Projects for Capstone Design (ME4182/GT4823)

Spring 2016

Industry Sponsored Projects

http://design.gatech.edu

Industry/External Projects

- Real world projects for a real need!
- Additional facilities, materials, components, etc. available including on-site trips
- At least $800 reimbursement for M&S
  - Sponsor might provide additional funds
- Discuss NDA and IP terms upfront

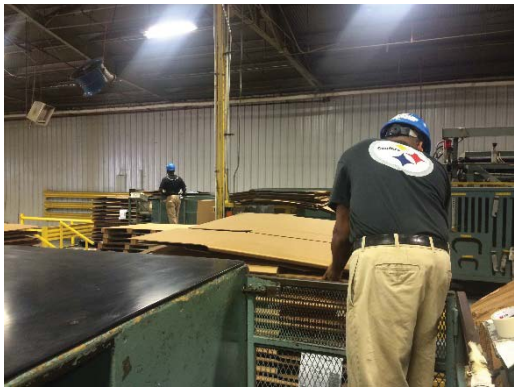
Dynamic stability sensing system

- Design, develop, and build a proof of concept dynamic stability sensing system for use on a tiling mechanical felling equipment which will allow feedback to the operator (in cab or remotely located) on the state of machine stability as well as intervene in machine operation if imminent rollover is detected.

Laminator Automation

Georgia-Pacific

- Georgia-Pacific manufactures large laminated bulk boxes on semi-automatic laminators. Evaluate automation options for the bulk box laminating equipment and develop an improved or new design.



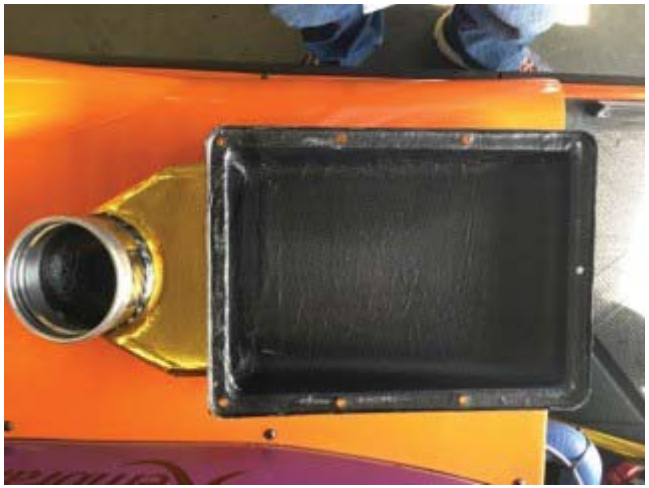
TEXTRON

XY Positioning for Tire Coupled Simulators

- Design, build, and test a device to remotely move the cylinders while noting their absolute and relative positions.
- In order to test variations on the simulator, the actuators need to be setup to match the correct wheel base and track width of the test vehicle.
- Programming shall be done in LabView.

Car Racing Intake Plenum Design

- Design a new intake plenum for a car racing team
- Our race shop is in Savannah so a physical visit is straightforward.
- Some clever ME work coupled with CFD should produce a good solution and a really fun and real world student project.



Sunamp Evolution

Sunamp
Heat Batteries™

- Radiant Glycol Solution
  - Sunamp is currently investigating the potential for a radiant floor heating solution that utilizes renewable energy sources only for (primarily) off-grid applications.
- RV Hot Water Solutions
  - Sunamp is currently investigating the potential for a hot water heating solution for Recreational Vehicles (RV's) that utilizes reclaimed waste heat from the vehicles internal combustion engine, renewable energy sources, and grid connection power.

Firewood stove design

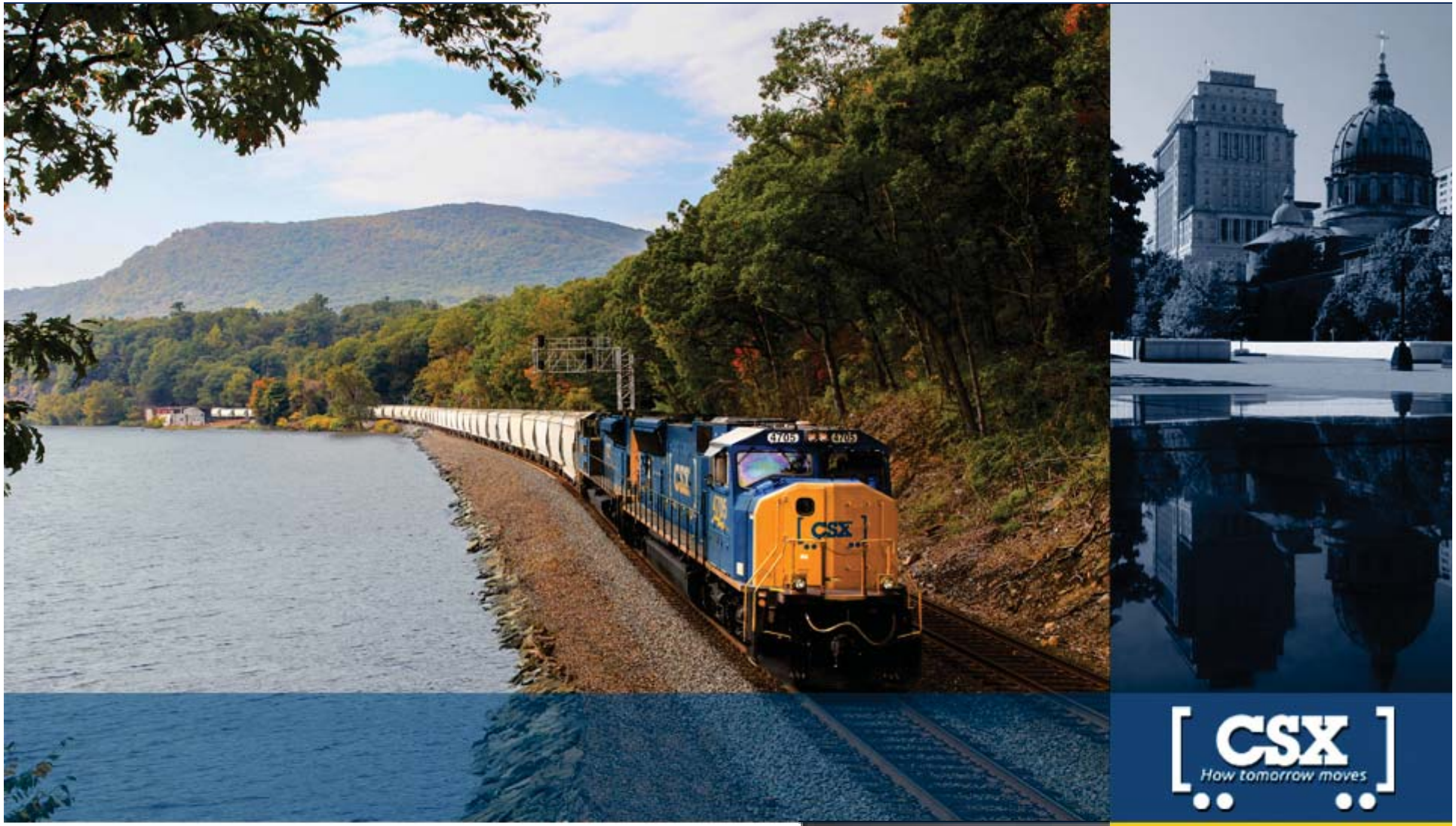
- To design and build a stove that uses less firewood and that emits less smoke.
- Panamanians who live in the countryside are very traditional people. The design of the stove should be pretty simple to encourage usage and not overwhelm them by looking too complicated.

Pressure Drop

- Design and modify open air convection cooling chassis to desired requirement

Sponsor Pitches

- CSX
- Coca-Cola
- IPA
- AGCO
- Jack Cooper
- Wahoo Fitness
- US Jetting
- Dezi-Roo



CSX Coal Freight Car Conversion

January 2016

CSX Coal Car Conversion Project

Problem

- Declines in coal demand have led to reductions in coal car utilization
- Increases in freight car fallout within other car fleets will lead to decreases in service capabilities and increases in capital demands

Project

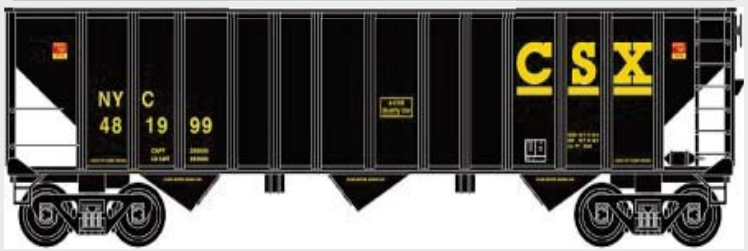
- Convert an existing coal car into a covered hopper using specified criteria

Perks

- Collaborate with CSX subject matter experts
- Visit CSX sites
- Visit customer sites

Convert Coal Car to Covered Hopper

From Coal



Coal Car

To Covered

Covered Hopper

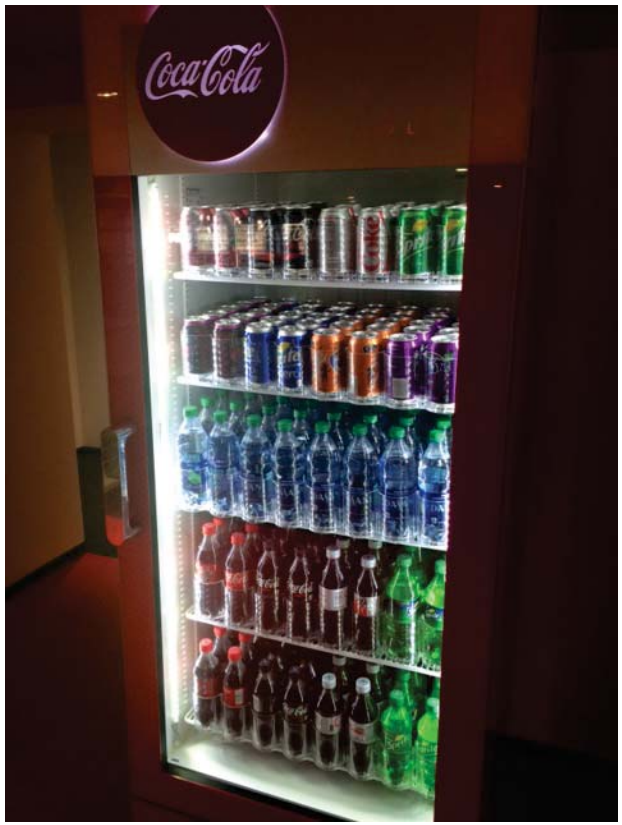
Capstone Project Objective: Redesign a coal car to function as a covered hopper

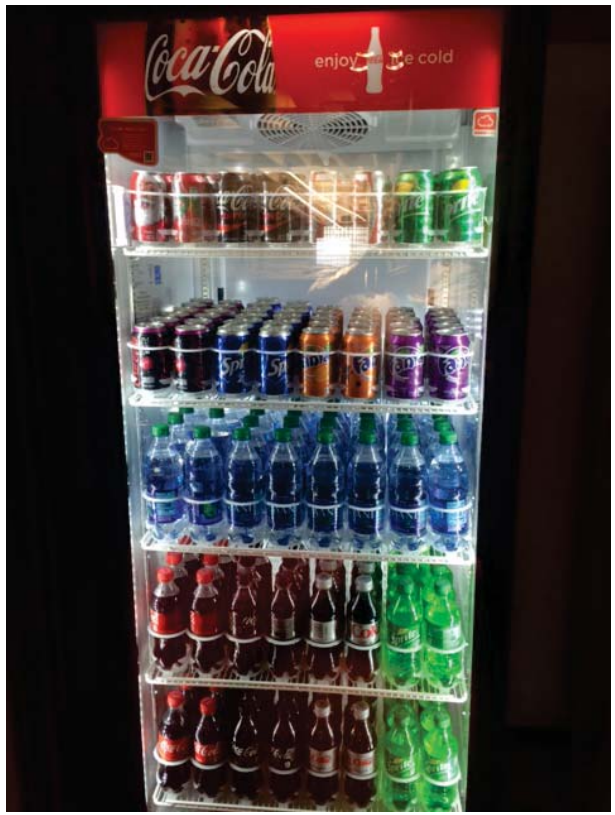
Notes

1. Environmental regulation along with low natural gas prices have decreased demands for coal
2. As a result, many of CSX's coal car assets are now sitting idle
3. A large amount of these coal cars have a long remaining life
4. Fortunately, coal cars can be repurposed into functioning covered hoppers to move grain, lime, or fertilizer
5. Covered hoppers are similar in shape and size to coal cars (with some key differences)
6. The covered hopper fleet will face a large number of fallouts over the next 10 years resulting in a 27% decrease in system capacity and a $175M capital replacement burden
7. Converting coal cars into covered hoppers will help CSX keep up with the demands of a growing grain market due to strong animal production and low corn prices

Shelf Inventory Management System

Tom North
tomnorth@coca-cola.com

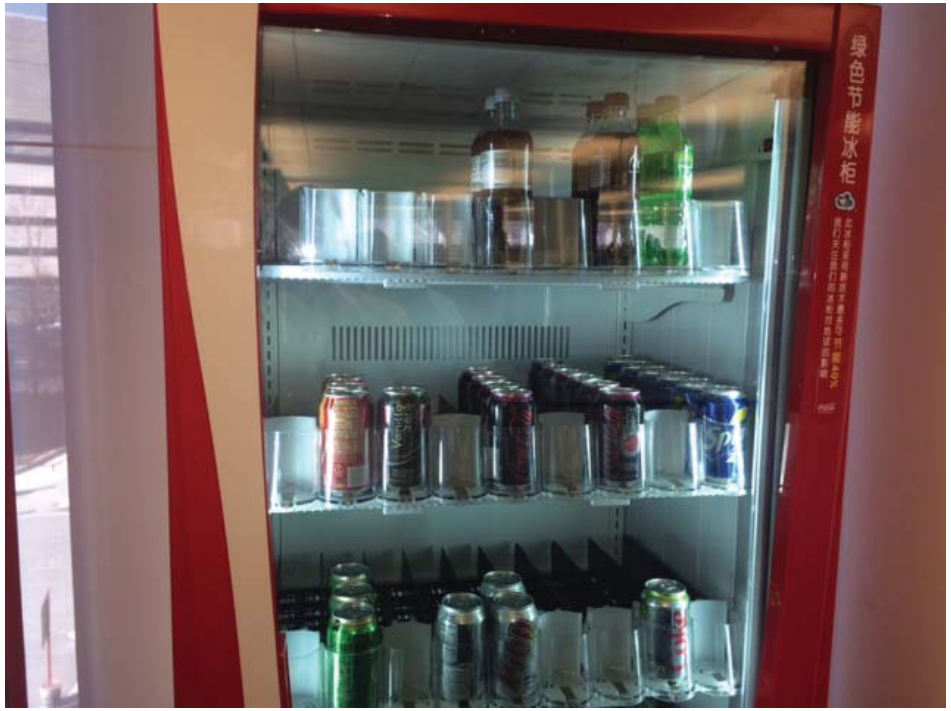




Technical
Global Research
and Development

PROBLEM

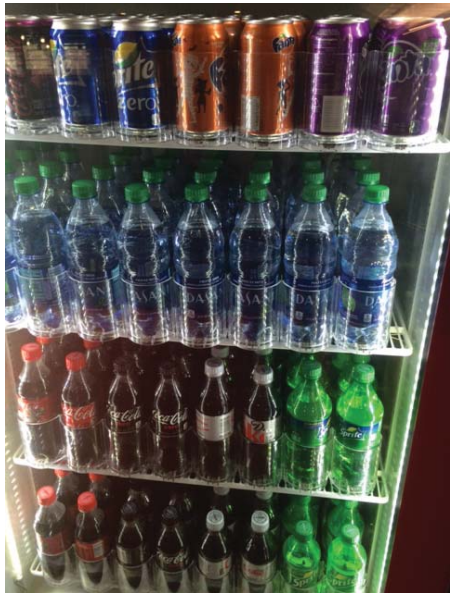
- The Coca-Cola system cannot cost-effectively monitor product integrity and product usage by brand within coolers



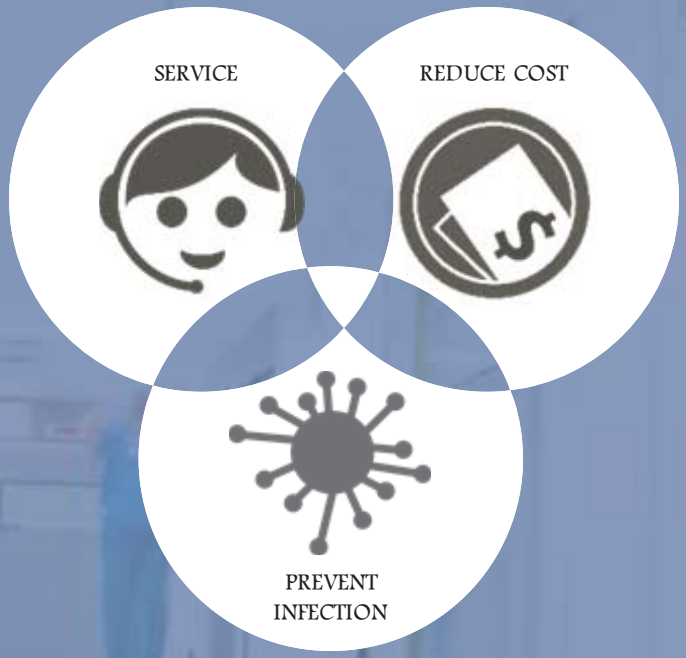
Coca-Cola Technical Global Research and Development

Objective

- Design and build a working prototype system that senses competitive product and product inventory levels within coolers to help minimize OOS (Out of Stock) scenarios



Coca-Cola Technical Global Research and Development



(IPA)®

INNOVATION + PASSION + AUTOMATION

(IPA) is the worldwide leader of scrub and linen automation for acute care hospitals because we:

Improve Service
Reduce Costs
Prevent Infection

Experience the (IPA) Solution!

The **worldwide** leader in linen automation

INNOVATION+PASSION+AUTOMATION

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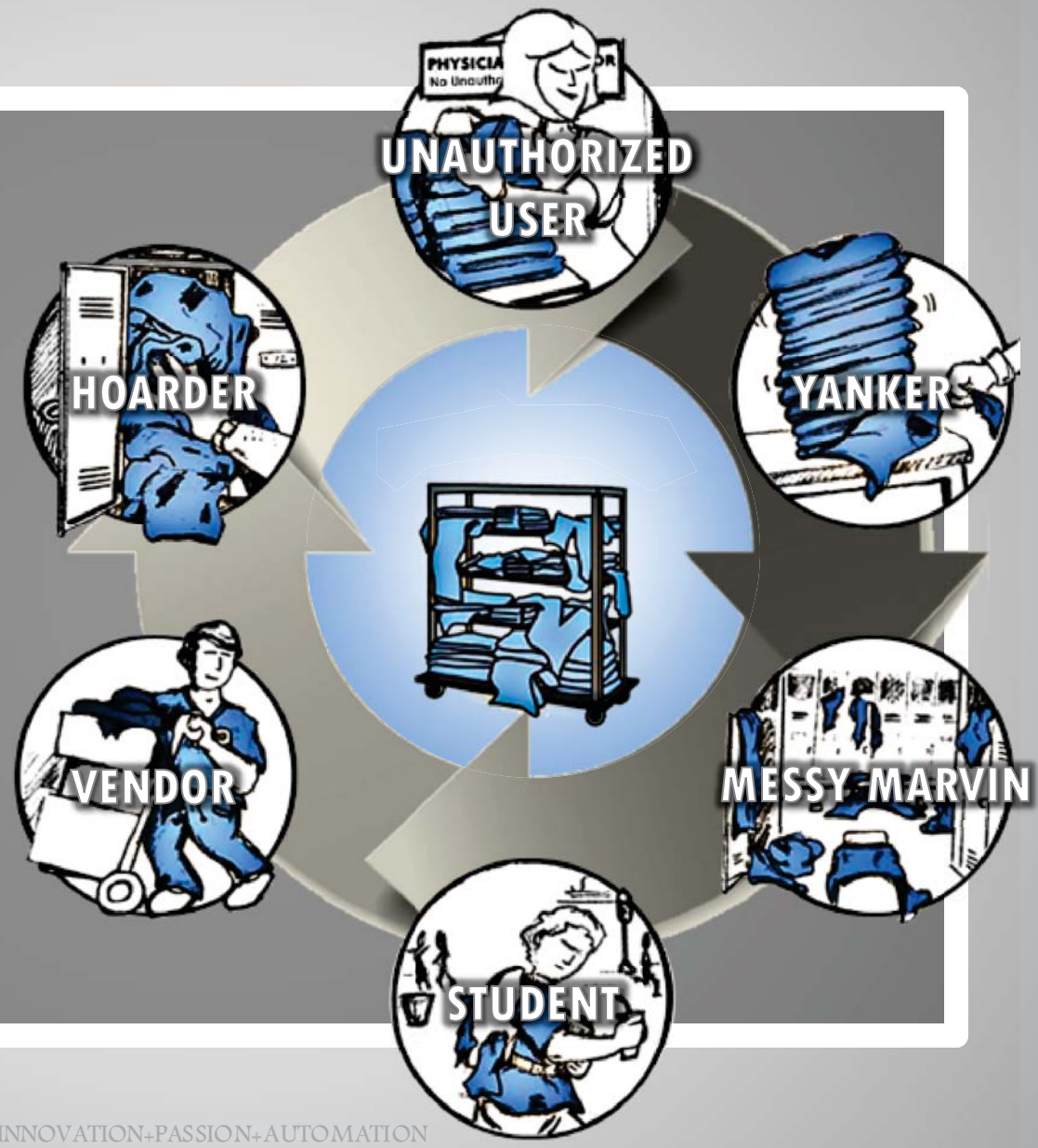
WOMEN

THE VICIOUS CIRCLES OF HOSPITAL SCRUB ABUSE



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HIGH CAPACITY SOLUTION

scrubBank & scrubXchange

INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

scrubXchange

HOW TO USE
scrubBank & scrubXchange

USE
Use your hospital ID

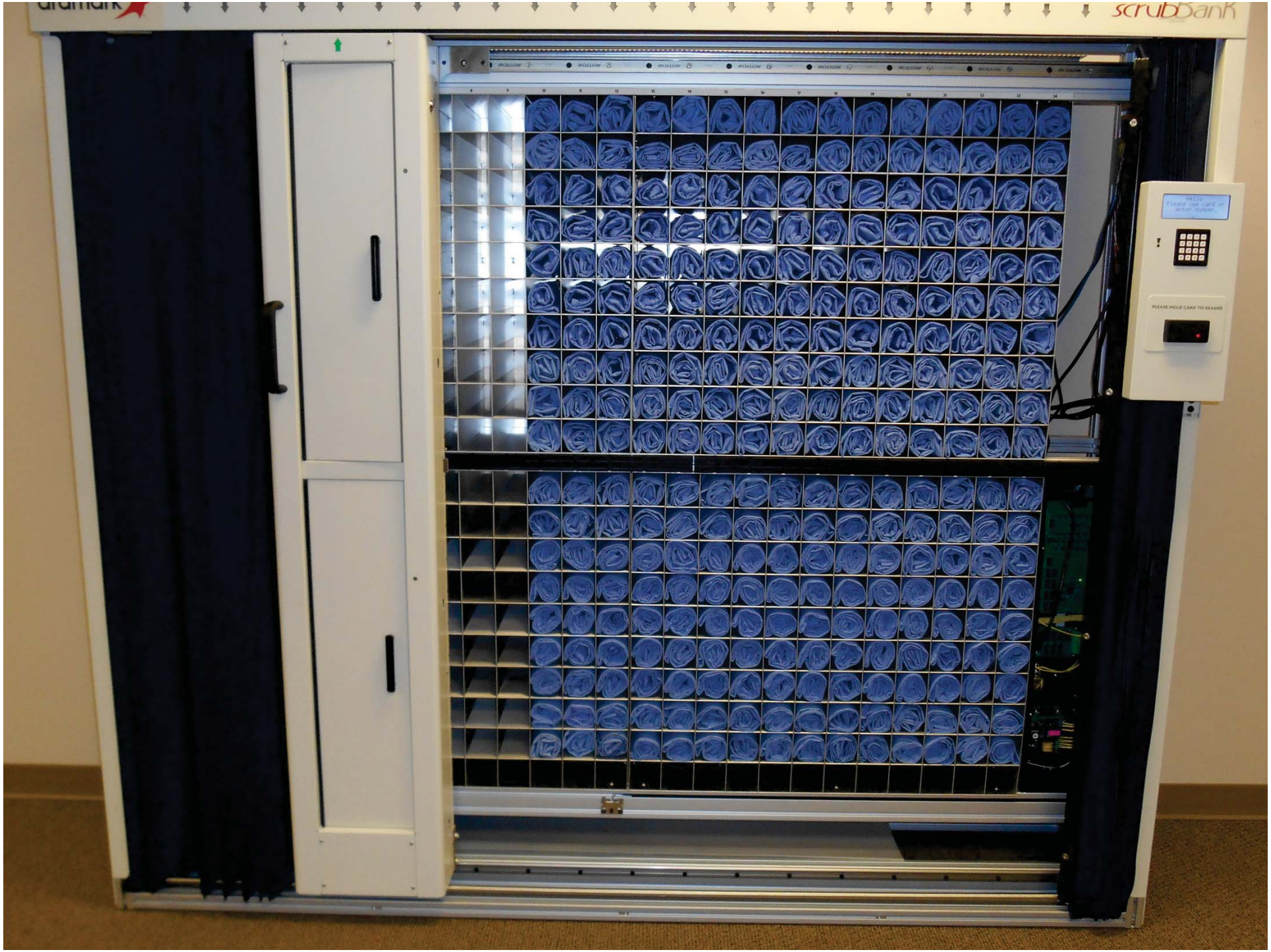
ALIGN
Align the door

OPEN
Open the door

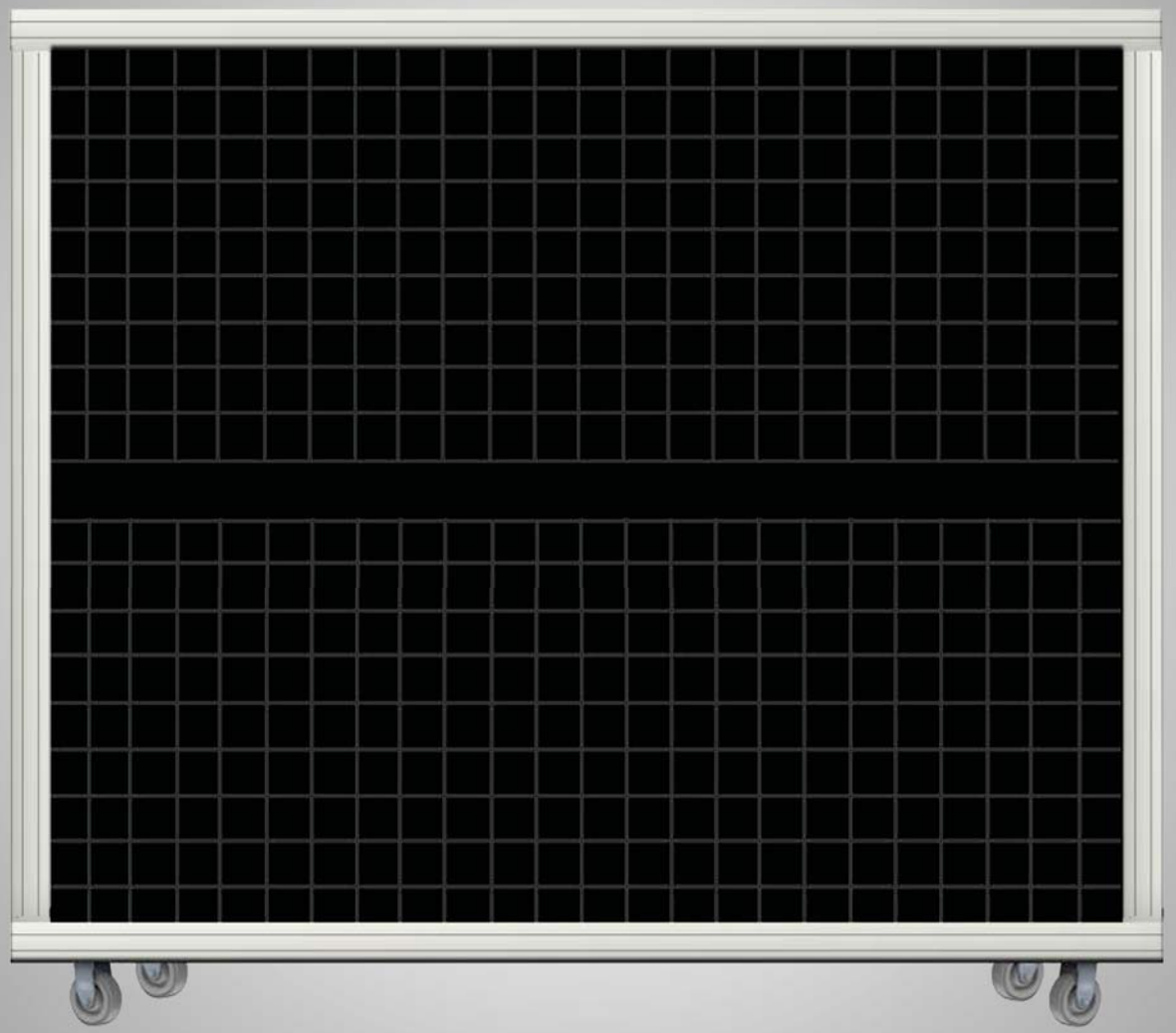
Dispenses the correct size scrub in seconds

SHOW MENU


aramark
scrubBank
PLEASE HOLD CARD TO READER


aramark
scrubBank
PLEASE HOLD CARD TO READER

SHOW MENU



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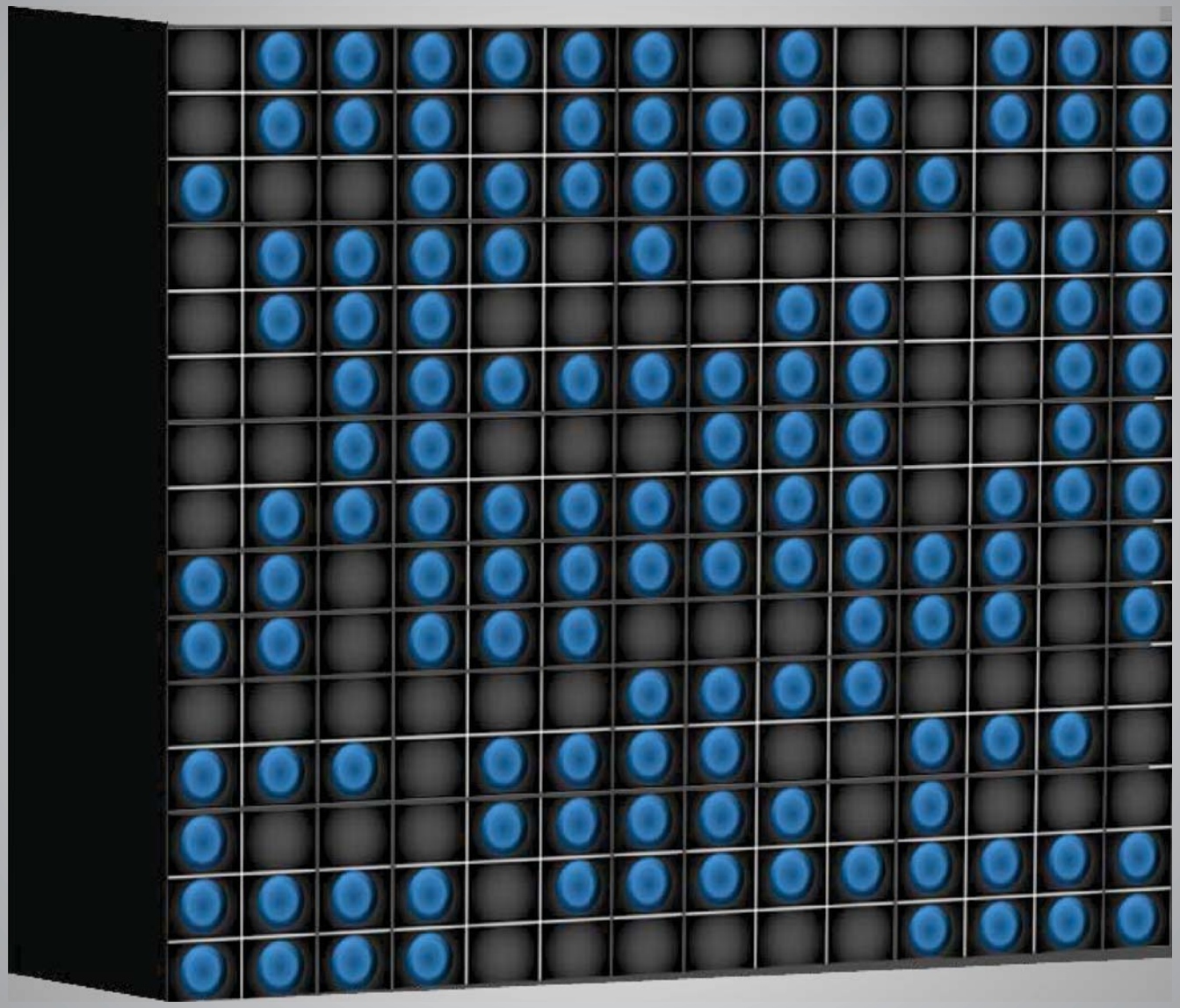

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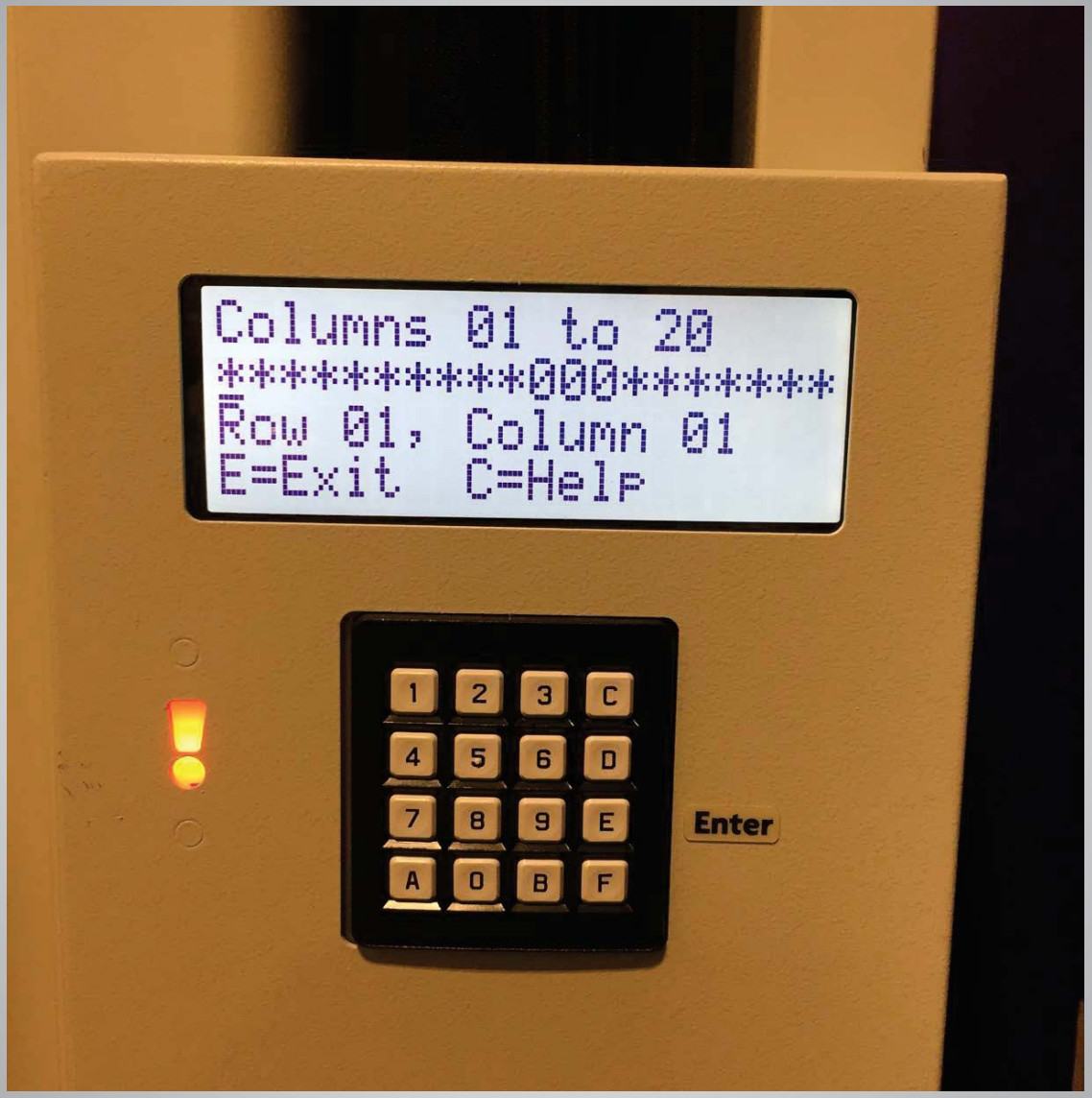
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Row 01, Column 01
E=Exit C=Help
1 2 3 C
4 5 6 D
7 8 9 E
A 0 B F
Enter

SHOW MENU

Challenge #1

Design a cost effective detection system to indicate the presence of scrubs in each slot

SHOW MENU

Challenge #2

Design a tool/system to increase the speed and accuracy of rolling and loading scrubs

The **worldwide** leader in linen automation

INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

01

18

1950's

1970's

1990's

Present Day

NOT MUCH HAS CHANGED

30

INNOVATION+PASSION+AUTOMATION

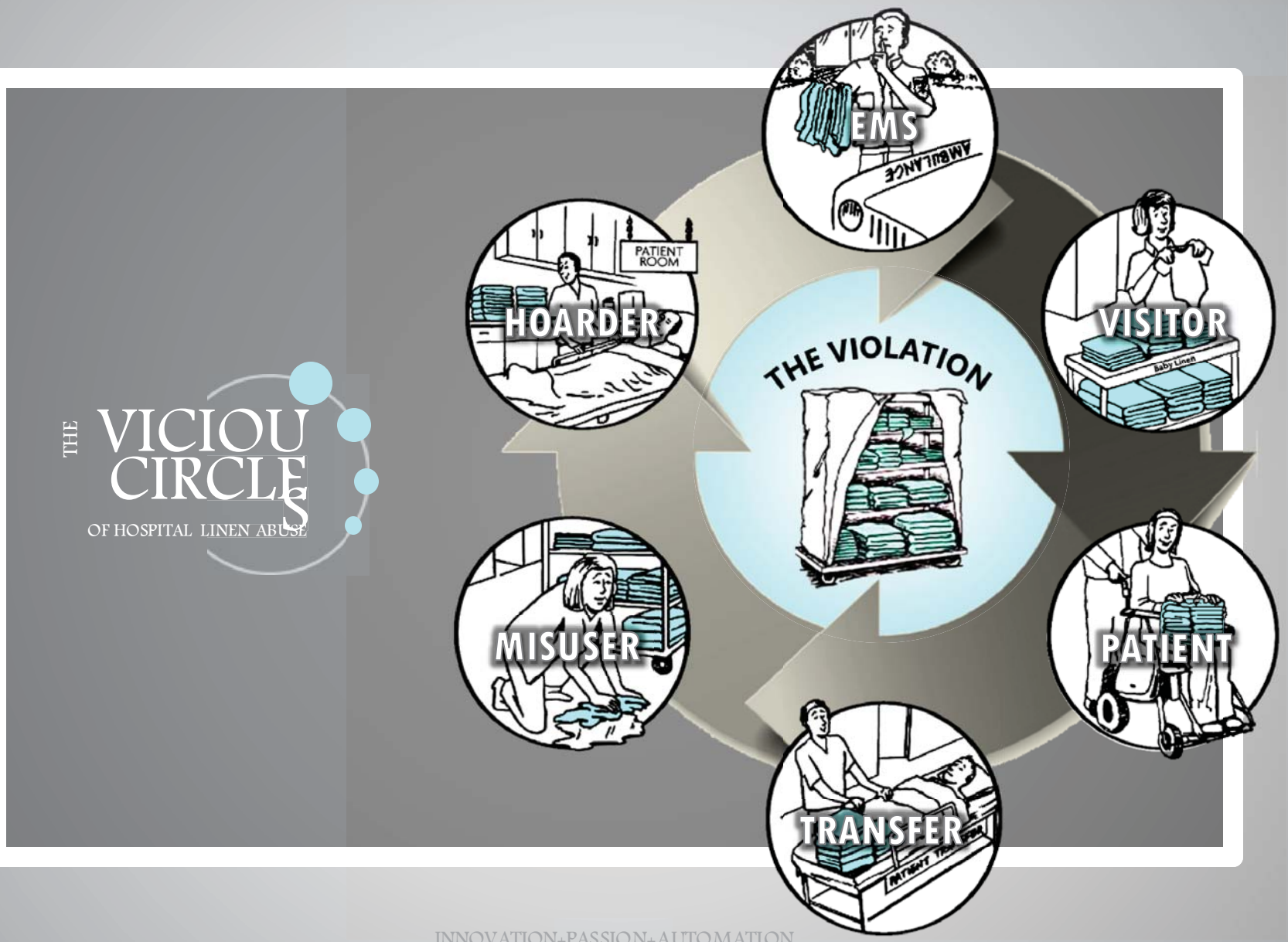
PATIENT

alEx

INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

THE VICIOUS CIRCLES OF HOSPITAL LINEN ABUSE



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INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

alEx LINEN CENTER

HOW TO USE THE LINEN CENTER

USE
Use your hospital ID

OPEN
Open the door

TAKE
Take linen

alEx automatically weighs what you take giving nursing staff instant feedback!

See the alEx AUTOMATED LINEN CENTER ▶

SHOW MENU

alEx

WEIGHS

WHAT YOU TAKE!

Caution! Closing!
Debbie
You received 5.2 lb
which = $21.57

HAWTHORNE EFFECT

Productivity improves simply in response to the fact that workers receive feedback

Misuser

Hoarder

INNOVATION+PASSION+AUTOMATION

INNOVATION+PASSION+AUTOMATION

Challenge #3

Design a solution to indicate the change in quantity of each specific item removed

THANK YOU

AGCO Corporation

Capstone Design projects for Spring 2016
Brandon Montgomery- Product Manager, Tractors <160HP NA

GA TECH- Jan 12th, 2016

AGCO Background

Challenger FENDT GSI MASSEY FERGUSON VALTRA

As a pure-play agriculture company, AGCO's research and development is focused on agricultural innovations. From hybrid combine harvesters to telemetry-based tracking systems, AGCO provides farmers worldwide with the technology they need to satisfy the growing demand for food, fuel and fiber.

- 7.6 Billion Annual Sales
- 20,000 employees globally
- World Headquarters- Duluth, GA

- **OUR VISION**

  High-tech solutions for professional farmers feeding the world.
- **OUR MISSION**

  Profitable growth through superior customer service, innovation, quality and commitment.

AGCO

AGCO Products

AGCO Design Situation

- **Current product for North America has 2 sensitive issues on a Cab Tractor:**
  - 1. There is no passenger seat currently available.
  - 2. Noise level is too high

- **Impact if these 2 items can be resolved**
  - Customers like to have someone ride safely in the tractor with them. Often times their kid, spouse, friend, neighbor, banker, etc. There is both an emotional and functional need.
  - Noise level is currently too high at 91dba. Having a long exposure to high noise level can cause hearing loss. Customers can gain a safer environment and health while operating this equipment.

AGCO

AGCO Current Platform 4600M

- **Below is an example of a cab tractor that has a passenger seat.**

AGCO Facility

- AGCO has a training facility with physical tractor, tools, work space, and shop needed to see and work on physical product.
- Location is 27 miles North of GA Tech campus in Duluth, GA.
- Shop is located 2 blocks away from main company headquarters.
- Students would be allowed to come and see the equipment first hand and would have access to the equipment as needed to complete the study.

JACK COOPER CAPSTONE PROJECTS

Dry Freight and Increased Length Initiatives


STERLING
2225
2226

JACK COOPER

INCREASED LENGTH INITIATIVE

JACK COOPER

INCREASED LENGTH INITIATIVE

- Design a universal model capable of adding length to Jack Cooper's diverse fleet of trailers
- Produce a design mock-up or computer-generated image to illustrate the solution.

JACK COOPER

DRY FREIGHT INITIATIVE

JACK COOPER

DRY FREIGHT INITIATIVE

- Design a new trailer or trailer add-ons to modify our current fleet and allow for new types of hauling.
- Produce a design mock-up or computer-generated image to illustrate the solution.

Capstone Proposal

1/12/2016

Problem: Exercise machines

- Generally limited to one exercise.
- Take up a lot of space
- Look cluttered, clunky, complicated
- Made up of complex mechanical arrangements
- Require extra attachments and configuration for multi-exercise machines
- Require multiple stations for each movement
- Require extra space for weight storage

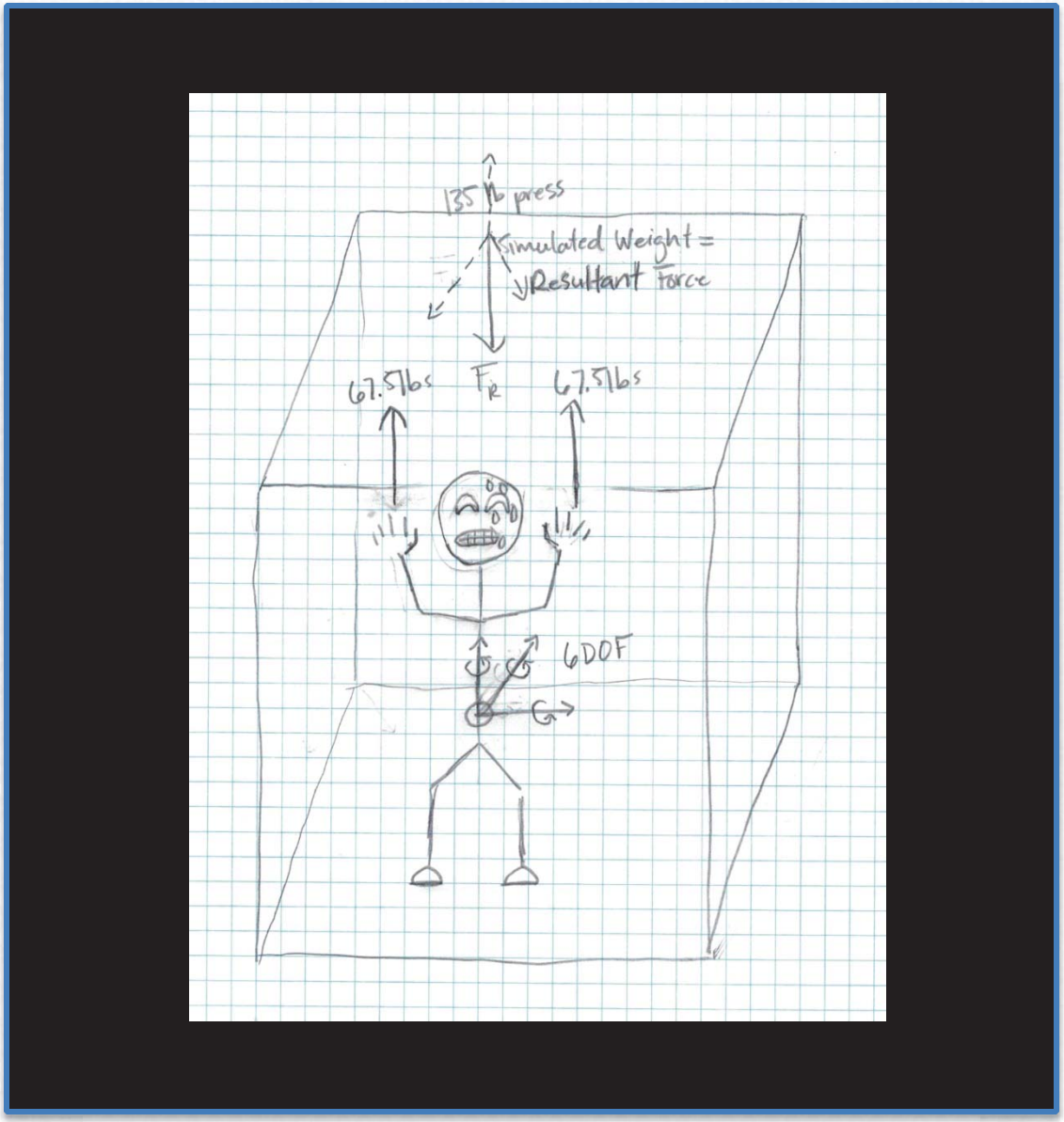
wahoo

Concept

- A strength training machine
  - Capable of a comprehensive range of movements.
  - No (traditional) barbell.
  - No weight plates.
  - Programmable.
  - Electromechanical force transmission.
  - Foot print no larger than squat rack platform.

wahoo

Early Ideation



https://goo.gl/ANsC6K

wahoo

Water Nozzle Design

- Develop a pipe cleaning nozzle for use with high pressure water jetting unit.
- Students will have the opportunity to visit the company in Alpharetta and work closely with a GT alumni

Automated Paper Folding System

- An automated device to assist with fabrication of a paper based cat toy. The end solution should help reduce the total fabrication time and overall manufacturing cost. The primary tasks the machine has to perform are the score and fold pieces of paper per a pre-determined size/shape.

Building Efficiency Technologies by Tomorrow's Engineers & Researchers- (BETTER) Capstone

5 project per semester
– potentially more than 1 team per project

Increased Team Project Funds: $3,000

Accelerating the Retrofit of Building Envelopes with 3D Printing

- Design a technique (i.e. material, 3D printing process, etc) in which 3D printing could be used to accelerate the retrofit of residential and/or commercial building envelopes.
- Develop, analyze, build, and test one small-scale prototype of a building envelope retrofit technique that uses 3D printing to deliver cost effective (or potentially cost-effective) retrofit solutions.

OAK RIDGE National Laboratory

Device to assist with maintenance of Refrigeration systems

- Utilize smartphone and location based (i.e. beacons) technology in addition to the Emerson refrigeration controllers to develop a smartphone app that a technician can use to quickly determine if a system is operating correctly.

EMERSON™

Georgia Institute of Technology

Advantage Renewable Energy, llc.
Innovative Clean Energy Solutions

Capstone Design Course

Semester for the project: *Spring 2016*

Project Name:

Novel ballasting system for flat roof photovoltaics

Next

Advantage Renewable Energy, llc.
Innovative Clean Energy Solutions

About Us

Advantage Renewable Energy LLC provides renewable energy and innovative energy efficiency solutions in commercial, industrial, and residential applications.

This includes design and installation of photovoltaic systems, solar thermal projects, and LED lighting upgrades/retrofit projects.

Company Founders (Project Contacts):
David Wiley
Todd Oliver

Back Next

Project Summary

- In many commercial photovoltaic installations it is not possible to use roof penetration methods for mounting.
- The most common practice is to attach the panels to a racking system and fix the rack to the roof with concrete block ballasts.
- This method is non-ideal and reduces energy efficiency.

Back Next

Mounting Techniques

Attached. A structurally attached type of system relies on penetrations in the roof surface and connections to the framing.

Ballasted. Ballast mounts rely solely on the weight of the array, racking system and additional material, like concrete pavers, to hold the array to the roof. Their biggest advantage is the lack of roof penetrations.

Hybrid. A minimally attached, or hybrid, system takes advantage of both attached and ballasted features. A hybrid racking system will require a minimum number of penetrations and some level of ballasting.

Back Next

Ballasted Mounting

- Their biggest advantage is the lack of roof penetrations.
- These arrays can generally be installed while maintaining the roof warranty.
- Ballasted systems need to be carefully analyzed due to the increased roof loading imposed by the array.

Back Next

Project Mission

- *The purpose of this project is to design, build, and test* a novel ballasting system for commercial flat roofs.

- Ideally the ballast system will provide additional benefits to the customer, which could include energy storage, increased stability, increased ease of installation, lower weight, or other benefits.

Back Next

Advantage Renewable Energy, llc.
Innovative Clean Energy Solutions

Thank you!

Advantage Renewable Energy, LLC.
3130 S. Martin Street, Suite 200
Atlanta, GA 30344
Phone: 404-763-5681

Back Next

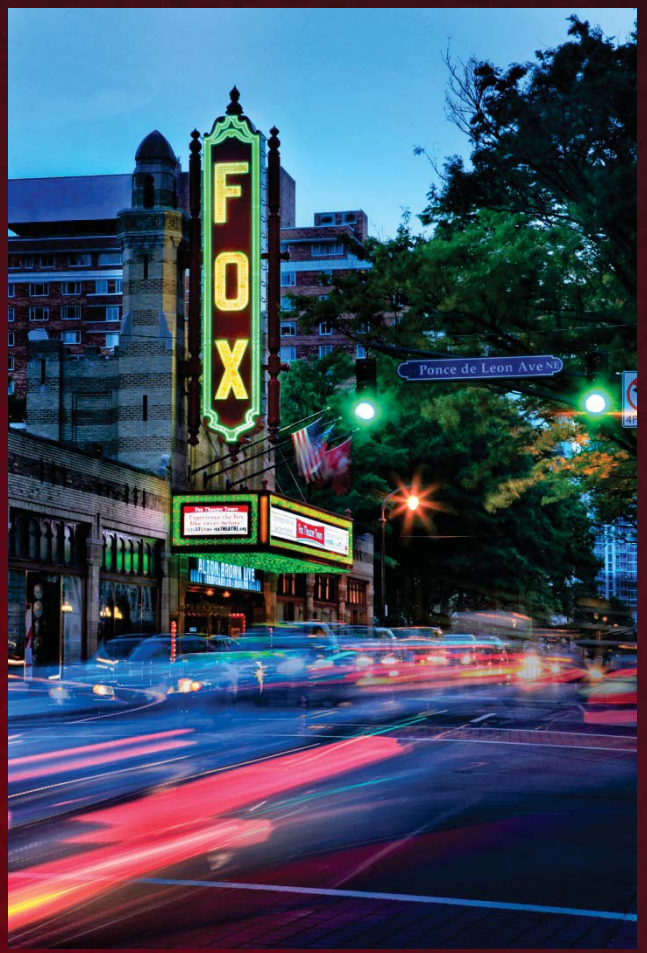
The Fox Theatre

Dominic Bruno, Operations Manager

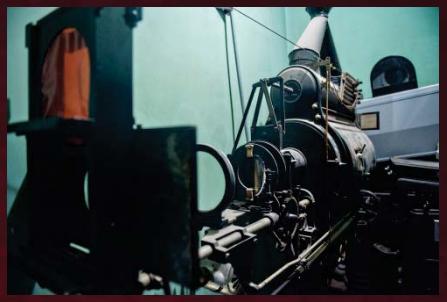
FOX THEATRE
ATLANTA'S
MEMORY MAKER

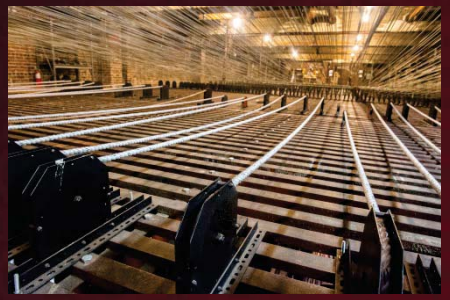
The Basics

- Facility Overview
- Department Structure
- Areas of Responsibility
- Energy Efficiency Challenges



FOX THEATRE
ATLANTA'S MEMORY MAKER



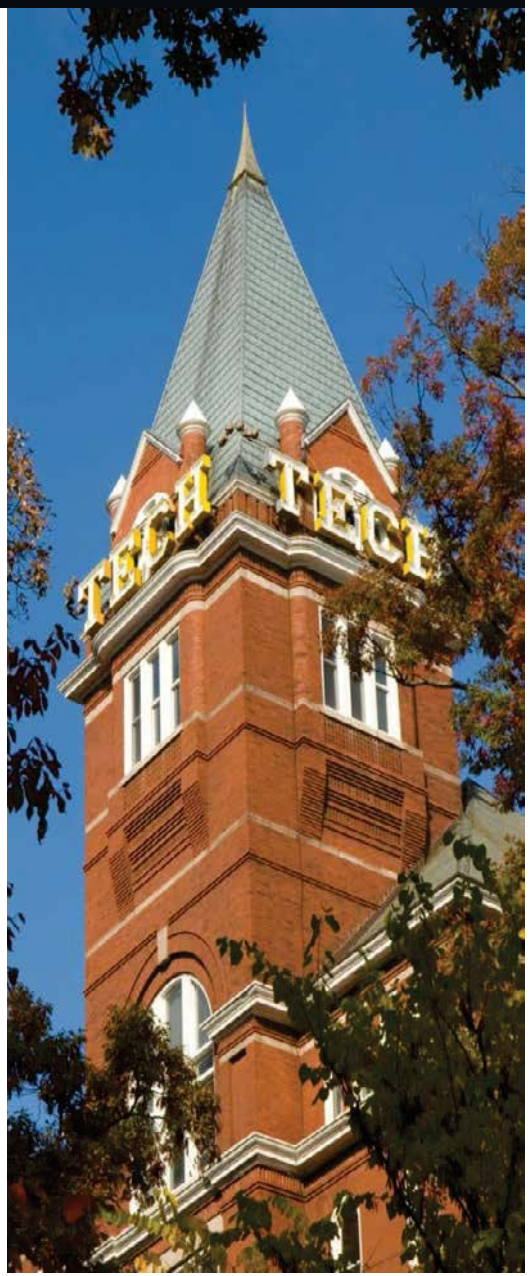


FOX THEATRE
ATLANTA'S
MEMORY MAKER

GT Internal Sponsored projects

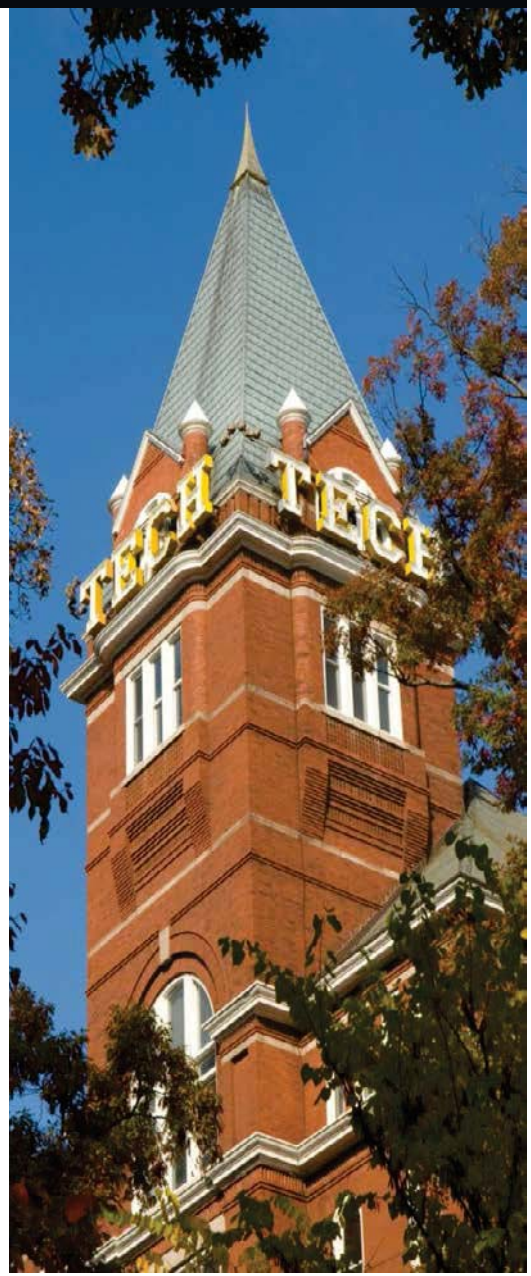
- Reimbursement for project prototypes directly by the sponsor
  - GTRI
  - Arch/ME/MSE
  - Dr. Harris
  - EcoCar Race Team – Dr. Leamy
  - Dr. Prausnitz

GTRI MACHINE SERVICES



Georgia Tech Research Institute
Problem. Solved.

Cole Borton
Design Services Engineer
404-407-8993
cole.borton@gtri.gatech.edu



Georgia Tech Research Institute

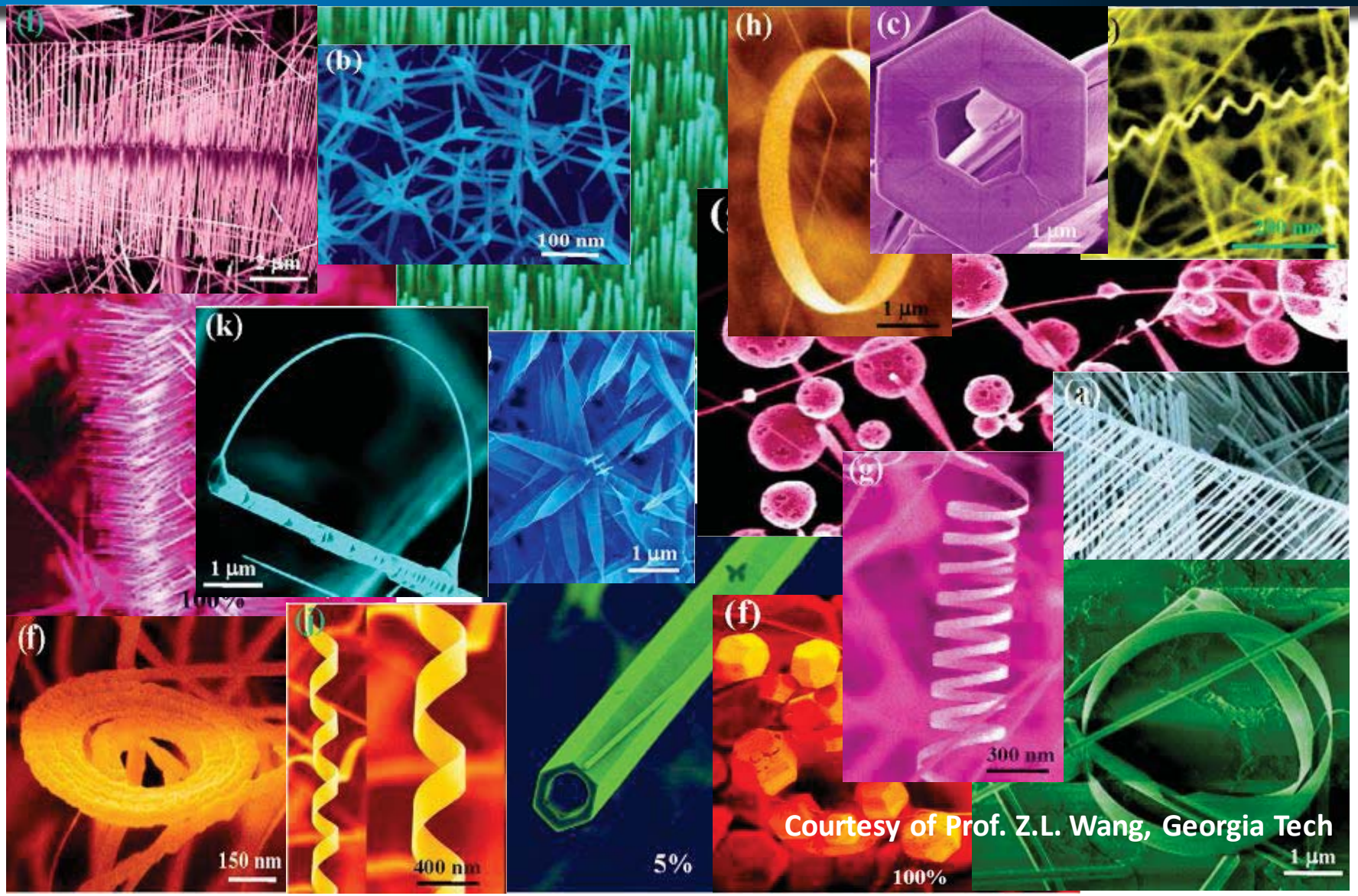
Problem. Solved.

Piezoelectric embedded in "Vapor Trail" path for interactive installations

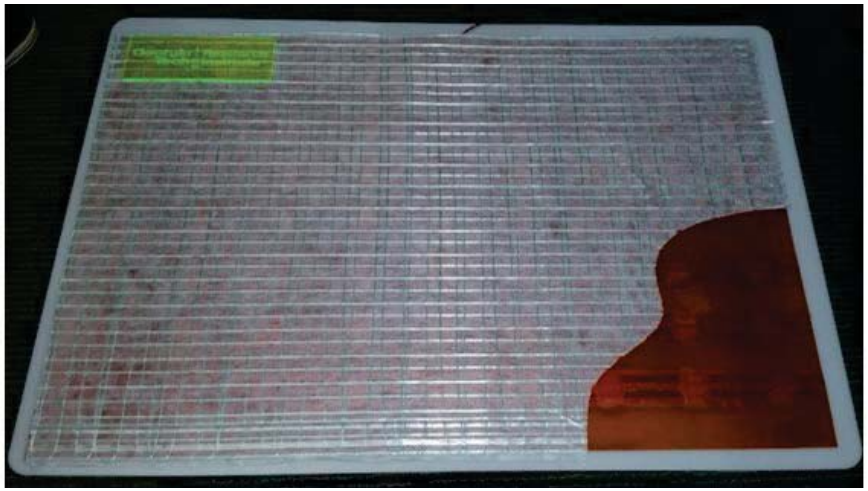
GTRI January 2016

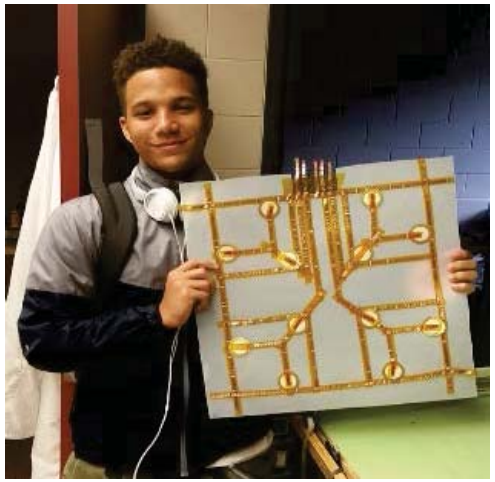
Nano Materials and Engineering

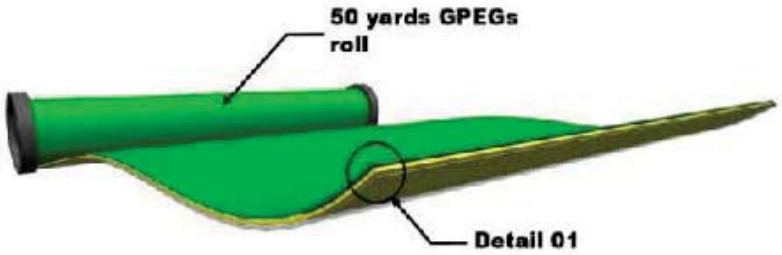
Georgia Tech Research Institute

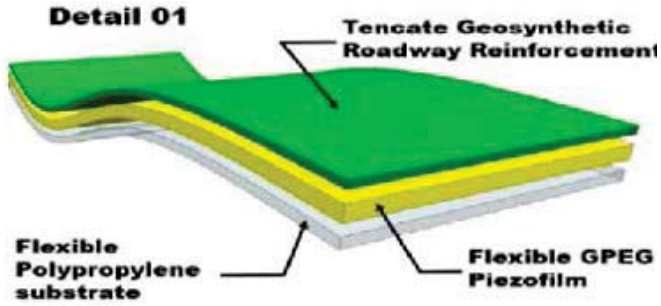


Piezoelectric System Developed at GTRI





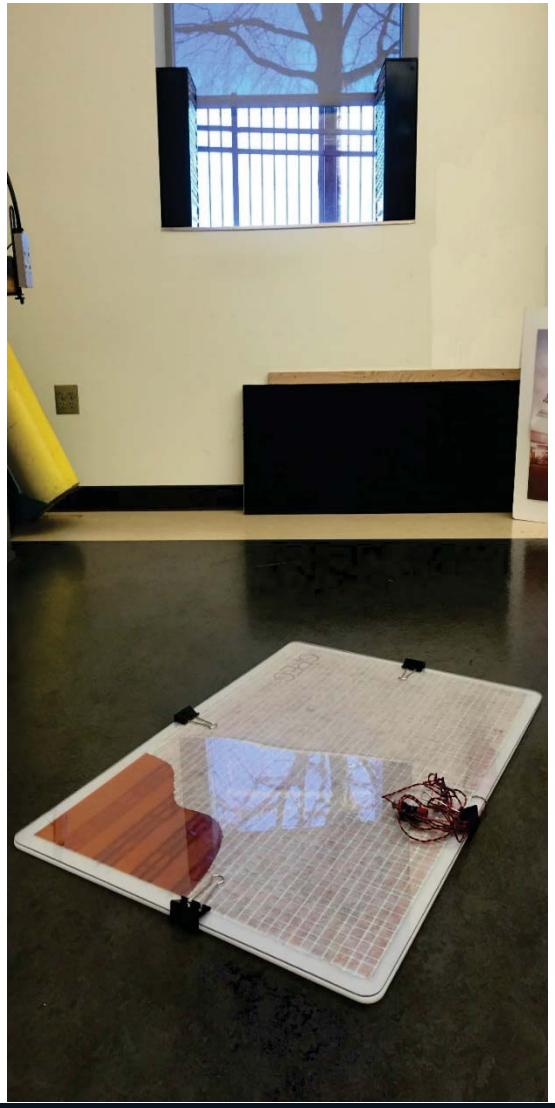


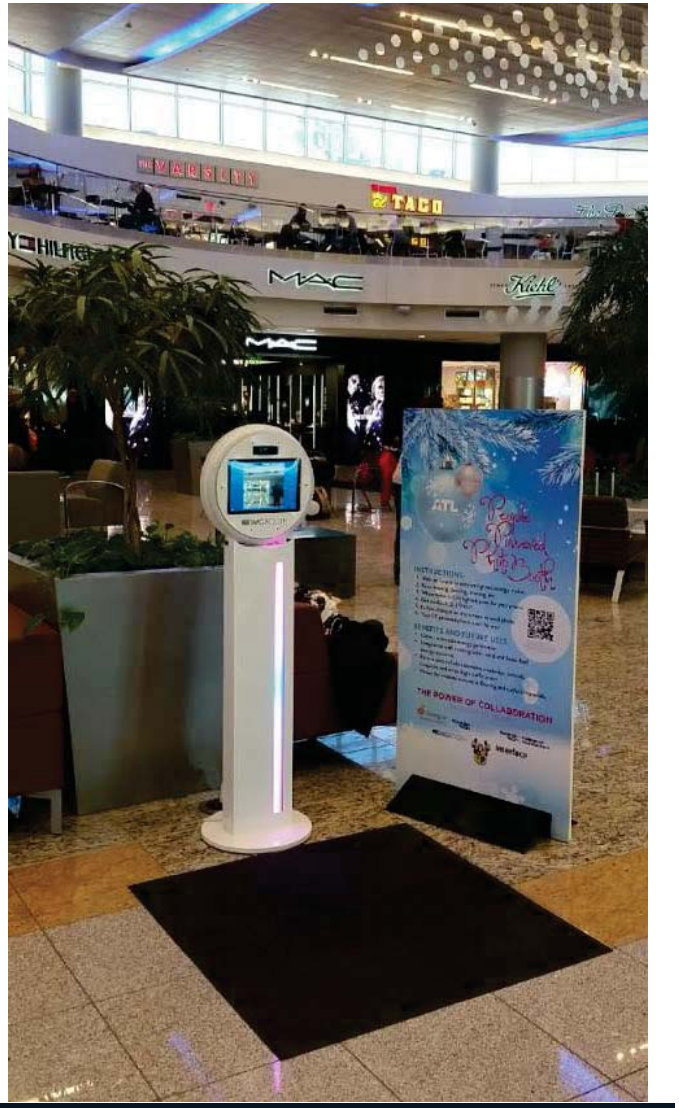


GPEG Prototype. Top layer, Tencate Mirafi, while cut out shows flexible PZ substrate Schematic of the geosynthetic piezoelectric generation (GPEG) system and its layered components.

GTRI Prototypes

Georgia Tech Research Institute





II. Applications

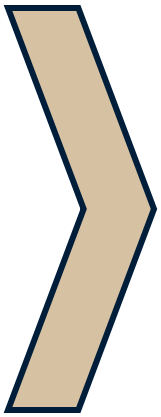
Georgia Tech Research Institute

A. SENSING

A. Traffic Patterns
B. Wayfinding and Tracking
C. Fall Detections (i.e. Healthcare)
D. Security

B. ENERGY

A. Indoor Flooring
B. Human Roads
C. Outdoors Roadways – Cement
D. Vehicular Roads



(A + B)

NASA Kennedy Space Center

Georgia Tech Research Institute

- **Piezoelectric embedded in Vapor Trail path for interactive installations**

Project A: Fabrication and Scalability of Piezoelectric Materials

Georgia Tech Research Institute

Problem

- The laboratory setting for fabrication of Piezoelectric materials does not yield to large scale manufacturing and scalability

Goal

- Understanding of the systematic process used to fabricate and characterize PZ materials, the student will be able to develop a process that expands upon the current growth techniques, allowing for future scalability

Deliverables

- Report/analysis on the current methods for fundamental fabrication and characterization of piezoelectric materials and devices.
- A roadmap for manufacturing scalability to create commercial ready products
- Cost analysis detailing the processes necessary to reach product commercialization, and the potential roadblocks we may face.

Team Budget: $2000

Project B: Piezoelectric Enabled Outdoors Flooring System

Georgia Tech Research Institute

Need

- Design of a Piezoelectric Enabled Outdoors Flooring System to be showcased in a interactive exhibit at NASA KSC.

Goal

- The PZ flooring system needs to be conceived as a discreet unit that create surface on its aggregation. These units have structural and electrical (low voltage or signal) connectivity, and should stand high pedestrian traffic.

Deliverables

- Product Requirements Summary Report
- Prior art review and patent search
- Design concepts and models
- Working prototypes of design embodiments

Team Budget: $2000

Project C: Automated System to Install PZ Components on architectural structures

Georgia Tech Research Institute

Need

- An automated approach to assist with the installation of piezoelectric embedded building components (developed by team B) on architectural structures

Goal

- The team will need to work with students from Architecture and team B to develop the specifications of the automated system. The outcomes of this project will be showcased at the NASA KSC

Deliverables

- Working prototype (maybe scaled) to demonstrate the design and final report
- Design Concepts/ models/ simulations

Team Budget: $2000

Customized seating for children with disabilities

Dr. Harris, Director of the Engineering for Social Innovation Center

Project Partner: The Spoon Foundation

- Works in orphanages, foster care, and low resource communities
- Aim to improve feeding and nutrition for children with disabilities
- www.spoonfoundation.org

Project Need: Customized Seating

- Holding children during feeding is difficult.
- Many children are fed lying flat on their backs.
- We need a customized seating solution for upright feeding.

Project Specs

- Easy to use, durable, and inexpensive
- For children weighing 6 lbs – 40 lbs
- Made with common materials that are locally available
- Easy to clean
- Adaptable for floor or table feeding
- Lean form factor
- Allow for face-to-face feeding

Project Team

- Mechanical Engineers
- Industrial Designers
- Biomedical Engineers
- CAD skills are desirable

Energy Storage System(ESS) Thermal Management Development

- ESS is a energy storage system that can have varying internal conditions such as time variant heat output in this case that needs to have careful temperature control (in 3-D geometry) influenced from outside temperature as well and control of the system.
- A graduate student will be available to mentor the student team and can lend COMSOL expertise to the team.

Device to Apply Microneedle Patch for Rabies Vaccination

- The project is to develop a device that can apply the microneedle patch to the ear of a dog (accounting for the diversity of dog breeds) in a way that is simple, fast and safe.
- ME/BME blended project offered by Prof. Prausnitz from School of Chemical & Biomolecular Engineering