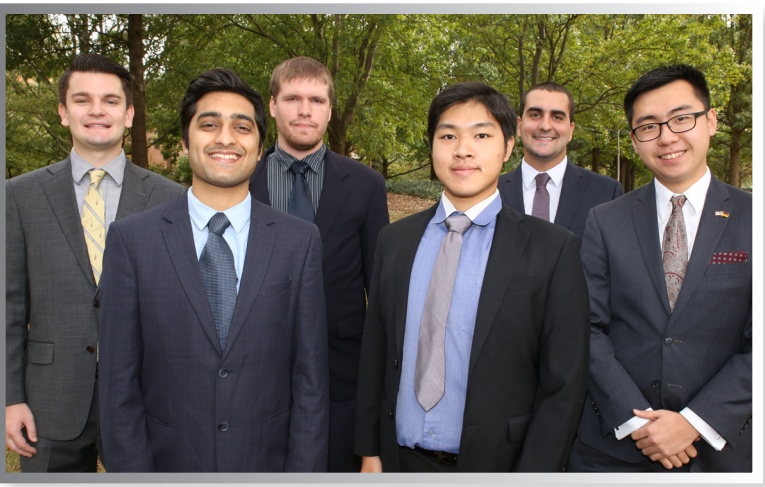
Daniel Crocker

Megan Tappan

Design for a cam-less engine using a worm gear. This will increase the power and efficiency of the engine.

Lost_In_Transmission

eCVT



Sponsor

GT Off-Road

Advisor

Dr. Kenneth Cunefare

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yzhou377@gatech.edu

Members

Nikhil Dhawan
Reed Nikolich
Jeremiah Castleberry
Luis Mayorca
Chun Ho Chan
Yiyang Zhou

Developing an electrically controlled continuous variable transmission (CVT) for small off-road vehicles. The goal is to improve power transmitting efficiency and control precision of the current mechanically-controlled CVT.

Pop in Place

R52

AUTOMOTIVE

Car Conversion Gearbox

Advisor

Dr. Amit Jariwala

Primary Email Contact

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Members

Andrew Smith
William Collings
Gaston Alvarez
Carter Yount
Kirby Carmack
Chase Alford

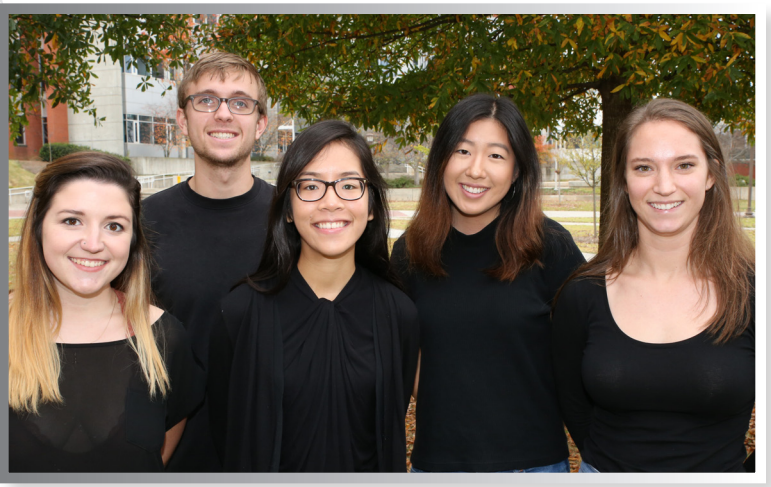
We are designing a gearbox that will be used when converting a gas powered vehicle to electric. It will make the installation faster and more efficient.

R28

BIOENGINEERING

Be Humble

GM Interactive Sensor Based Driver's Seat Design



Sponsor

General Motors

Advisors

Dr. Stephen Sprigle

Dr. Wayne Li

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Members

Golda Nguyen

Isabelle Zhang

Doug Learnard

Annika Strauss

Megan Eberle

Our project involves equipping a car's driver's seat with an array of sensors. Through these sensors, we hope to be able to guide the development of a driver's seat with technology to increase comfort and safety while improving the driving experience.

C-137

Physically Emotive Flying Robot

R40

CONSUMER PRODUCTS

Sponsor

Veronica Spencer

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Members

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Tyler Pinaud
Matthew Rather
Jonny Tan
Manuel Torres
Zachary Crawford

Nearly half of the average child's day is dedicated to touch screen technology use and this can lead to health and developmental issues during their susceptible elementary years. In order to reduce the duration of time spent on digital devices, a robot companion is developed to encourage physical activity and mental development.

R44

CONSUMER PRODUCTS

Celf Defense

Cell-phone Self Defense Mechanism

Advisor

Dr. Amit Jariwala

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Members

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Jordan Karten
Clay Robinette
Jacob Flynn
Sukwon Shin

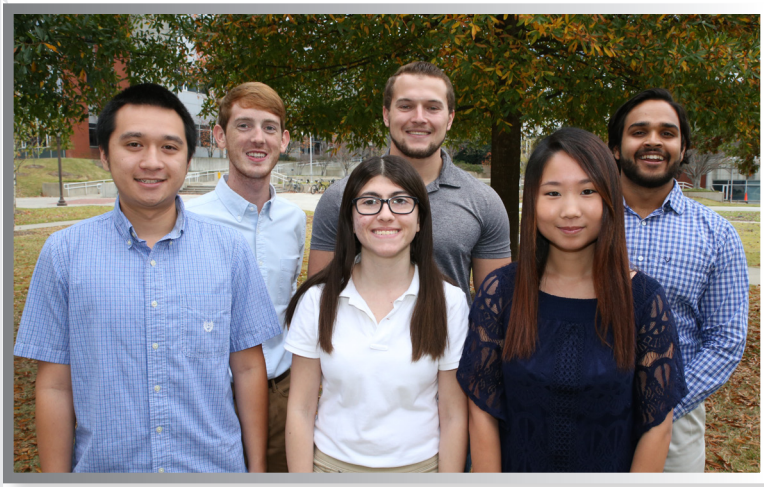
On a dark night, you find to your horror that you have unwanted company and little more than a phone on you; what do you do? With Celf Defense's discrete pepper spray phone case, you can defend yourself with confidence! In 2015, there were an estimated 5 million accounts of violent victimizations, many of which could have been prevented if victims had access to a portable and discrete self-defense tool. Team Celf Defense has created a discrete pepper spray tool integrated into a cell phone case. The device offers peace of mind in a convenient package.

Smart Patch

R19

CONSUMER PRODUCTS

Design of a Flexible, Wearable Fitness Tracker



Sponsor

Advancing Technologies, Inc.

Advisor

Dr. Tequila Harris

Primary Email Contact

danicewang@gatech.edu

Members

Kunal Mehan
Dalton Smith
Theodore Virtue
Britny Farahdel
Anthony Tran
Danice Wang

We are creating a flexible fitness tracker that can be adhered to an individual's body similar to that of a patch. It will be able to count kicks/punches and track their speeds, in addition to monitoring heart rate while displaying these metrics onto a device. It will be small enough to meet the standards to be worn in professional athletic competitions such as in MMA and UFC.

R18

MANUFACTURING

Capt. Stone

3D Printing Fibrous Reinforced Concrete

Sponsor

Dr. Russell Gentry

Advisor

Dr. Kenneth Cunefare

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Members

Wenu Mutanda
Alexander Wong
Helen Cannella
Ashton Farr

An ME and a CEE team are working together in designing a 3D Printing Fibrous Reinforced Concrete System. The ME team is focusing on the delivery system of the fibers and concrete while the CEE team is focused on the cement matrix and testing.

Fearless Six

R06

MANUFACTURING

Surface Scratches/Pitting Measurement ProcedureTracker

Sponsor

United States Air Force

Advisor

Dr. Tequila Harris

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Members

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Logan Brafford
Kirit Joshi
Bradley Long
Lam Vu
Jermaine Medley

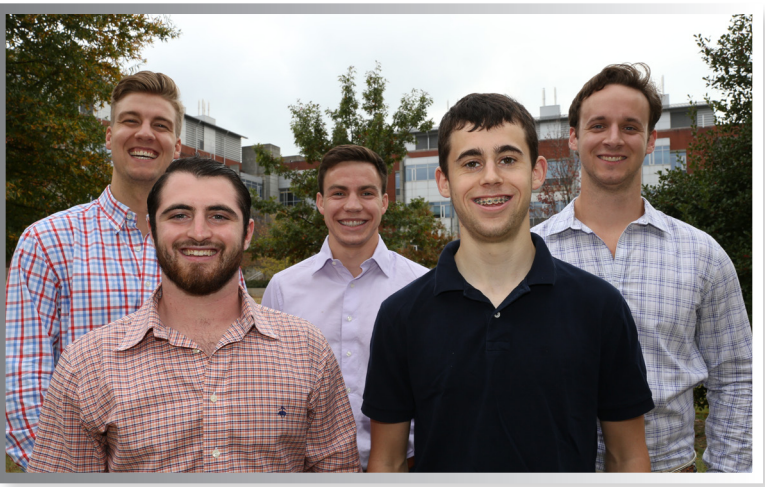
Our team is tasked with creating a mechanism that accurately gauges the depth of surfaces defects on the C-130 military aircraft. As a means of non-destructive inspection, we look to implement mm-Wave technology to improve the inspection process and ultimately mitigate crack propagation on these aircrafts.

R48

MANUFACTURING

Miracle on Techwood

Lockblox



Sponsor

Lockblox

Advisor

Dr. Peter Hesketh

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jsalesky3@gatech.edu

Members

Ben Ibach
Ben Rothschild
Will Byars
Mick Baker,
Jake Salesky

The overall goal of the Lockblox project is to create low-cost, locally producible, easy-to-assemble, and structurally robust building materials for developing nations. To achieve this task, our team has designed and prototyped a mobile machine that will convert rapidly renewable agricultural waste (i.e. straw, corn husks, etc.) into a patented system of mortarless interlocking construction elements that directly compete with traditional cement building blocks.

Porsche 987

Design and Validation of a System to Reduce Inventory for Automotive Dealerships using 3D Printing/A

Sponsor

Porsche Cars North America

Advisor

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Members

Miyeon Bae
Peter Khamphouvong
Kyle Boykin
Brighton Kamen

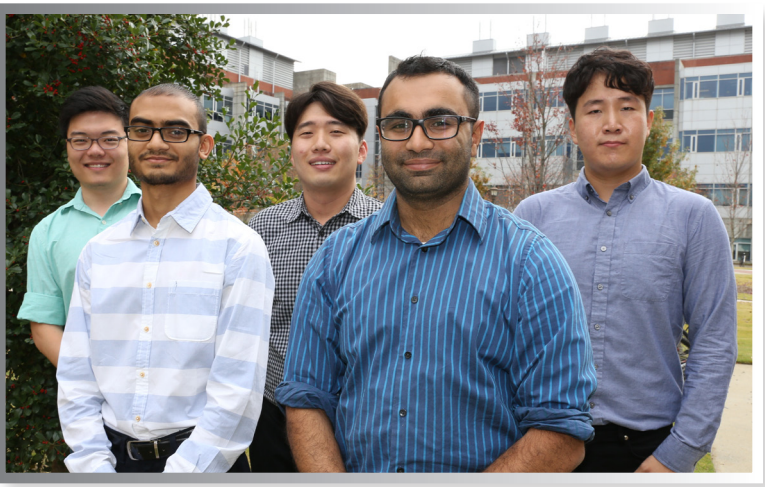
With recent technological innovations in additive manufacturing and other processes, the automotive industry has room for change. The purpose of this project was to investigate these processes and how we can apply them to Porsche Cars North America to create a “workshop of tomorrow.”

R47

MANUFACTURING

Team A.I.

Material Handling Revolution



Sponsor

Skyline Steel

Advisor

Dr. Gregg Larson

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Members

Rahim Bhagat
Ji Yong Kang
Ki Tae Kim
Weiyang Li
Urmil Patel

Design a polyester strapping tool for applying woven strapping to round and irregular shaped objects.

A-Broaching Graduation

R27

MECHATRONICS

Automated Broach Delivery System

Sponsor

Textron

Advisor

Dr. Bert Bras

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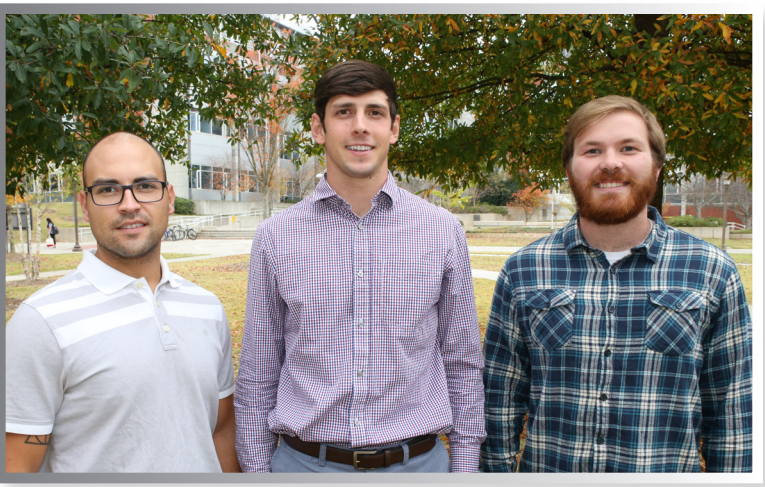
Members

Squires Dearinger
William Short
Megan Tucker
Katherine Roth
Ariel Koh
Neil Yoder

Design a system to hold and dispense steel rods one at a time to be picked up by a robot arm and to receive rods one at a time from the robot arm. The design must be capable of accommodating 300-500 rods, fit within a confined space, and be easily unloaded and moved in a timely manner.

C.H.A.R.

Improving the Resilience of Kenyans to Drought



Sponsor

Bechtel Corporation

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Members

Henry Hewitt
Arnab Dey
Robert Warren
Curtis Gurule

Kenya is currently experiencing an ongoing and worsening drought. The Kenyan government has sought out the help of international assistance in a humanitarian effort to quell the Kenyan drought and provide her citizens with safe and clean drinking water.

Jingleheimer Schmidts

R46

SUSTAINABILITY

Solar Canopy

Sponsor

Ford Motor Company

Advisor

Dr. Bert Bras

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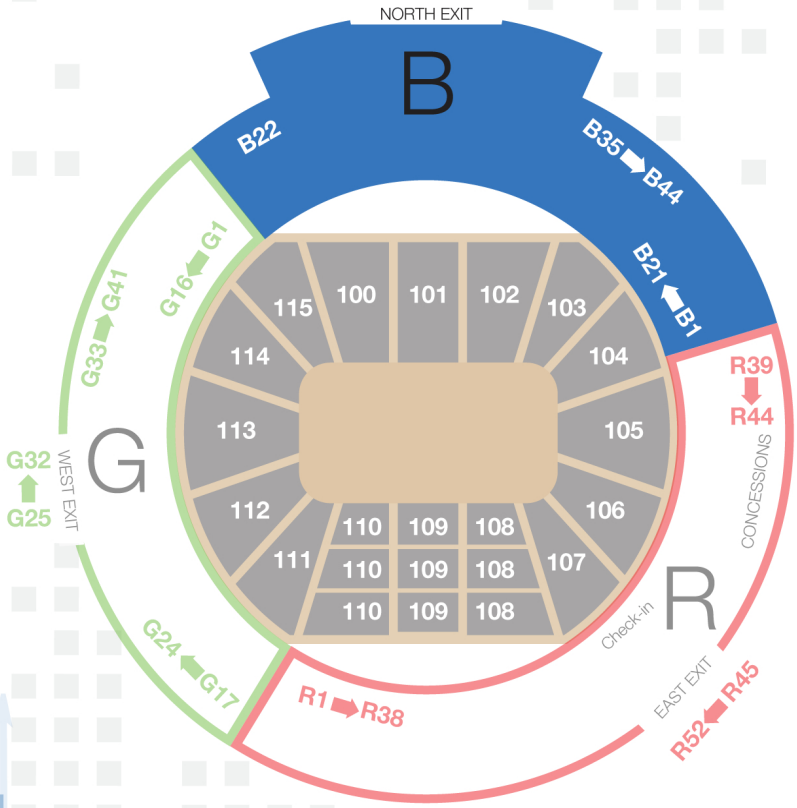
Members

Zhaowen Wang
Kayla Broughton
Kyle Brantley
Reagan Wilkerson
Sean Denney

Our design is a portable solar power system that is capable of generating 2 kiloWatts of power. This device also provides shade for users.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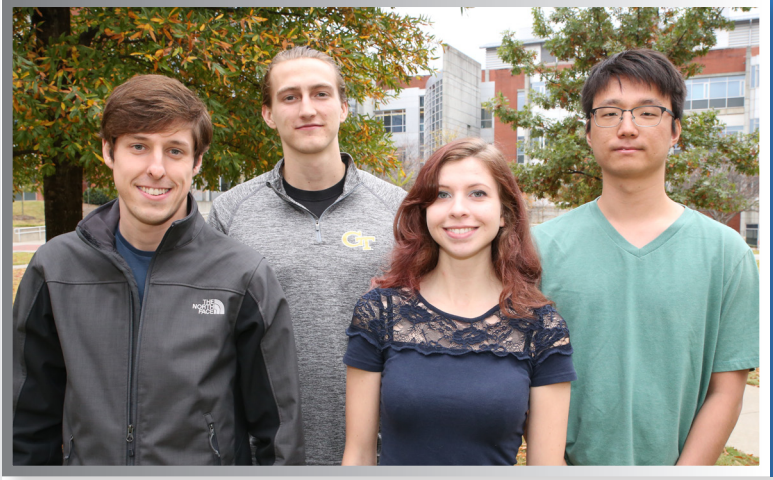
Cheeto Fingers

Autonomous EV Charger



Sponsor
Ford Motor Company

Advisor
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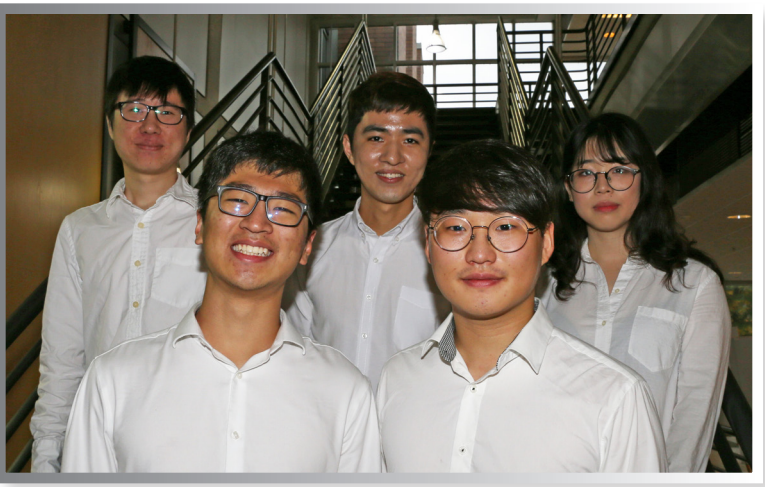
Members
Clark Hamilton
John Lee
Kyle Williams
Meredith Sanders
Zach Scott

A robot that will autonomously charge an electric vehicle by opening the charging port, inserting the plug, removing the plug, and closing the port.

Chocochip

Microfluidic Chip for Cell Separation and Diagnosis



Sponsor

Dr. Todd Sulchek

Advisor

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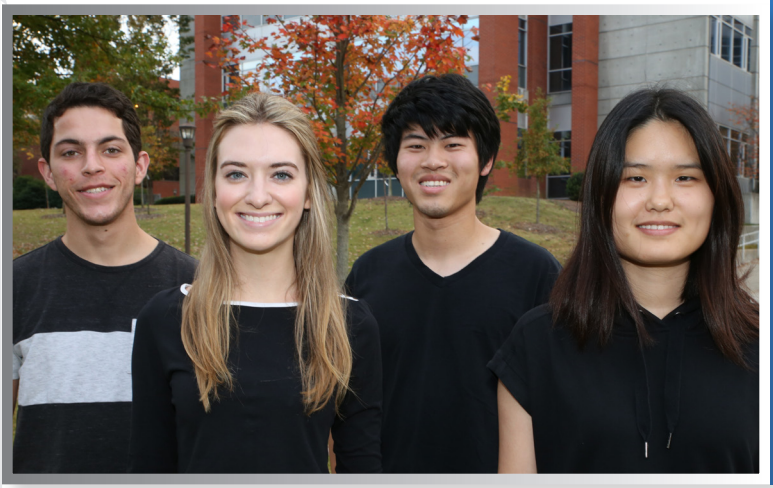
Members

Sung Woo Cho
Do Hyun Ahn
Jun Yeob (Antonio) Lee
Gookhee Lee
JoonSu Han

Cell sorting is an essential process in both medical diagnostics and clinical testing for diseases such as cystic fibrosis. However, current laboratory sorting techniques are costly, tedious, and time intensive. The goal of our project is to design and construct an inexpensive cell filtration system using microfluidics.

Rampion

Dance Ramp Assembly Optimization Project



Sponsor

Kinetic Light Dance Group

Advisor

Dr. Stephen Sprigle

Primary Email Contact

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Members

Julia Vorpahl
Enrique Garcia
Melissa Shi
Jeffrey Ding

The goal of this project is to design an improved wheelchair dance ramp for the Kinetic Light dance troupe. The team was tasked to redesign the dance ramp to meet the client's needs including reducing construction/transportation costs, decreasing the overall weight, and reducing the overall assembly and disassembly time. Success in this project entails benefits for the dance troupe, artistic venues and potential presenters as a newly designed ramp with better aesthetics, reduced weight, and a shorter requirement for assembly/disassembly time would have a significant impact for the dance troupe's venue flexibility, cost savings, and artistic experience.

No Sweat

Cool-Aid

Sponsor

Dr. W. Hong Yeo

Advisor

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Members

Vicki Shaw
Tyler Blevins
Shen Yoon
Priyanka Deo
Alex Grady
Kevin Edwards

The purpose of this project is to design a product to mitigate the negative effects of sweat. Due to the market saturation of externally moderating sweat products and shortage of affordable alternative sweat-managing products, the design focuses on moderating core body temperature.

VR the Best

Creation of Realistic VR Gun Attachment (VRifle)

Advisor
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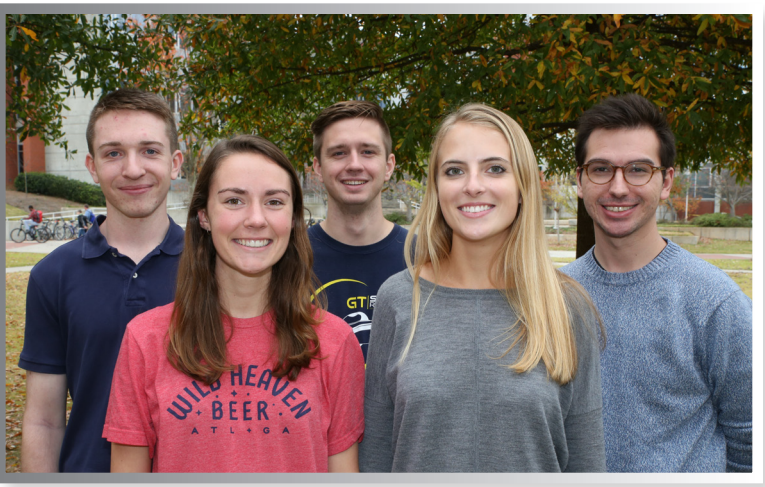
Members
Quinn Zhang
David Cregg
Ricky Ospino
Abby Olker
Alex Berlinsky
Patrick Riley

The team is designing a gun attachment for use in HTC Vive virtual reality shooter games. This attachment will allow full use of the HTC Vive VR controller, while maintaining the realism of a true rifle. As such, the VRifle will be true to weight and true to feel, with realistic recoil.

Blankity Blank

Material Handling Revolution



Sponsor

Skyline Steel

Advisor

Dr. Kenneth Cunefare

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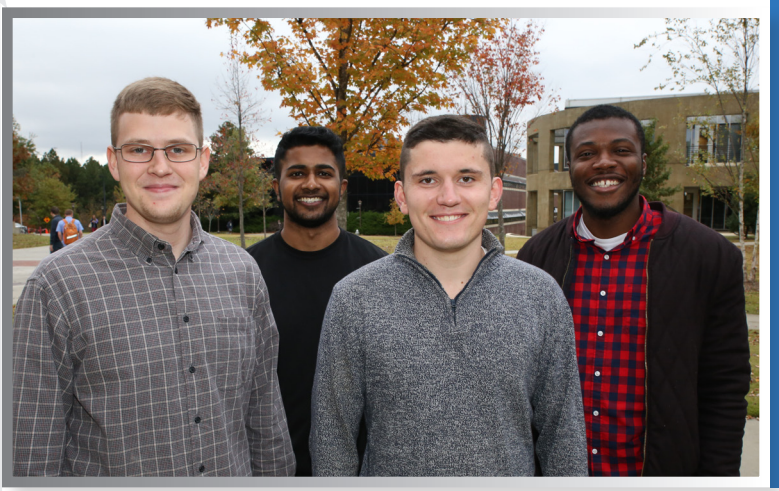
Members

Brandon Will
Michael Bailey
Austin Forgey
Hannah Larson
Lauren Perrine

The steel industry currently bundles steel products for shipping with razor sharp steel strapping that can cause lacerations to workers' arms, hands, and faces. Using polyester woven strapping is a safer and stronger solution, but it is difficult to correctly tension loads that have a round or irregular shape because polyester strap tensioners are designed to work on flat surfaces. The goal of this project is to design a polyester strap tensioner that will work on round or irregularly shaped loads while remaining easy and efficient for workers to operate.

You Can Probably Change the Name Later

Use of PTFE for UV Water Sterilization



Sponsor

Porex

Advisor

Dr. Bert Bras

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Johnathan.D.Todd@gmail.com

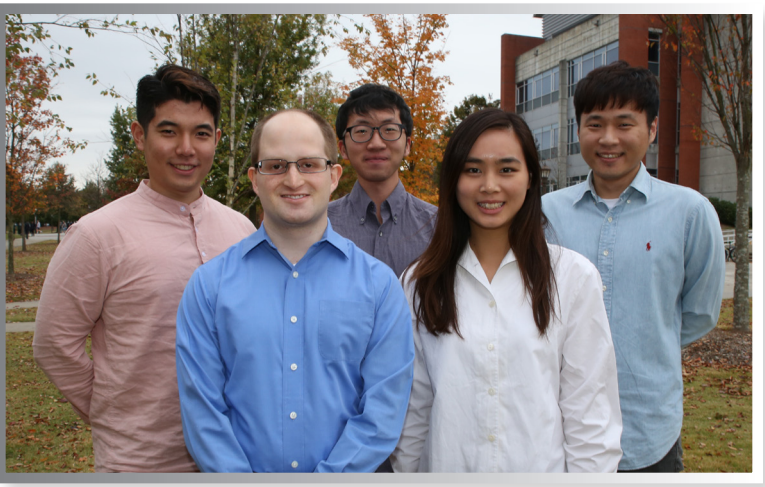
Members

Daniel Strevel
Olawale Agoro
Ajith Shajan
Johnathan Todd

Our team is investigating the use of PTFE as a reflecting surface for UV light. Reduction in energy usage is attainable using PTFE in UV sterilization devices compared to stainless steel, or other common materials.

Bandsaw

Aircraft Overhead Bin Dynamic Damper



Sponsor

Formation Design Group

Advisor

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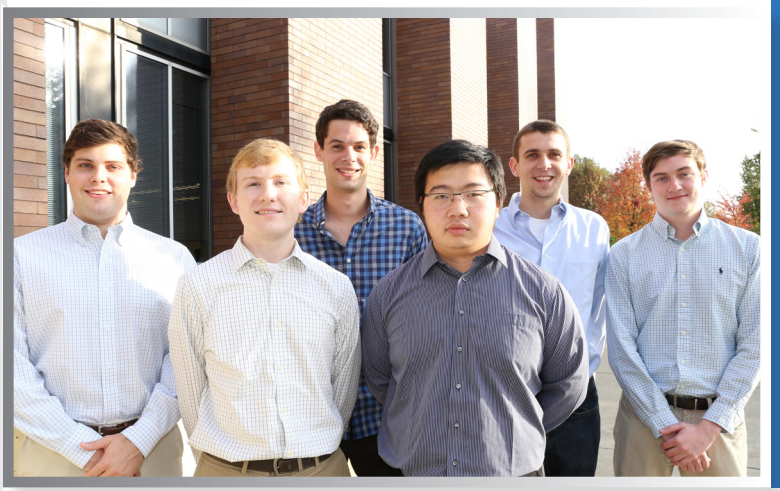
Members

Jeho Kim
Peter Mitchell
Jaeseok Cha
Jaehyung Park
Hiu Yan Ip

The overhead bin project is concerned with the design of a dampening hinge that can yield the best results in terms of adaptability, durability, and performance in response to loads. The goal of the project is to develop a dynamic dampening hinge device which is capable of reducing fuel consumption by minimizing weight and improving the onboard passenger experience through an aesthetically pleasing uniform deployment speed.

Safety Zone

Seatback Inertial Release Mechanism



Sponsor

Rockwell-Collins

Advisor

Dr. Gregg Larson

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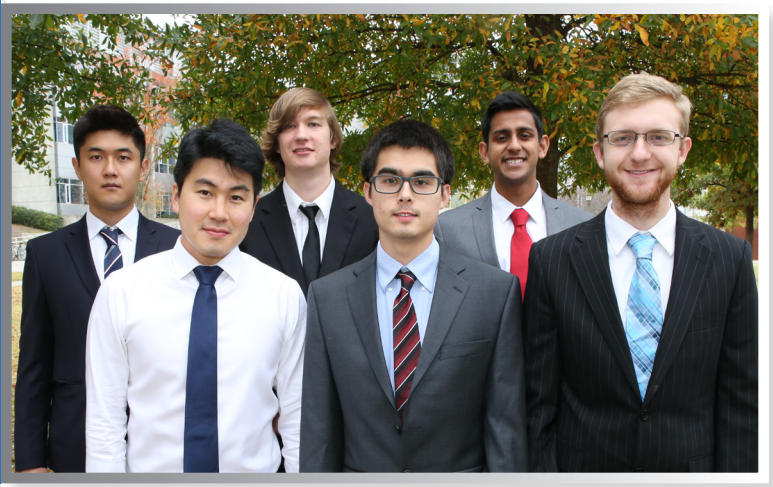
Members

Sebastián Aberastury
Lawrence Bray
Jimmy Tandiono
Ryan Carr
Grayson Smith
Ryan Norrell

The Seatback Inertial Release Mechanism is designed to decouple the seat back from the seat base in the event of an airplane crash. This will allow the seats to fold forwards, resulting in fewer serious head and neck injuries.

Yellow Jacket 6

Eaton 5G Urban Microgrid



Sponsor

Eaton

Advisor

Dr. Bert Bras

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Members

Sunghoon Kim
Hyun Suk Kim
William Reffitt
Thomas Board
Joseph Hornung
Siddharth Gore

Designing a 5G package to be deployed on light poles. The solution aims to provide the infrastructure for the next generation of cellular technology in densely populated urban areas.

Super Seniors

Super Sucker

Advisor

Dr. Gregg Larson

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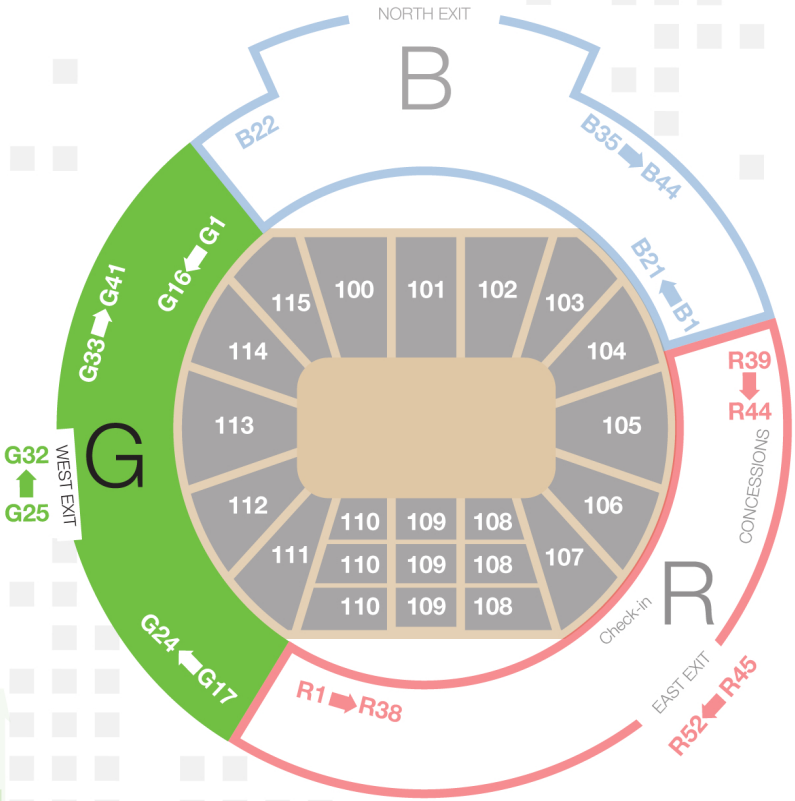
Members

Zach Bailey
Tarah Lewis
Jordyn Ranoine
Justin Reichling

Our mission is to prevent the unnecessary waste of canned food occurring at The Low Country Food Bank. Visual inspection is far from precise and excessive amounts of safe food is discarded. Our advanced vacuum system tests the integrity of a can's hermetic seal thus saving cans that should be feeding millions of American families.


NORTH EXIT
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WEST EXIT
G24
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R38
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Check-in
EAST EXIT
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R45
CONCESSIONS
R39
R44
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Quicker Pace

Quicker Pace

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Bruce Fenderson
Silas Hegeman
Moriah Mattson
Matthew Brady

Quicker Pace is a semi-active ankle exoskeleton which reduces energy expended during walking by using a spring and clutch system to apply additional torque at the ankle. It allows the user to go faster and further than they would otherwise. It is targeted towards a healthy aging population to restore some of their endurance.

Orchard

Orchard

Sponsor

Orchard Utilities, LLC

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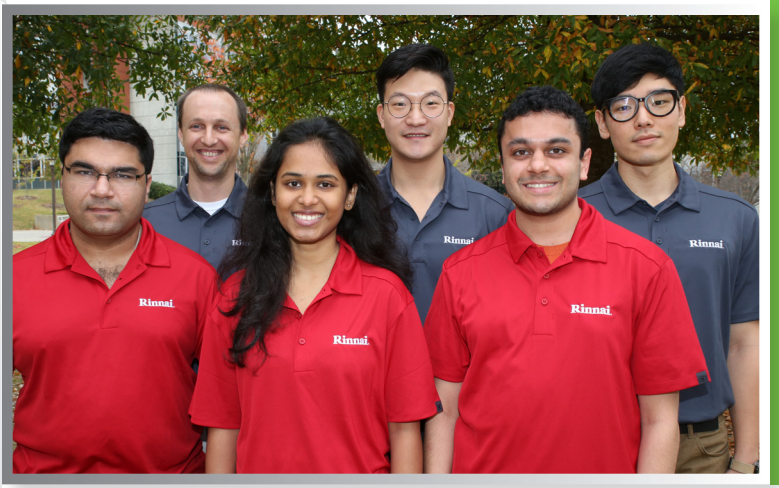
Shinjae Kwon
Evan Pax

The Orchard is a fully automated, compact, plant cultivation device. This appliance redefines our daily food from finite resource to utility by producing abundant leafy greens in a form factor that seamlessly replaces your living room coffee table.

Winter is Coming

Winter is Coming



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Kelly Grissom

Our project involves designing a novel water heater. The water heater needs to provide at least as much hot water as current tank water heaters while minimizing problems with tank water heaters and installation cost.

G11

MANUFACTURING

Porsche 918

3D Printing: Auto Workshop of the Future

Sponsor

Porsche Cars North America

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Kevin Hansen
Tazeen Hossain

This team is tasked with designing a process to be utilized in dealerships to decrease lead time in procuring rare parts and tools, specifically by taking advantage of additive manufacturing. The model is backed by engineering and design research and analysis.

THE Dream Team

G32

MANUFACTURING

LockBlox

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LockBlox

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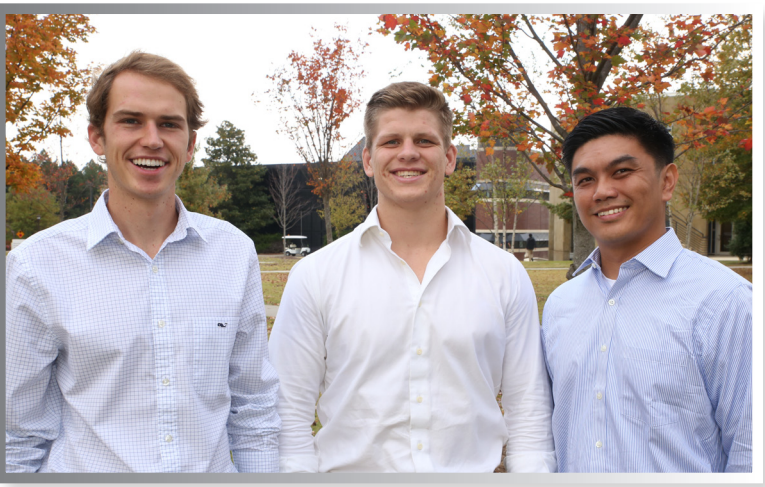
Ryan Alain
Evan Khan
Haley Beebe
Shelby White

LockBlox is a CMU replacement composed of agricultural waste. Using molds and a high pressured device, LockBloxs can be created in a fraction of the time it takes to make a concrete block. Additionally, due to the interlocking design of the LockBlox, assembly is faster as well.

ACE: Durable Recon

Durable, Transforming Reconnaissance Drone



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Military and first responders need information before entering an enclosed space that current drone technology cannot access. Our goal is to develop a device for responding personnel to deploy a reconnaissance robot into tight environments so that it can travel to a new destination, deploy itself, and gather information.

Game of Drones

G26

MECHATRONICS

Drone and Package Autonomous Receptacle

Sponsor

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Natasha de Gunten
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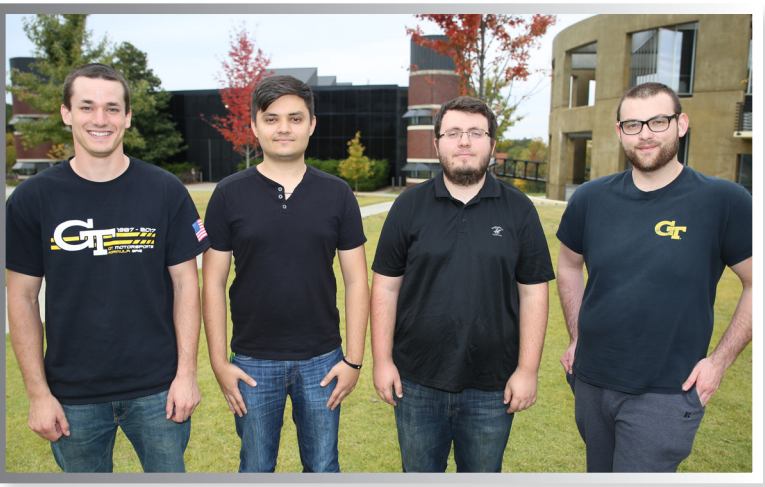
With logistics constantly evolving to be more efficient, Mercedes-Benz USA has chosen to invest in the novel technology of drone transportation to improve supply chain and promote their luxury brand. Our team, Game of Drones, has focused on optimizing receiving operations by developing a receptacle to automatically detect drones, store packages, house drones, and facilitate outgoing aerial shipments at Mercedes Benz dealerships.

Team VJET

Aircraft Overhead Bin Dynamic Damper



Sponsor

Formation Design Group

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Eric Flint

The purpose of this concept is to design, test, and validate a new dynamically variable damping hinge mechanism and produce a functional prototype that can be demonstrated and installed into an overhead bin design in development by Formation Design Group for Rockwell Collins. The mechanism must be able to maintain a consistent deployment damping rate such that the bin will deploy at the same speed whether it is empty, full, or any level of loading in between. The damping rate must adapt to the load automatically as the bin is deployed.

Draft not Drought

G17

SUSTAINABILITY

Improving the Resilience of Kenyans to Drought

Sponsor

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On February 10, 2017, the Kenyan Government declared a national drought emergency; severe drought dried up water resources in half of Kenya's 47 counties, and an estimated 3 million people lack access to clean water. The purpose of this project is to design and prototype a system to generate and store clean water at a household scale in Nairobi, Kenya. Through this design solution, we hope to improve the resilience of Kenyans to the drought.

Far Out Rocketry

Far Out Rocketry

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Jeshua Jemson
Benjamin Marchese

The aim of this project is to design, build, and test the structure and recovery system for a liquid bi-propellant supersonic level 3 class O rocket that will attempt to reach an altitude as close as possible to 45,000 ft. The structure of the rocket must be easily recoverable and reusable for multiple launches at speeds up to Mach 1.8.

Grub-a-dub-dub

The Grub-Tub: Stackable and Aerated Larvae Bed

Sponsor

Grubbly Farms

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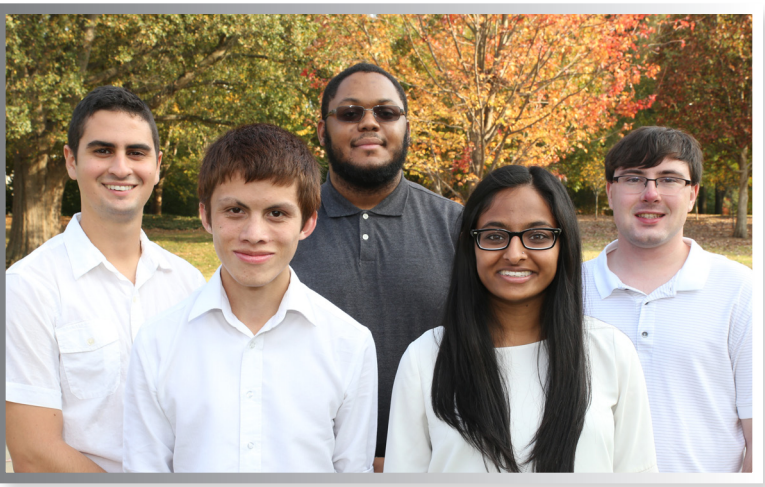
Addison Lazarus
Will Wagenseil

Grubbly Farms began as a GT student startup and its goal is to supply a sustainable source of livestock feed using the very protein dense black soldier fly larvae. In order to grow the larvae on a large and economical scale they wish for us to design a larvae rearing bed that is stackable to optimize warehouse floor space. Additionally, the beds must be aerated to prevent the larvae from overheating during their lifecycle.

G06

Hi-Dry

Hi-Dry High-Efficiency Clothing Dryer



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Jacob Rowe
Sachi Amin
Benjamin Trangle

A typical clothing dryer is the third largest consumer of energy in the house. The only systems that consume more energy are the air conditioning systems and the water heater, appliances that are used continually. The goal of our team is to design an affordable and practical dryer that requires less energy to operate while still successfully drying a normal load of laundry.

MEthodical, MEticulous, MEsmerizing Urban Farm Composter

Sponsor

Atlanta Food and Farm

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Navya Palacherta
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Sean Santoro

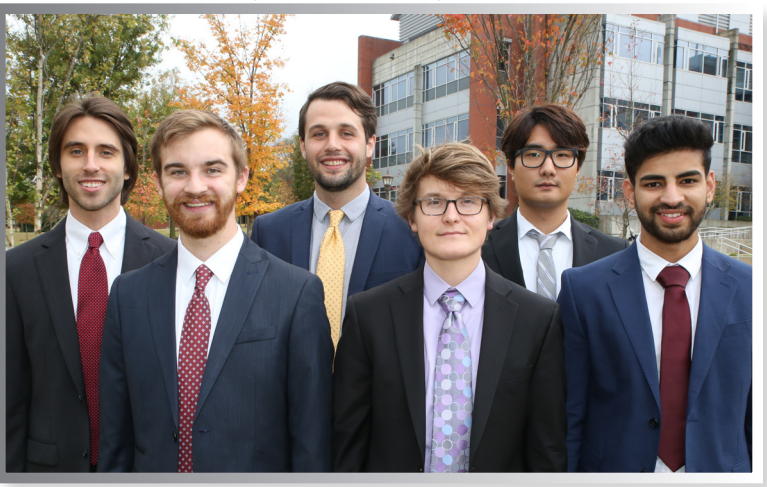
A device that separates and sorts organic waste from non-organic waste, grinds organic material into small particles, and accelerates the processing of organic material that transforms waste into nutrient-rich compost. The device also incorporates automated functions including a vision system that assists in material separation and a compost ventilation system that aerates and insulates small organic particles during the composting process.

SUSTAINABILITY

G33

Net-Zero

F2-Energy Storage System (for Solar-Powered Residential House) Sustainability



Sponsor

King Fahd University of Petroleum and Minerals

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Sam Kuehn
Zachary Duncan
Zachary Allen
Josh Reynolds
Priyank Acharya

Design an energy storage system to store the solar energy which can be used outside of solar window. Perform a cost and thermodynamics analysis on different type of storage and provide an optimal solution.

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