Projects for Capstone Design (ME4182/GT4823)

Fall 2018

Sponsored Projects

http://projects.gatech.edu

Types of Projects

- **C**ompany sponsored
- Non-sponsored (**S**tudent) projects
- **F**aculty & **E**ntrepreneur sponsored

Project Types

- **C**ompany-sponsored projects are eligible for reimbursement of 90% of each team's expenses up to a maximum amount of **$900**. If your team spends $1,000 or more, you can receive $900 as a reimbursement. If your team spends less than $1,000 you will be reimbursed 90% of your expenses **by the School**.

- Non-sponsored (**S**tudent) projects are eligible for reimbursement of 80% of each team's expenses up to a maximum amount of **$800**. If your team spends $1,000 or more, you can receive $800 as a reimbursement. If your team spends less than $1,000 you will be reimbursed 80% of your expenses **by the School**.

- Projects sponsored by **F**aculty and **E**ntrepreneurs (projects titles have "F" or "E" as prefix on projects.gatech.edu) are eligible for reimbursement of 100% of each team's expenses **directly** by the faculty/entrepreneur sponsor. Please confirm the expense with the sponsor prior to making the purchases.

Due Dates

- Next Studio – Come prepared to form teams of 4-6; discuss project ideas.
- **Saturday, 08/25, 08:00pm** – deadline for submitting bids for sponsored projects on **projects.gatech.edu**
- For your own idea:
  - Get approval from instructor;
  - Register your team on projects.gatech.edu
- Make sure **ALL** team members are listed in your team on projects.gatech.edu

Company Projects

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

Sponsor Pitches

- C01-Powered Golf Club
- C02-Gas Turbine Transition ...
- C03-Development of Applianc...
- C04-Mechanically Advantaged...
- C05-Portable Ventilator Hum...
- C06-Reel repeatability and ...
- C07-Ruggedized Outdoor Eco ...
- C08-E-Nano
- C09-Hole Shape Inspection o...
- C10-Improved Load Arrestor ...
- C11-Compressor vane carrier...
- C12-Textile Recycling Machine
- C13-Universal Pill Dispenser
- C14- KC Project

- E1-Rapid-Cooling Tea Device...
- E2-Spring Shoe
- E3-Automated 360-degree 3D ...

- F1-System to measure normal...
- F2-DESIGN OF AN EXTRUSION H...
- F3-Swimming Swarm

C01- Powered Golf Club

- A new company would be created
- Guided by Dr. Steve Dickerson, Professor Emeritus
- Former companies

Peachtree City Commuter Bus
DVT Corporation
SoftWear Automation
CAMotion Inc.
RideCell
SoftWear Automation
RideApp

- GA Tech has made about $3M on these companies
- Total values over $200 million

Golf Equipment Market Expected to Reach $9,666 M, Globally, by 2023 https://www.alliedmarketresearch.com/press-release/golf-equipment-market.html

a “golf club” that permits a *disabled* person to have the pleasure of golfing

likely configuration hits the ball with a hammer powered by compressed air driving a pneumatic cylinder. *High-tech* in materials and energy system. 20 to 200 yards.

www.ezeegolf.com

C02 - Gas Turbine Transition Hole Resizing Project

MHPS

Mitsubishi Hitachi Power Systems

Gas Turbine Transition Hole Sizing Challenge

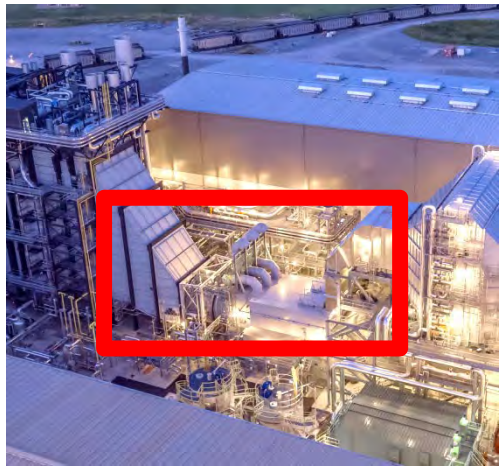
Stephen von Broembsen, CI Manager

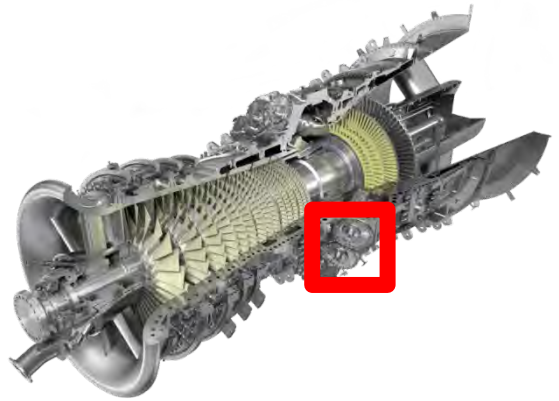
Mitsubishi Hitachi Power Systems Savannah Plant

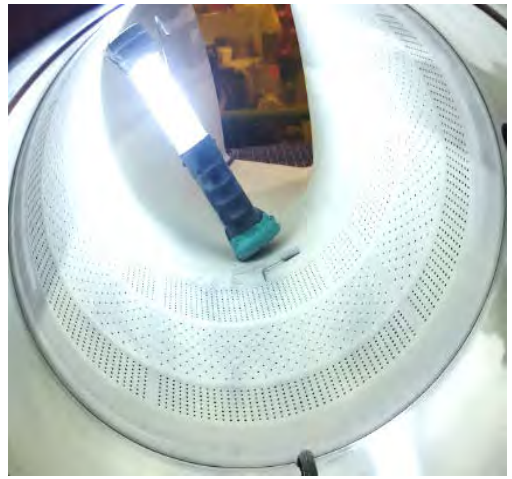
Items of Interest:

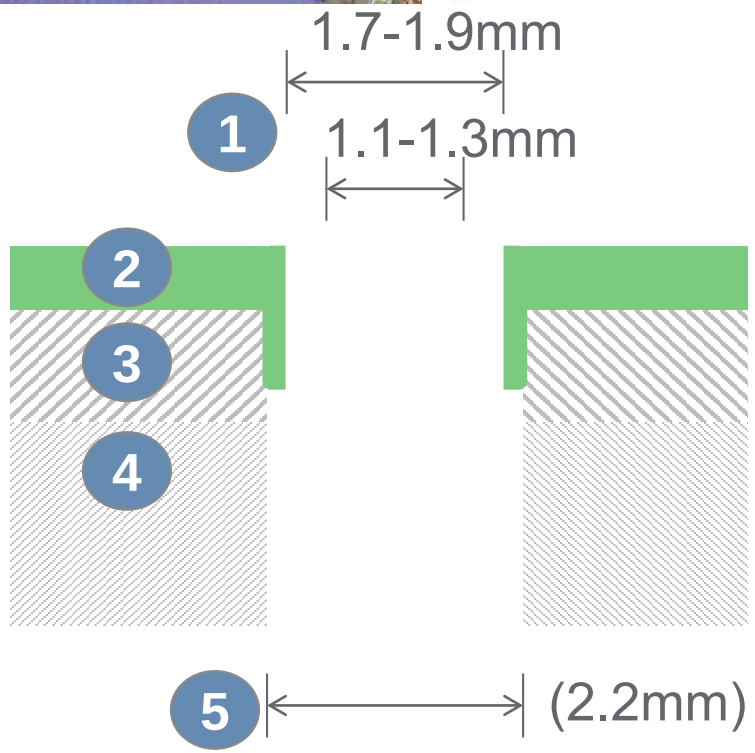
- We don't make cars, air conditioners, ships, fridges, vacuum cleaners …
- What we do make is large scale gas and steam turbines used to generate electricity
- 2010 SMW personnel move into building
- 2012 First M501GAC unit shipped from SMW
- 2014 First Steam turbine shipped from SMW
- 2015 SMW awarded medium size manufacturer of the year
- 430,000 ft^2 under roof
- 120 acre site

Description of Challenge and the Team









1. Hole size after inner panel coating
2. Layer of coating
3. Inner panel
4. Outer panel
5. Reference hole size after coating

Description of Challenge and the Team

C03-Development of Appliance Insulation Process


ROPER
CORPORATION

Freestanding

Wall Ovens

Slide-Ins

Radiant Counter Units

Gas Counter Units

GE | Café™ Series

GE

GE Profile

GE Monogram

CAVITY INSULATION WRAP

INSULATION

CAVITY PARTIALLY WRAPPED

CAVITY BLANKET ADDED

CAVITY BLANKET TUCKED

C04-Mechanically Advantaged Handle for Sliding Glass Door

Kawneer Co., Inc

- *A single source for diverse façade solutions*

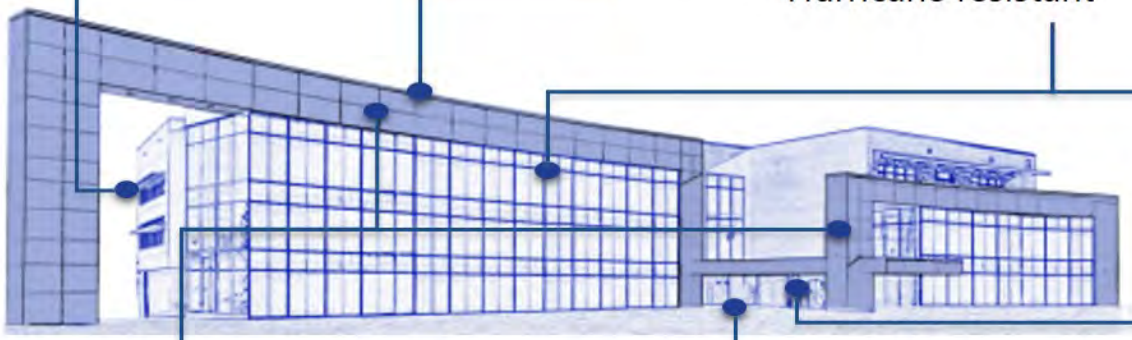
Kawneer Sunshades/ Light Shelves

Innovative Solutions

Kawneer Curtain Wall Systems
- Thermal
- Ultra thermal
- Blast mitigation
- Hurricane resistant

Window Wall Systems
- Thermal

Kawneer Windows
- Thermal
- Ultra thermal
- Blast mitigation
- Hurricane resistant



Aluminum Composite Panels

Kawneer Framing Systems
- Thermal
- Ultra thermal
- Blast mitigation
- Hurricane resistant

Kawneer Entrances
- High traffic
- High thermal
- Blast mitigation
- Hurricane resistant

Kawneer Balcony/Terrace Doors
- Hurricane resistant

ARCONIC

C05-Portable Ventilator Humidifier

- Design a portable device that gives proper heated humidity to the lungs and airway when traveling away from home.

C06-Reel repeatability and power reduction

Reel Repeatability & Power Reduction

- **Background:** Reels cut grass precisely and

  which is easier on the grass & roots

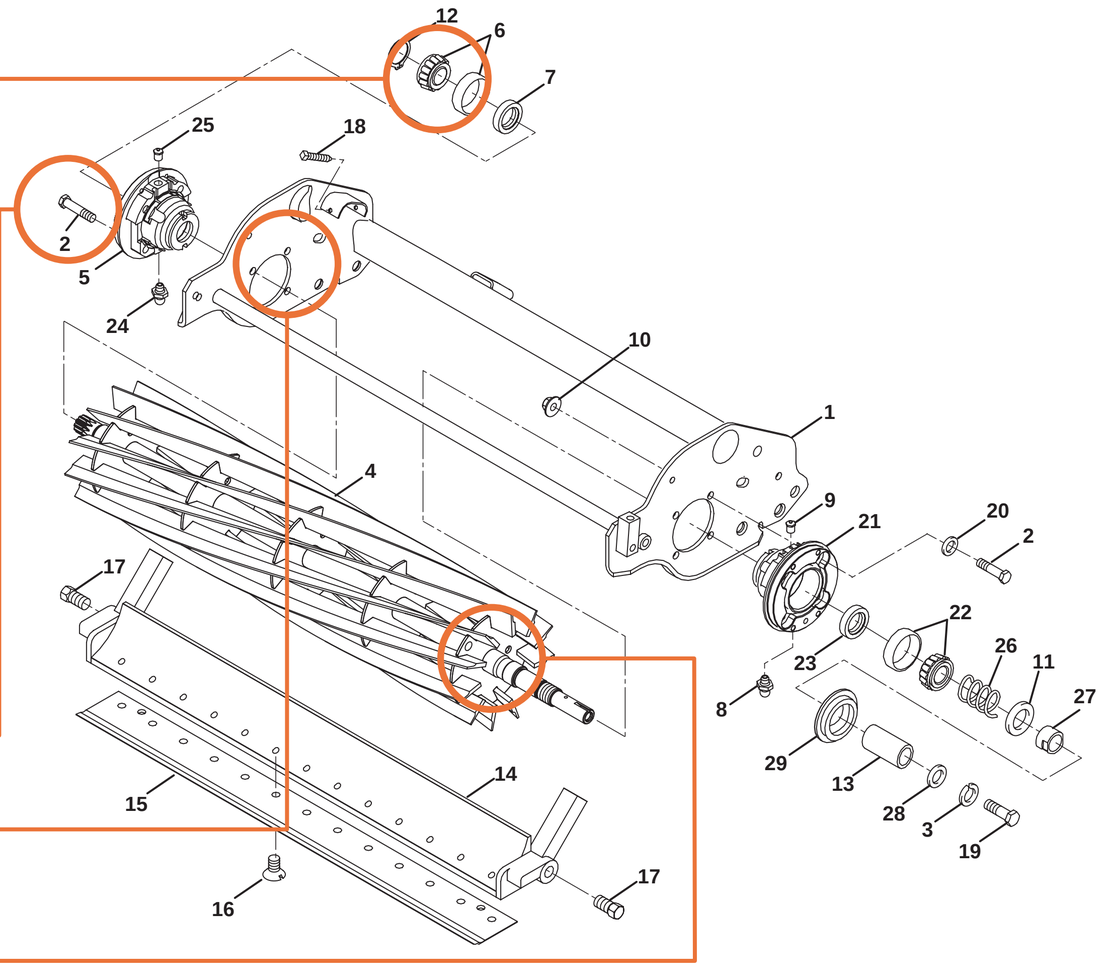
- **Problem:** Power consumption varies from unit to unit (of the same model), due to variations in assembly

- **Objectives:**

1. Remove variability in manufacturing
2. Reduce power consumption by 15%

...without changing...

reel function, bed knife adjustment,
reel-to-bedknife position, or weight distribution



- **Areas of Analysis & Exploration:**

- Bearing loading & friction

- Fastener torque

other components

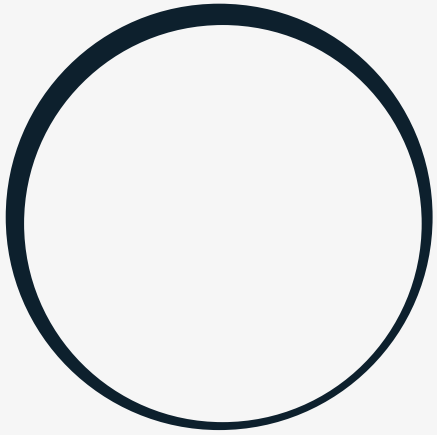
- Rotating mass

- Fluid mechanics :)

- **Might get to use:**

- CAD, FEA, Tolerance Stacking, Computation Fluid Dynamics (CFD)

C07-Ruggedized Outdoor Eco (ESS)
C08-E-Nano



sonnen

energy is yours

sonnen

- Market Leader in residential energy storage systems (ESS)
- 10-years in the business (3+ in the US)
- 500 Employees across Germany, US, Italy, Australia, UK and France
- 30K+ Units installed globally
- Offering On-grid / Off-grid systems tailored for self-consumption + grid enable services

Ruggedized Outdoor eco

Project Summary

SCOPE

Design a concept that will provide a viable and efficient method to support energy storage systems in outdoor environments

1. Increase the operating temperature range of the sonnen eco
2. Resist heavy corrosion due to higher saline content in ambient
3. Consume as little power as possible
4. Maintain design aesthetics (rugged, simple and of high-quality)

IMPACT

Design will be the baseline of our outdoor product line targeting markets such as Hawaii, Puerto Rico, LATAM, coastal and desert US.

E-nano

Project Summary

SCOPE

Design a portable power plant concept that:

1. Will be easy to transport
2. Will be easy to setup
3. Combines Solar + Battery Storage Technology
4. Suited for outdoor environment

IMPACT

Provide a viable and robust solution to disaster relief initiatives that is only dependent on solar energy thus reducing the amount of downtime critical electric loads are without power.

C09-Hole Shape Inspection of Laser Drilled Suture Needles

Needle Inspection System

ETHICON
a Johnson & Johnson company

Needles Background

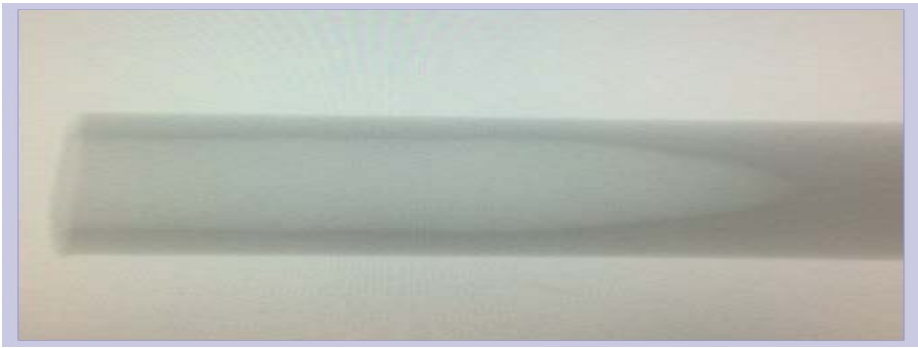
Are utilized in surgery for wound closure surgical procedures.

There are multiple hole sizes and depths depending to the type of suture they will be attached to

ETHICON, Cornelia manufactures the needles and sutures for downstream assembly.

Current Process

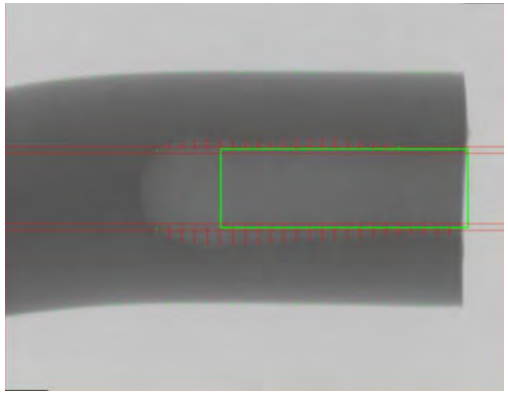
The Ethicon (Johnson & Johnson) manufacturing process for surgical suture needles utilizes a laser to drill a hole in the needle that is necessary for suture attachment. The holes are aligned with the center of the needle wire. The hole diameter, depth and hole shape are important for correct suture attachment.

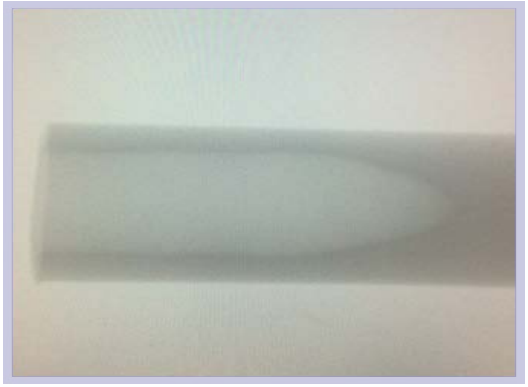


Project Concept

The purpose of this project is to identify a technology that is capable of analyzing the hole shape of laser drilled suture needles. Study should be conducted with the identified technology to establish Proof of concept

A proposal could be to utilize the existing X-ray machine to provide a digital image of the needle hole. Machine vision software can be developed to measure and analyze the needle hole shape.





Other information

Design considerations (if any): The laser drilled suture needles have a hole diameter of approximately 0.010 inch (from .0024 to .0165 inch). An inspection system will need to provide sufficient resolution for the hole measurements.

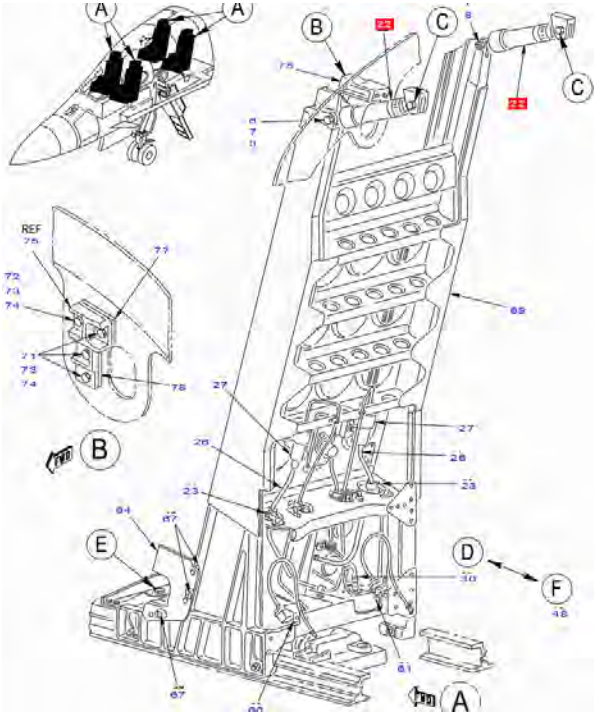
Desired student skills:
At least one of the team members needs to have skills necessary to utilize machine vision software tools.

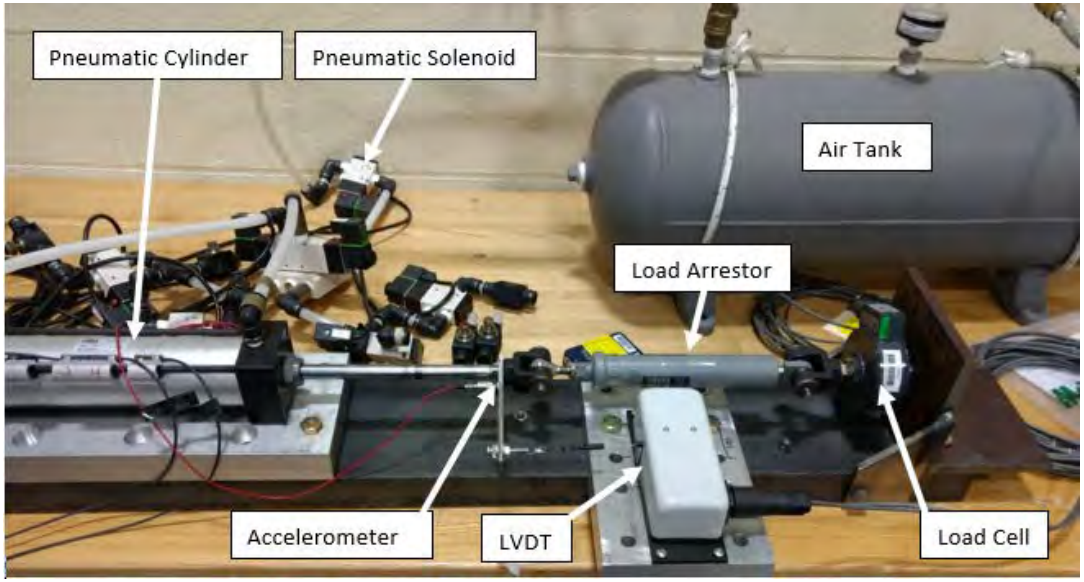
Acceptable solutions/deliverables:
Identify and investigate different technologies for measuring the needle hole shape and diameter. Complete study with selected technology to establish proof of concept.

C10-Improved Load Arrestor Test Stand

By Robins Air Force Base

- The B-1B aircraft seat carriage is attached to fuselage structure using a device called a load arrestor. After performing maintenance the load arrestors require operational testing prior to being placed in service. An improved tester is required that fully complies with the load condition specifications and generates a user friendly data output





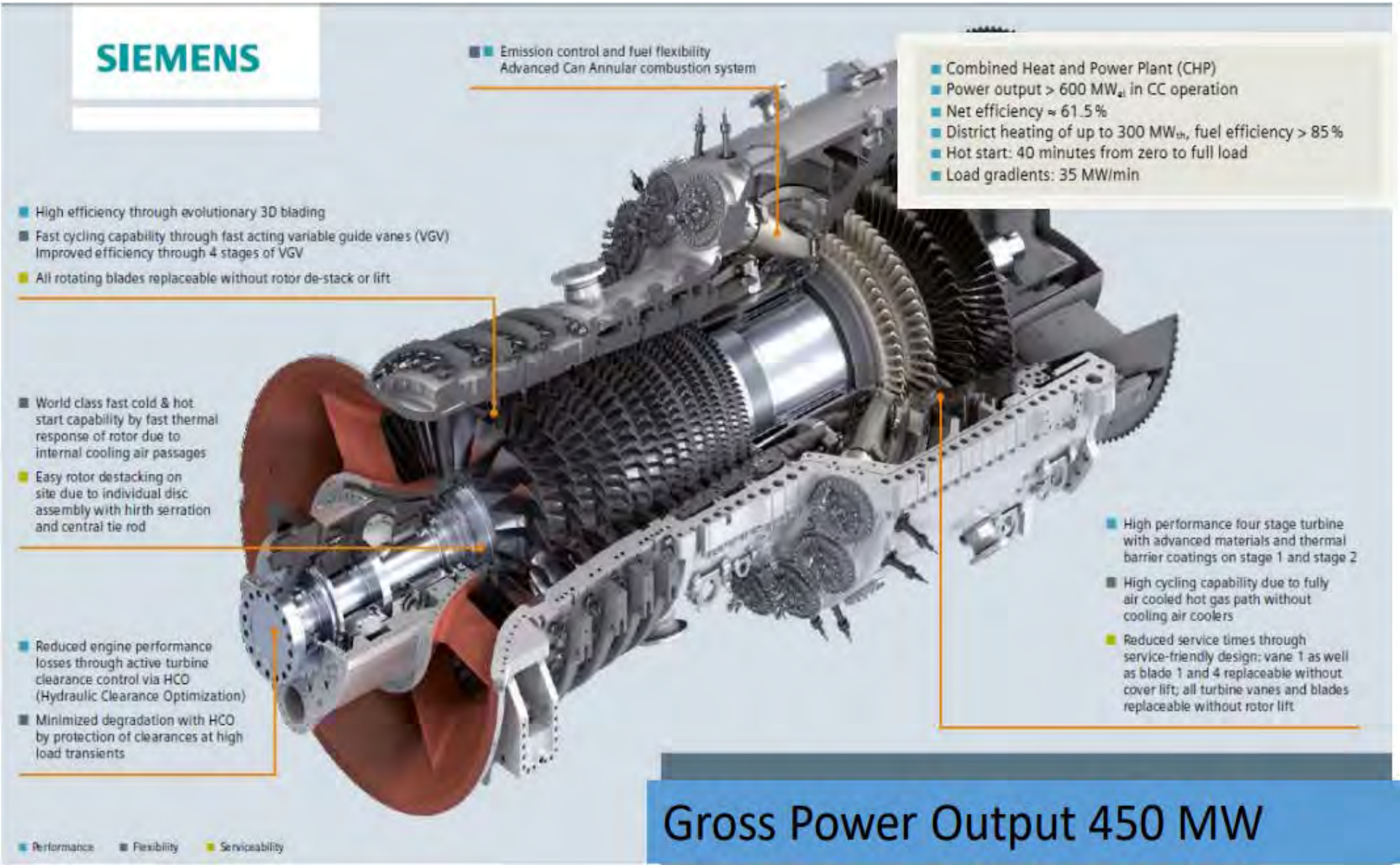
C11-Compressor vane carrier roll out Tool Design – Siemens Energy

SIEMENS

Project Name: 8000H Row #2, #3 and #4 Compressor Vane Carrier Roll-Out tool(s)

Contact & Time Zone	Name & Title	Email	Phone
Direct Contact (EST)	Gabriel Rubio, Project Lead	gabriel.rubio@siemens.com	Tel: (404)-514-5155
Liaison (CST)	Ernie Ayala, Project Manager Operational Excellence	ernie.ayala@siemens.com	Tel.: +1 (281) 946-4138 Mob:+1 (409) 539-2068
R&D Engineer (CST)	Praveen Matlapudi	praveen.matlapudi@siemens.com	Tel: +1 (281) 946-4019 Mob:+1 (281) 220-7086
Assets Manager (Hou/Atl) (CST)	Shannon Ziskovsky	shannon.ziskovsky@siemens.com	Tel: +1 (281) 946-4065
Plant Manager (EST)	Singleton, Blanche Plant Manager (Atl)	blanche.singleton@siemens.com	

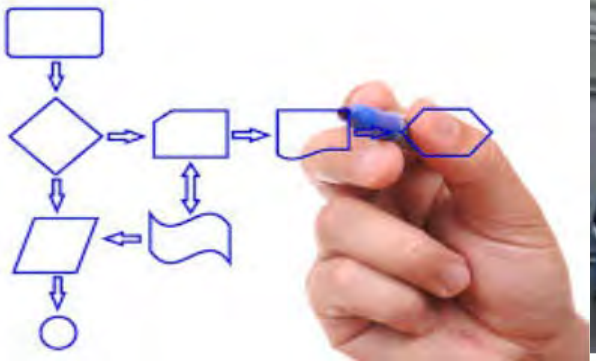
s SGT-8000H


SIEMENS
Emission control and fuel flexibility
Advanced Can Annular combustion system
Combined Heat and Power Plant (CHP)
Power output > 600 MWel in CC operation
Net efficiency ≈ 61.5 %
District heating of up to 300 MWth, fuel efficiency > 85 %
Hot start: 40 minutes from zero to full load
Load gradients: 35 MW/min
High efficiency through evolutionary 3D blading
Fast cycling capability through fast acting variable guide vanes (VGV)
Improved efficiency through 4 stages of VGV
All rotating blades replaceable without rotor de-stack or lift
World class fast cold & hot start capability by fast thermal response of rotor due to internal cooling air passages
Easy rotor destacking on site due to individual disc assembly with hirth serration and central tie rod
Reduced engine performance losses through active turbine clearance control via HCO (Hydraulic Clearance Optimization)
Minimized degradation with HCO by protection of clearances at high load transients
High performance four stage turbine with advanced materials and thermal barrier coatings on stage 1 and stage 2
High cycling capability due to fully air cooled hot gas path without cooling air coolers
Reduced service times through service-friendly design: vane 1 as well as blade 1 and 4 replaceable without cover lift; all turbine vanes and blades replaceable without rotor lift
Performance
Flexibility
Serviceability
Gross Power Output 450 MW

Motivation, Impact & Benefits

- ↑ *Financial Benefits* = ↑$$
- ↑ Process Improvement = ↑$$
- ↓Procedure Steps = ↑$$
- ↓ Time at Site = ↑$$
- ↓ *Crane Time* = ↑$$
- ↓ Critical Time = ↑$$$$

Time



C12- Textile Recycling

CELESTIAL

THEORY

Creating a more sustainable society through sustainable textile manufacturing and clothing design.

the problem

Facts:

Americans produce 14 million tons of textile waste each year, approximately 80 lbs per person. That waste is disposed in landfills and left to decompose. Textiles are either made from natural fibers (cotton) or synthetics (polyesters, nylons), and the decomposition route for either is less than ideal.

the vision

Project Title:
Textile Recycling

Design Considerations:
Solutions can be manually operated if needed, but should provide a transparent route for automation.

Preferred Solutions:
Design a second step to make the shredding finer. Speed up the process to shred the fibers. The current prototype can process 1 kg of textiles per hour in one step This is the equivalent to roughly 6 shirts an hour. In regard to force the machine exerts the minimum 70 MPa needed to rip the individual fibers so the motor provides the minimum 1032 Nm torque. It is able to accept up to 35g of input clothing every minute.

Develop a machine part that can accommodate the melting process. This part of the machine should have the ability to withstand extreme temperatures and should be removable.

C13-Universal Pill Dispenser

INTENT SOLUTIONS™

The Opioid Crisis is Real

*In 2017, over 72,000 people died from drug Overdoses – up from ~25,000 in 2002

We can stop this scary trend and your input could be the key to saving lives

- Smart pill dispenser
- Tracks all activity
- Biometric control
- Mobile integration

Intent Solutions is a medical device startup dedicated to helping solve the opioid crisis
Founded by Martin McLean, a recovering opioid addict

* https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates

INTENT SOLUTIONS™

Problem Definition

Dispensing pills one at a time is not easy

- Opioids come in different shapes and sizes
- Most pills come in one of 3 shapes (round, oblong and oval)
- We currently use over-encapsulation but that is problematic
- To have the largest impact possible, we need a way for tad to dispense different shapes and sizes without encapsulation

We are seeking an energetic team of creative engineers to develop concepts for dispensing pills of various shapes and sizes

Join us on our mission to save lives and reverse the opioid crisis trend

C14 - Hard Roll Towel Dispenser Access

Capstone Design Project 2018

Who We Are

The Kimberly-Clark Professional* Brand helps you make a difference, with innovative solutions.

The Kleenex® Brand promises to constantly innovate to consistently deliver superior product performance and premium quality.

Scott® Brand promises design that consistently delivers superior value by offering the optimum balance of product quality and affordability.

The Current Problem

Our dispensers are currently opened at the top with a metal key. The door hinges at the bottom and opens forward to allow access to the internal compartment. This requires an active action by the servicer to ensure the door is not damaged, which takes more time and effort to change out paper or address a dispenser issue. By opening at the top, this also creates a challenge for servicers who might not be able to reach where the lock is currently located.

The Challenge

- Develop mechanics required to open and close dispenser door
  - Seamless, intuitive servicer experience
  - Ergonomics are considered so that actions required to open and close dispenser are minimal and effortless

  Thought-starters:
    - Where and how does the dispenser door hinge?
    - Does the dispenser open and close itself?
    - What forces are required to close the dispenser?

- Develop mechanics required to secure door in a closed, sealed position
  - Develop latching mechanism
  - Ensure door edge is sealed and does not allow water ingress

The Challenge (Cont.)

- Consider locking mechanism
  - What is the optimal position for lock access and how is the lock actuated?
  - Non-powered and powered executions

- Solution can be optimized to fit dispenser interior volume while minimizing footprint and size
  - Interior volume will be defined by Kimberly-Clark
  - Dispensers will be provided for reference and inspiration but would not be used to define creative limitations

We Are Looking For….

- Strong, robust mechanical solutions that take into consideration volumetric and manufacturing constraints
- Creative executions that account for ergonomics and human-centric design
- Unique perspectives that strive to optimize systems designs through iterative design and rapid prototyping

Thank you!

F1-System to measure normal and tangential loads on a hospital bed chassis

- Feel free to contact Prof. Stephen Sprigle if you have any questions.

F2-Design of extrusion head and process for 3D Printing of Cellular Refractory Insulating Materials using a Cement Matrix

Design of an Extrusion Head and Process for 3D Printing of Insulating Concrete

Russell Gentry (ARCH + CEE)

Shedon Jeter (ME)

CEE + ME Capstone Proposal
Fall 2018

Sponsor:

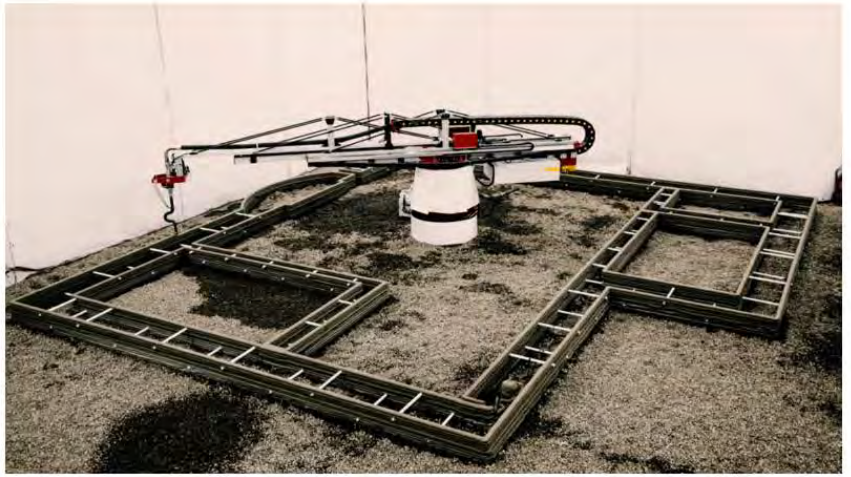
Georgia Tech Digital Building Laboratory

Problem: Many researchers have developed ideas on how to deposit massive amounts of concrete using automated methods, but few address the possibility of printing with fine detail, using a continuous process. And nobody is working on lightweight, insulating concretes that are of interest to us. We propose to develop a new material and process for 3D Printed Insulating Concrete or 3DPIC.

MIT

USC - Khoshnevis

ETH Zurich – Gramazio and Kohler



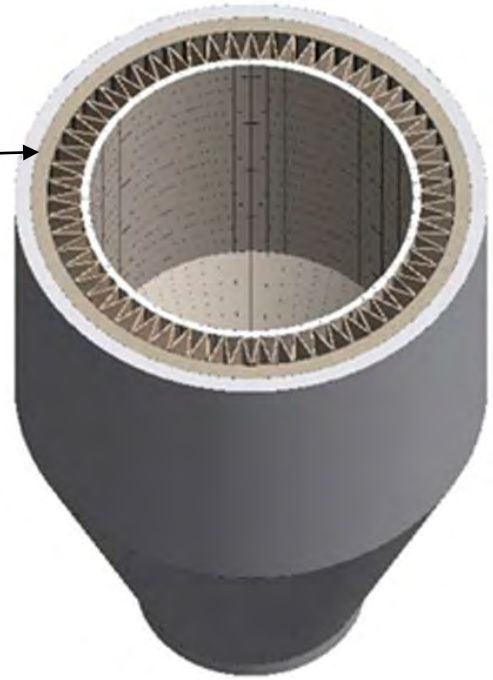
Apis Cor - Russia

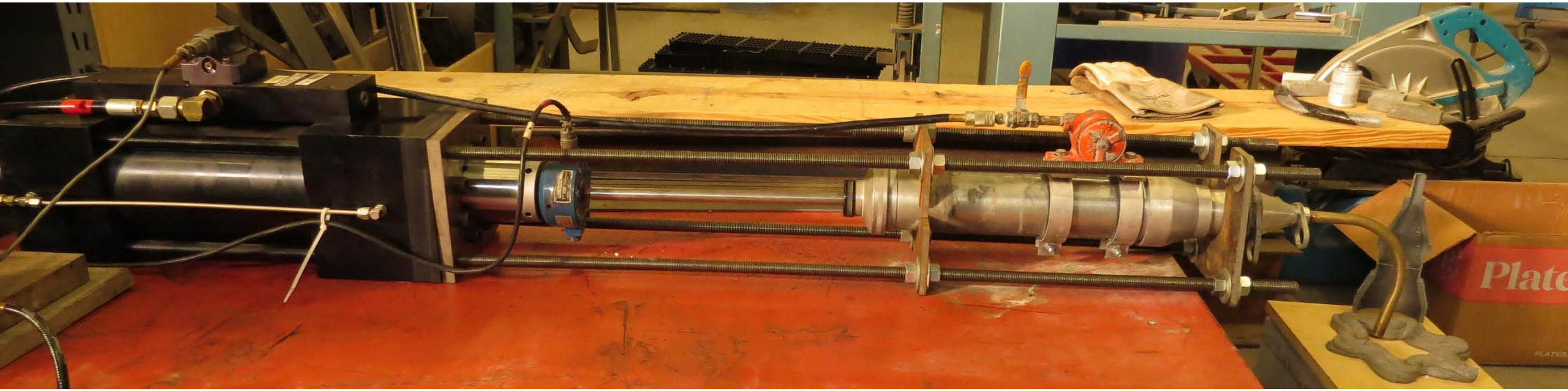
- Assess existing nozzle design and extrusion process for integration of perlite into 3DPC
- Develop perlite concrete mix designs and establish parameters for varying the mix
- Assess properties of cured insulating concrete
- Design and demonstrate new material and process for extruding 3DPIC

russell.gentry@design.gatech.edu

sheldon.jeter@me.gatech.edu

Proposed geometry for insulating concrete core in thermal reactor





Existing extruder in the GT Digital Fabrication Laboratory

Students wishing to join the interdisciplinary capstone should sign up for GT 4823, 86213.

Special Topics - Design - 86213 - GT 4823 - ME

Long Title: Interdisciplinary Capstone
Interdisciplinary Capstone Design
Associated Term: Fall 2018
Registration Dates: Mar 26, 2018 to Aug 24, 2018
Levels: Graduate Semester, Undergraduate Semester

Georgia Tech-Atlanta * Campus
Lecture/Supervised Lab* Schedule Type
3.000 Credits
Grade Basis: L
View Catalog Entry

Scheduled Meeting Times

Type	Time	Days	Where	Date Range	Schedule Type	Instructors
Class	12:00 pm - 2:45 pm	TR	Coll of Computing 53	Aug 20, 2018 - Dec 13, 2018	Supervised Laboratory*	Amit Shashikant Jariwala (P)
Class	3:00 pm - 3:50 pm	TR	Architecture (East) 123	Aug 20, 2018 - Dec 13, 2018	Lecture*	Amit Shashikant Jariwala (P)

F3 – Swimming Swarm

- Feel free to contact Dr. Mick West if you have any questions.

Georgia Tech Research Institute

Problem. Solved.

Swimming Swarm

Michael E. West, PhD

Principal Research Engineer
Electronics Systems Laboratory
Georgia Tech Research Institute
430N Tenth St. Rm 210D
Atlanta, GA 30332-0829
Mick.west@gtri.gatech.edu

Dr. Michael West

Georgia Tech

- Roboticist with over 20 years of experience
- Instructor at Georgia Tech and Researcher Georgia Tech Research Institute
- Research interests include Maritime Robotics, GPS Denied Navigation and Multi-vehicle Collaboration

The Age Old Problem in Sampling the Ocean

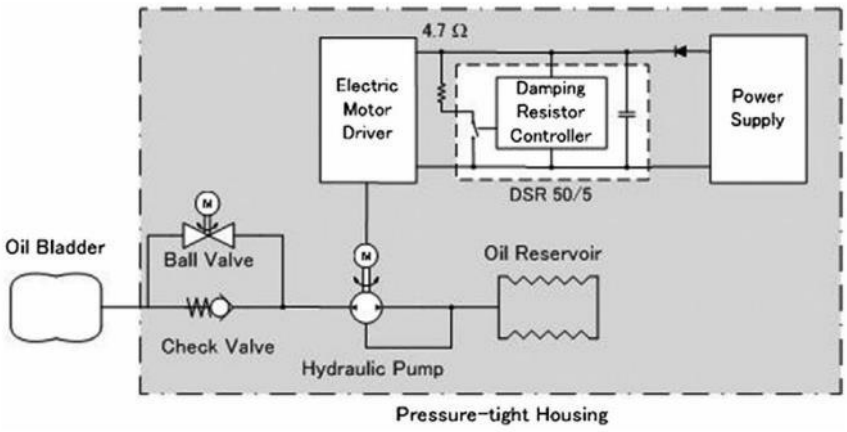
Georgia Tech Research Institute

- The Ocean is a dynamic environment in both space and time… How can we sample it?
- Walter Muck: "The 20th century will go down as the century in which we "under-sampled the ocean"
- Our Solution: A Swarm of Underwater Robots

Swimming Swarm

Georgia Tech Research Institute

- Objective: Realize an underwater float that can perform long term monitoring in a designated area.
  - Operate in the water-column.
  - If possible, develop several prototypes for team deployment.
- The project will require the development of a novel SWaP (size, weight and power) buoyancy engine allowing the efficient movement in depth.
- Interested in ME students with robotics, hydrodynamics, mechanical design and fabrication, and hydraulics.



Thank You!

Simple Team 2014 (from left to right): Catherine Walker, Mick West, Jacob Buffo, Anthony Spears, Britney Schmidt, some unknown person, Matt Meister

F4 - Autonomous Golf Cart Test Rig Development

ME4182 Capstone Concept

Autonomous Golf Cart Test Rig Development

Faculty contacts: Dr. Rich Simmons & Prof Bert Bras

Aug 21, 2018

Problem Statement

- Autonomous vehicle development is expensive and complex
- Energy consumed by autonomous vehicles is not well understood

Project Overview

Objectives

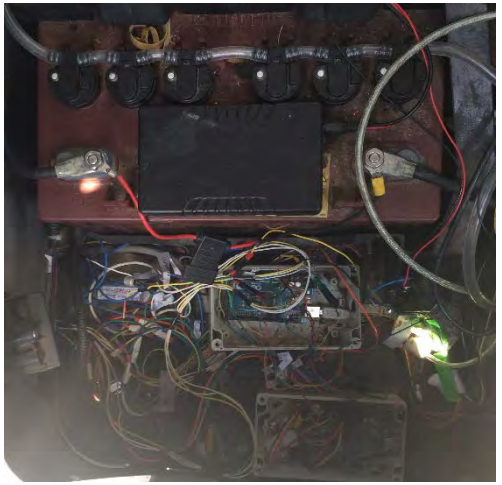
- Develop a control system for a small electric vehicle to perform simplified autonomous operations
- Develop a data acquisition system for monitoring performance and energy consumption
- Leverage the low cost and flexibility of an existing golf cart as a platform for the project

Approach

- Design an electromechanical system of controls, sensors and actuators
- Autonomous driving will: (A) follow a line; (B) mimic a manually operated or prescribed route
- The test rig may be demonstrated in specific applications/settings
- The test rig will enable repeatable cycling, helping quantify control approaches and energy use

Desired Skills

- Strong prototyping, fabrication and system integration skills
- Experience testing electrical and mechanical equipment
- Excellent oral and written communication skills
- Self-starters seeking new knowledge in unfamiliar areas
- Programming, Arduino, myRio, MATLAB/Simulink a plus



Faculty Contacts

- Dr. Rich Simmons richard.simmons@me.gatech.edu 404-385-6326
- Prof Bert Bras bert.bras@me.gatech.edu 404-894-9667

E1-Rapid-Cooling Tea Device for the Kung Fu Tea Truck

Kung Fu Tea Truck

GT Capstone Fall 2018

Kung fu Tea Truck

Mission

Bringing Kung Fu Tea to colleges and universities around the Atlanta area in the form of a food truck.

PROBLEMS

The standard procedure for producing herbal tea at a commercial scale for our mobile food service is a lengthy, resource unfriendly operation that we would like to adjust.

- **Time Sensitivity**
- **Reusability**
- **Inefficient Space Use**
- **Environmentally Inefficient**
- **Money**
- **Limited Ice Production**

Your project

Concept

The purpose of this project is to design, build, and test a rapid cooling device for large batches of liquids used for the food production industry, specifically water-based, herbal teas.

Project Constraints

1. **Limited Space**
   Size constraints might be a factor, given this will be placed on board a food truck - specific size constraints can be further discussed.

2. **FDA Regulation**
   Material constraints must be put in place, as this must be constructed of food-grade materials.

3. **Local H&S Restrictions**
   In addition, harmful materials or those requiring ventilation cannot be used, given the layout of the truck being "sealed."

4. **Electrical Constraints**
   Power consumption for the device will also be limited due to power restraints on board the truck - specific power constraints can be further discussed.

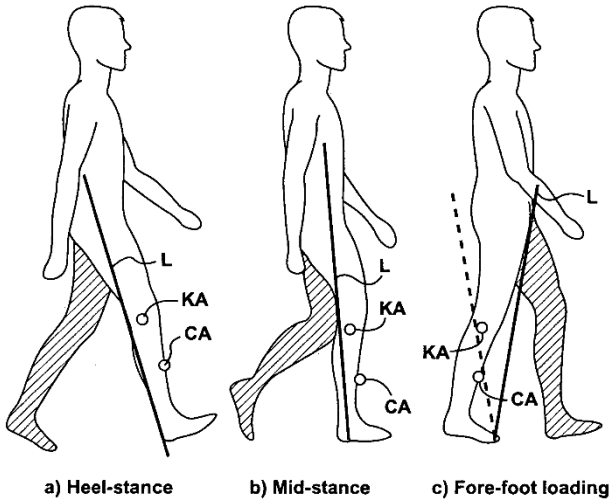
Your Team

- Mechanical Engineering - Heat Transfer Specialty
- Chemical/Material Science Engineering
- Electrical Engineering
- 3-6 People

E2-Spring Shoe

Problem Statement

- An injury to the right forefoot has created a long term condition in which it is painful to load when walking

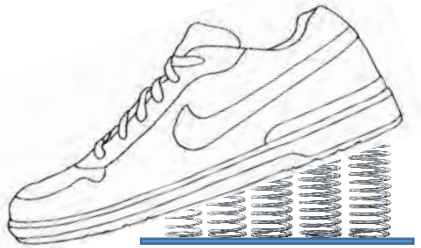


Painful to bare load in this region

Objective

- Interface Control Drawing (ICD) will be provided to specify dimensions for state 1 and 2 (design space).
- Design spring system to fit within these dimensions
  - Evaluate spring types (coil, torsion, leaf, flexure, etc)
  - Develop calculations/models
    - Determine spring parameters and attachment methods
  - Test prototype(s) to optimize system
    - Support 180lb subject
    - Minimize vertical stack up

State 1



State 2

E3-Automated 360-degree 3D image capture of human limb for measurement and evaluation of lymphedema

LymphaTech

Advancing Lymphedema Technologies

Lymphatechnology.com

LymphaTech's Focus

Lymphedema

LYMPHEDEMA is a painful and debilitating limb swelling disease that is permanent unless detected early, and is a life-long struggle once contracted

4 MILLION patients currently suffer from lymphedema in the U.S. and at-risk populations increase every year

Project

Automated 3D acquisition

LymphaTech

LYMPHATECH SOLUTION: Mobile iPad-based 3D imaging with proprietary algorithms for automated and accurate human geometry measurement to improve clinical evaluation of edema

PROJECT GOAL:

Investigate and build a method for controlled systematic mechanical 360-degree rotation of 3D scanner around an arm to acquire high quality 3D images without hand-held operation

THANK YOU

What is a Good Bid?

Basically, convince us that you are the best group for the project.

Tell us:

- Why do you want the project?
- What are your skills, talents, experiences relevant to the project?
- What is your understanding of the project?
- Anything else that is relevant

Due Dates

- Next Studio – Come prepared to form teams of 4-6; discuss project ideas.
- **Saturday, 08/25, 08:00pm** – deadline for submitting bids for sponsored projects on **projects.gatech.edu**
- For your own idea:
  - Get approval from instructor;
  - Register your team on projects.gatech.edu
- Make sure **ALL** team members are listed in your team on projects.gatech.edu