

Confirmed Sponsors for AY '23-'24

Company Name
Aerovec
American Society of Naval Engineers
ASHRAE
Boeing
Corning Inc
Electrolux
Govsphere
Lockheed Martin
LOTTE BIOLOGICS
NIST
Pursuit Aerospace
SAAB
SEPAC
Hydronic Shell Technologies
Thermal Space
DOT
Microsoft
L3Harris
Northrop Grumman



Company Name	Project Title/Description
Aerovec	Develop novel and cost-effective way to generate renewable electrical energy and leveraging the Aerovec novel wind turbine rotor design.
American Society of Naval Engineers	Senior Design/Club Competition for Promoting Electric Propulsion (PEP)
ASHRAE	HVAC Design for San Paolo Brazil Library
Boeing	Sustainable Composite Materials for Aircraft Interiors
Corning Inc	Generative AI for Solving Real-World Business/Engineering Problems
Electrolux (4)	Assembly Pallet Tester, Back Panel Cell Automation, Production Bottlenecks, AGV (Automated Guided Vehicles)
Govsphere	Modernization of MedX Rehab Medical Machines
Lockheed Martin	Additively Manufactured Cold Plate (cont.)
LOTTE BIOLOGICS	Utility Steam Generation Plant Design
NIST	Neutron Velocity Selector Test Base and Cover
Pursuit Aerospace	CNC MACHINING FIXTURE - CLAMP REDESIGN
SAAB	Micro-Unmanned Underwater Vehicle STEM Design and Customization
SEPAC	Universal torque testing machine
Hydronic Shell Technologies	Simulation & Testing of a Novel Façade-Integrated Heating & Cooling Concept
Thermal Space	Lightweight Graphene Radiators for Space System
DOT (3)	Maximum Horizontal Force and Deformation of Elastomeric Bridge Bearings, PORTABLE MODULAR TEMPORARY BRIDGE, CULVERT STREET OVER OSWEGO CANAL
Microsoft	Bifacial Coldplates for high power servers
L3Harris	Universal Adjustable Antenna Mounting System for Rotary Winged Aircraft
Northrop Grumman	Generate an empirical database to characterize critical Oscillating Heat Pipe parameters such as channel geometry and fill ratio

Aerovec

<https://www.aerovec.com/>



Develop Novel and Cost-effective Way to Generate Renewable Electrical Energy

Solar cells on the roof of a building take up a considerable amount of space relative to their Annual Energy Production (AEP), they produce much less in the deep of winter and no energy at all at night. Small wind turbines take up a much smaller footprint relative to AEP. Some have been placed on roof tops, but there are some challenges, such as the need for yaw motion to orient towards the wind, or having sufficient clearance to eliminate the wind turbulence due to obstacles. Often the greater challenge is to understand and mitigate the impact of the wind turbine vibration on the building structure and associated noise when the building never considered this in its initial design. However, we believe that there could be substantial demand for an integrated wind/solar roof-top solution if the challenges could be overcome in an economically attractive way. We also see an opportunity to recycle energy coming from such as Air Conditioning units, so reducing energy consumption. The project will entail the development of novel and cost-effective way to generate renewable electrical energy and leveraging the Aerovec novel wind turbine rotor design.

American Society of Naval Engineers

Competition website: www.navalengineers.org/PEP

Senior Design/Club Competition for Promoting Electric Propulsion (PEP)

The American Society of Naval Engineers hosts an annual competition in which undergraduate engineering students work in teams to build electric-powered boats. For new teams, we suggest making a remote-controlled boat that is between 4 and 8 feet so teams can successfully integrate batteries, controls and the propulsion system. Our five-mile race in partially-protected waters is an endurance test requiring extensive pre-race testing.



ASHRAE

<https://www.ashrae.org/>

HVAC Design for San Paolo Brazil Library

HVAC design for new library building in San Paolo Brail. Over two semesters project will work through complete design process including:

- Codes and Standards
- Ventilation Calculations
- Heating and Cooling Load Calculations (using Carrier HAP Program)
- System Selection
- Equipment Selection
- Ductwork and Piping Design
- Temperature Controls



Boeing

<https://www.boeing.com/>

Sustainable Composite Materials for Aircraft Interiors

There is increasing pressure on the aviation industry to move to more sustainable material sources. The commercial aviation industry requires materials that are strong and lightweight to serve as interior components for the aircraft. Every ounce of weight is important in an aircraft to reduce fuel consumption. Our customers (Airlines) are constantly seeking interior components that are durable and weight optimized. The project will entail developing sustainable composite materials for aircraft interiors.



Corning Inc

<https://www.corning.com/worldwide/en.html>

Generative AI for Solving Real-World Business/Engineering Problems

In an era of rapidly evolving technology, businesses are constantly seeking innovative solutions to stay competitive. Generative Artificial Intelligence (AI) has emerged as a powerful tool that can transform the way businesses address challenges. This project aims to provide university-level students with the opportunity to apply generative AI techniques to real-world business problems, fostering both technical and practical skills.



- Explore Generative AI: Introduce students to the fundamentals of generative AI
- Apply AI to Business Contexts: Enable students to understand and identify business problems that can be addressed using generative AI, such as data synthesis, image generation, text generation, and more
- Apply AI to Mechanical Engineering Contexts, such as predictive maintenance, design optimization, generative design, robotics and automation and quality control

Electrolux (X4)

<https://www.electrolux.com/en/>

Assembly Pallet Tester

This project proposal will be prepared for our new Springfield, TN manufacturing facility which produces cooking appliances for the North American market. For this project, we will engineer and implement a solution that allows 100% of the assembly pallets to be automatically confirmed in good condition prior to use on the assembly lines. For this project, we will determine the best location and method to confirm the following features of the assembly pallets:



- Proper function of the RFID tags (Read & Write)
- Physical condition of the pallet is acceptable (locator pins, no damage)
- Power terminals are free of debris and build-up
- Verify continuity and resistance of automation connectors (AC Voltage)
- Verify flatness of pallet does not exceed specification

Anderson Back Panel Cell Automation

This project proposal will be prepared for our Anderson, SC manufacturing facility which produces refrigerators and freezers for the North American market. For this project, we will examine the feasibility/safety/financial impact of automating a manual valve installation in a robotic cell which handles and mounts the metal back panel of the unit. The business case will be conducted based on standard Electrolux process using financial data supplied by Electrolux controlling. The best solution defined as well as a recommended method (with justification).

Things to be considered during the selection process:

- Layout/ Floor Required (we have limited space)
- Cycle time (needs to be masked in cycle)
- Cost & Integration
- Type of Media (Flapper Valve) Supplier development
- Media alignment to Part
- Maintainability
- Operational support – Changing media, Fault recovery, etc

Anderson Production Bottlenecks

This project proposal will be prepared for our Anderson, SC manufacturing facility which produces refrigerators and freezers for the North American market. The Anderson facility is new and still has many opportunities to improve throughput and reduce costs. An important way to accomplish this goal is to eliminate bottlenecks (based on Takt Times). For this project, we will examine the feasibility of eliminating production bottlenecks to improve Safety, Quality, throughput, and costs. For this project, we will analyze each workstation for opportunities to reduce the takt time.

AGVs (Automated Guided Vehicles)

For this project, we will analyse the potential use of AGVs (Automated Guided Vehicles) to deliver sump assemblies and/or front frames from the former rack department to the point of use on assembly lines 1, 2 and 3 as well as potential for picking up molded sumps from Plastics to be returned to Rack department for assembly of the sump. For this analysis, Electrolux will supply pertinent data to support the analysis. In addition, we would like to include the option to add additional components as we intend to add opportunities to vertically integrate into the manufacturing process of Kinston NC factory. This analysis is to include feasibility analysis (business case) and safety analysis to ensure both financial benefit and assurance that we will not present any potential safety risk to employees. For this project, we will require quotes from (3) potential suppliers and an analysis of the suitability of the suppliers to perform the work. The business case will be conducted based on standard Electrolux process using financial data supplied by Electrolux controlling. Methods of AGV navigation will be analyzed and the best solution defined as recommended method (with justification). For this project, we will require a prototype to be built in order to confirm the engineering concepts are feasible for mass production.

Govsphere

<https://www.govsphere.com/>

Modernization of MedX Rehab Medical Machines

The purpose of this project is review and analyze the current MedX Lumbar Extension & Cervical Extension machines and identify how advancements in materials science and modern manufacturing can allow us to develop a more efficient machine that can be produced at a lower cost.



Lockheed Martin

<https://www.lockheedmartin.com/en-us/index.html>

Additively Manufactured Cold Plate (cont.)

Continue the development of a cold plate using additive manufacturing methods to provide adequate cooling for high power electronic components, while optimizing performance, cost, and material used. This project is a continuation of the AY '22-'23 "Additively Manufactured Cold Plate" project. The AY '23-'24 team will need to review the work completed by last year's team and be specific about the current status of the project. The whitepaper will need to provide a brief overview of what was accomplished last year and what needs to be completed this year.



LOTTE BIOLOGICS

<https://www.lottebiologics.com/en/>

Utility Steam Generation Plant Design

The existing steam plant on site was built in 1943 and is constructed of three 800 hp boilers that feed the entire campus. The current steam plant is significantly oversized for our current and future anticipated plant steam loads. It is desirable to retire the current steam plant and build a new steam plant with modern technology that is right sized for our current and future needs. A new design project has already been initiated with an outside A&E firm to design a natural gas fed boiler house with three 500 BHP boilers. The project objective is to develop an alternate design for consideration to meet the site's plant steam needs. The project goal would be to maximize overall long-term value to the site, increase environmental sustainability, and take advantage of New York State and federal incentives where possible.



NIST

<https://www.nist.gov/ncnr>

Neutron Velocity Selector Test Base and Cover

Design a base and cover for use in testing Airbus velocity selectors at the NIST Center for Neutron Research. At operational speeds, these devices possess a great deal of rotational kinetic energy. To protect personnel performing the test and others nearby, a permanently mounted base with a removable cover shield must be designed to contain projectiles (velocity selector components) following the worst conceivable accident. A universal mounting surface is needed to allow the various models to be tested and the cover must be sized to house these same models. It would be desirable if the cover could be positioned and removed without the use of an overhead crane and allow convenient access and attachment of all cabling and cooling water lines.



Pursuit Aerospace

<https://pursuitaero.com/>

CNC MACHINING FIXTURE - CLAMP REDESIGN

Working directly with manufacturing engineers at Pursuit Aerospace, senior capstone students will design an improved clamping system for a 5-axis CNC machining Fixture. Using lessons learned from the current production fixture, students will update the design to enhance the overall performance and ease of use of the hydraulic clamping mechanism in accordance with the priorities set by Pursuit Aero personnel. These priorities include:

- Clamping performance
- Serviceability
- Manufacturability
- Ingress protection (IP56)
- Low profile packaging



SAAB

<https://www.saab.com/>

Micro-Unmanned Underwater Vehicle STEM Design and Customization

The project is to develop a design for a cost-effective STEM kit variant of the micro-unmanned undersea vehicle at reasonable cost for academic usage (less than \$5K per unit with optional payload design). This effort is envisioned to leverage previously developed architectures, electronics, software, and hardware from one of Saab-Inc.'s micro-UUVs that has been demonstrated as very easy to use, operate, launch, and recover.



SEPAC, Inc.

<https://sepac.com/>

Universal Torque Testing Machine

In reviewing some ideas we had put together a few months ago I think the most practical project would be a universal torque testing machine for small to medium sized friction units. Idea would be something that can be loaded and have burnishing and torque checks completed with minimal if any user input thus minimizing person to person variance while also making assembly more efficient since the assembler can be building the next unit while the current unit is being tested.



Hydronic Shell Technologies

<https://www.hydronicshell.com/>

Simulation & Testing of a Novel Façade-Integrated Heating & Cooling Concept



The Hydronic Shell HVAC system incorporates a novel concept where heating and cooling are integrated into the outer shell of a building (US patent 11,415,328 B2).

The first phase of the project will include computational modeling/simulation of three unique aspects of the Hydronic Shell System:

1. Thermal output of a convective element within a building façade cavity: Students will model a convective element within a closed façade cavity at the exterior wall of a building. Students will model different convector types and sizes at varying water temperatures to be used as design guidance and for system optimization.
2. Thermal storage capacity of a masonry wall heated/cooled by the Hydronic Shell system: Students will simulate the heat transfer from the heated/cooled façade cavity to the existing masonry façade to evaluate the radiant conditioning effect that can be achieved within the space. Students will also model the thermal storage capacity of the heat stored within the masonry to evaluate its effectiveness as a demand-response strategy.
3. Thermal comfort of occupants in a space conditioned by the Hydronic Shell system: Students will simulate the thermal performance of the Hydronic Shell system within a room to evaluate comfort parameters for occupants, including air temperature, mean radiant temperature, and air velocity. Conventional systems such as packaged terminal air-conditioners (PTACs), mini-splits, and ducted fan coils will also be simulated for comparison.

Thermal Space

<https://thermal-space.com/>

Lightweight Graphene Radiators for Space System



The initial part of the proposed project will be to research applications and potential markets that could benefit from reduced mass radiator panels. With applications identified, a suitable radiator panel design will be proposed and thermal performance models will need to be created to predict heat rejection capacity and temperature gradients. A representative radiator will need to be fabricated and tested to verify performance predictions. The engineering strengths necessary to complete this project successfully include market research, material science, thermal engineering, mechanical engineering, test engineering, and project management.

Department of Transportation (x3)

<https://www.dot.ny.gov/index>

Maximum Horizontal Force and Deformation of Elastomeric Bridge Bearings

The objective of this project will be to determine these unknown aspects of elastomeric expansion bearings that NYSDOT uses. It is anticipated that non-linear finite element (FE) models will be used to determine the aforementioned unknowns and that the models will be validated by physical testing. The FE models used should account for the non-linear behavior of the internally steel reinforced neoprene, and its variations in material properties that occur at different temperatures, and the behavior of the vulcanized neoprene to the external steel plates.



Department of
Transportation

PORTABLE MODULAR TEMPORARY BRIDGE

Develop a rapidly deployable modular bridge:

- Sections will need to span two interstate standard lanes unsupported.
- Sections will need to be transportable (oversized and overweight loads would need to meet permitting requirements)
- Transported sections to meet bridge clearance restrictions.
- Modular sections allow for both longitudinal and transverse connections (longer and wider options).
- Bridge deck can be attached or placed following deployment.
- Pier and abutment supports to be adjustable to meet deployment site conditions.

CULVERT STREET OVER OSWEGO CANAL

Deteriorated Canal crossing bridge built in 1990.

- Single span, simply supported steel girder lift bridge with concrete substructure.
- Important community connection for local first responders and community members.
- Bridge condition and mechanical lifting operational issues.

Microsoft

<https://www.microsoft.com/en-us/>

Bifacial Coldplates for High Power Servers

As server powers increase, and requirements for server density increase, we're looking at putting chips on both sides of the motherboard. However, this will make it relatively challenging to achieve thermal and mechanical goals simultaneously. On the thermal side, all of the components need to be cooled below their maximum operating case temperature. On the mechanical side, the chips need to be held under pressure against the coldplate (to reduce contact resistance), without flexing the board.



L3Harris

<https://www.l3harris.com/>

Universal Adjustable Antenna Mounting System for Rotary Winged Aircraft

L3Harris is the world-class leader in dual polarization sinuous antenna design supporting Air, Sea, Ground and Space domains covering wide-band frequency ranges in electronic warfare and electronic support measures systems.



L3HARRIS

Northrop Grumman Systems Corporation, Space Systems Sector

<https://www.northropgrumman.com/>

Generate an empirical database to characterize critical Oscillating Heat Pipe parameters such as channel geometry and fill ratio.

Develop test matrix of design parameters that will be varied to understand impact on OHP performance. Design sample OHP's that are representative of an edge cooled 6U 220mm VPX heatsink and vary the OHP parameters per the test matrix. Design sample OHP's that can transport up to 150W of power dissipation on a 2"x2" square area, centered on the heatsink.



Below please find the video recordings of all of the 2023 ME capstone final presentations:

ME Capstone_Intro: https://video.syr.edu/media/t/1_qg88b53p

ME Capstone_Presentation 1_Lockheed Martin: https://video.syr.edu/media/t/1_z3f7mxc1

ME Capstone_Presentation 2_GE: https://video.syr.edu/media/t/1_hx4uf66t

ME Capstone_Presentation 3_ASHRAE: https://video.syr.edu/media/t/1_1y0d57pb

ME Capstone_Presentation 4_Berry Global: https://video.syr.edu/media/t/1_edr52kb1

ME Capstone_Presentation 5_Bluefors (Cryomech): https://video.syr.edu/media/t/1_s28v02az

ME Capstone_Presentation 6_Upstate Parts&Supply: https://video.syr.edu/media/t/1_mxytdh1q

ME Capstone_Presentation 7_Wellbuilding: https://video.syr.edu/media/t/1_19azubz4

ME Capstone_Master File: https://video.syr.edu/media/t/1_moci5ljf