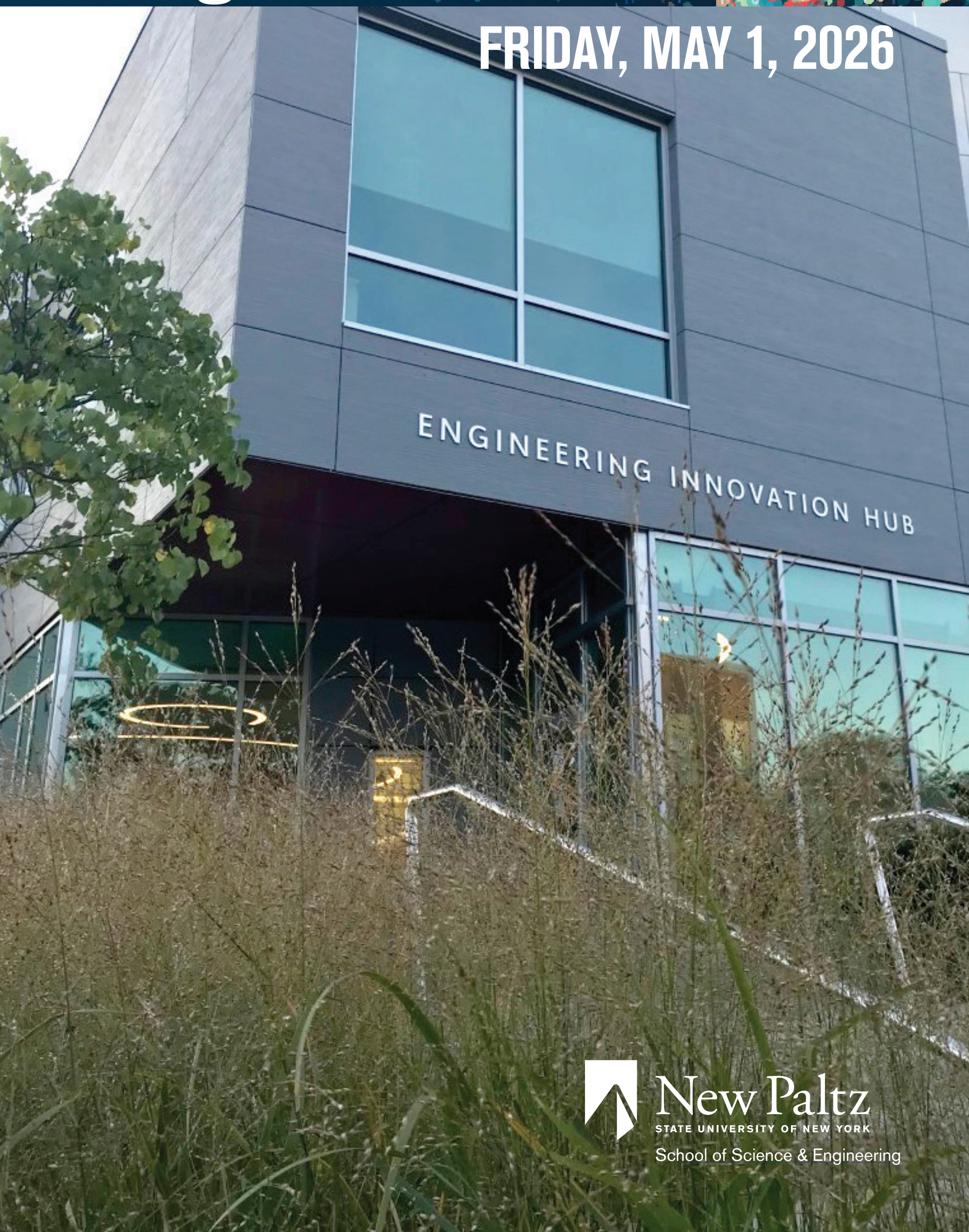
2026 Annual Engineering Design EXPO

FRIDAY, MAY 1, 2026



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Welcome to the 2026 Annual Engineering Design EXPO!

Today, we proudly celebrate the remarkable dedication and innovative spirit of our students as they step up to solve complex, real-world engineering problems. This Senior Design EXPO is a wonderful opportunity to witness firsthand how technical expertise, bold creativity, and a passion for discovery merge to drive the technology of tomorrow.

This year, we are thrilled to feature 67 students from our Computer, Electrical, and Mechanical Engineering programs, collaborating across 13 dynamic teams. Their collaborative spirit and problem-solving prowess are on full display as they present this year's ambitious projects—featuring everything from a Corrosion Detecting Analysis Robot (CDAR) and a Localizable and Customizable Flood Advisory System, to a Self-Balancing Electric Unicycle and a Heart Simulator.

We want to extend our deepest gratitude to our incredible 2026 EXPO sponsors:

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We recognize that we are navigating challenging and uncertain economic times, which makes your generous financial support and hands-on collaboration even more profoundly meaningful. Your willingness to invest in our students despite broader challenges has been absolutely essential in bringing these innovative projects to life.

To our industry partners and our dedicated faculty advisors, thank you. Your invaluable mentorship, real-world insights, and unwavering encouragement have guided these teams through rigorous design challenges, helping our students bridge the gap between classroom theory and professional readiness.

To our guests, prepare to be amazed! As you tour the exhibits, chat with our talented students, and interact with their working prototypes, we hope you leave feeling inspired by the bright future that engineering innovation promises.

Most importantly, a massive congratulations to our graduating seniors! May the skills, resilience, and hands-on experience you have acquired here at SUNY New Paltz launch you into a fulfilling career of lifelong problem-solving and positive global impact.

Once again, welcome to the 2026 Annual Engineering Design EXPO—let the celebration of creativity, collaboration, and engineering excellence begin!

Warm regards,

Kevin T. Shanley

Kevin T. Shanley, Ph.D.
Chair, Division of Engineering Programs

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SENIOR DESIGN II

Team 1

Corrosion Detecting Analysis Robot (CDAR)

Andrew Smith (EE), Paolo Cacio (ME), Jennifer Callan (ME), John Loulo (ME), Jonathan Farnham (CE)

Advisor: Dr. Mahdi Farahikia

Stakeholder: Echem Consultants LLC

Abstract

Civil infrastructure is highly dependent on the integrity of embedded steel reinforcement in concrete structures called rebar. Corrosion of structural steel presents a critical safety concern. Half-Cell Potential Testing is a form of Non-Destructive Testing (NDT); a method used to detect the active corrosion of the rebar within concrete. Traditionally, this process is labor intensive with manual data collection. The test is performed by an operator rolling a copper-copper sulfate (CuSO4) coated electrode wheel across a concrete surface. A voltage potential is then read between the rebar and the reference electrode. The voltage being read will change based on the presence of a corroded rebar. Higher differences in voltage indicate higher corrosion risk. This project details the creation of an NDT robot that scans a set area and uploads the data in real time via wireless communication. The robot employs a tracked design with a center mounted electrode wheel and traverses in a configurable grid pattern. Two ESP32 microcontrollers manage data acquisition and control movement. Data processing is accessed through a web application, allowing users to generate a heat map to visualize potential corrosion. The grid size is adjustable to meet specific dimensional requirements. NDT engineers can focus on other tasks while the robot performs analysis. The successful deployment of the robot demonstrates a viable, cost-effective, and efficient way of testing concrete surfaces for structural defects.

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Team 2

Tabletop Printed Circuit Board Tester

Cody Higbie (ME), Troy Maurizzio (ME), Menachem Leitner (ME), Philip Hanhurst (CE), Martin Aguilar Solano (EE), Alec McCormack (EE)

Advisor: Kerry Ford

Abstract

An overwhelming majority of modern technology is built using printed circuit boards (PCBs); however, errors can occur during the printing process or arise from design faults. It is critical to ensure that all connections are sound and properly aligned before investing in the addition of components to the board. While such testing machines exist in industry, they are often inaccessible to hobbyists or students at New Paltz. Therefore, a relatively low-cost machine was developed to test through-hole, single-layer connections for electrical continuity. The design utilizes custom built 3D-printed parts in combination with spare components from 3D printer kits, SG90 servo motors, an STM32F446RE microcontroller, and the necessary motor driver modules. A source file for the PCB, uploaded by the user, is processed to extract coordinates for each connection; these coordinates guide the motion of stepper motors and servos. In addition to electrical components, structural design plays a crucial role. The machine is mounted on a transportable cart to enhance mobility while maintaining sufficient structural integrity to prevent vibrations from disrupting the automation process. Through the integration of three engineering disciplines, a fully automated PCB tester is achieved.

Team 3

Localizable and Customizable Flood Advisory System

Logan Rodriguez (ME), Aileen Pastrana (ME), Michael Macri (ME), Edward Atristain (CE), Briana Bonilla (EE), Yuriy Yakymiv (EE)

Advisor: Dr. Julio Gonzalez

Abstract

Flash floods are increasingly frequent natural disasters, yet current warning systems often fail to reach those in remote or low-connectivity areas due to signal interference and infrastructure gaps. This project developed a portable, localized flood alarm system designed to function independently of cellular or Wi-Fi networks. The device utilizes a high-precision water-level sensor and a microcontroller to monitor environmental conditions in real time. To ensure accessibility in dead zones, the system employs a dual alert mechanism: a high decibel onboard buzzer for immediate vicinity warning and a Bluetooth module to provide mobile app notifications within a nearby area.

During the development and testing phases, we focused on seamless integration between the hardware sensors and the user interface. A central component of our solution is a dedicated mobile application designed to bridge the gap between raw environmental data and actionable user information. This app provides a constant stream of updates, allowing users to monitor water levels directly from their devices without relying on external network infrastructure. This redundancy ensures that even if a user is preoccupied or away from the physical sensor, they receive ample warning to evacuate. By providing a customizable interface this project offers a scalable solution for disaster preparedness in high risk zones. Future iterations will focus on further extending the wireless communication range and refining the app's predictive alert algorithms.

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Team 4

Self Balancing Electric Unicycle

Evan Kharlamb (CE), Sara Bernabe (ME), Aneysies DeMore (ME), Alianna Jimenez-McCoy (ME), David De La Cruz (EE)

Advisor: Dr. Damadaran Radhakrishnan

Co-Advisor: Graham Werner

Abstract

This project focuses on the design and development of a self-balancing electric unicycle aimed at improving safety, durability, and user customization compared to existing personal electric vehicles. Current commercially available unicycles often prioritize cost reduction and mass production, resulting in limited repairability, reduced structural integrity, and insufficient user-centered design features. To address these limitations, this project applies a control theory based multidisciplinary engineering approach integrating mechanical design with electrical systems. The system was designed around an architecture that incorporates a programmable motor controller. Real-time balance control is achieved using an inertial measurement unit (IMU) to measure pitch angle and angular velocity. A closed-loop proportional–integral–derivative (PID) control algorithm processes sensor data and regulates motor current to implement balance and acceleration. A robust alloy frame is used to improve structural reliability while maintaining manufacturability and cost efficiency. Additionally, a modular accessory system was explored to enhance utility, including features such as storage integration, ergonomic improvements, and customizable external components. Computer-aided design (CAD) tools were used to model the system and evaluate component integration. Electrical subsystems, including smart headlights and tail lights, and power distribution module, were designed and validated using Electrical Computer Aided Design (eCAD) tools. This project demonstrates the feasibility of a safer, more durable, and user-focused electric unicycle design while highlighting the importance of interdisciplinary collaboration in engineering design.

Team 5

Solar Hybrid Autonomous UAV

Aaron Mendoza (ME), Abdulrahman Saleh (EE), Allan Vinod (ME), Christian Geraghty (ME), Jake Rosenfeld (ME), Sean Wilk (CE, CS)

Advisor: Dr. Kevin Shanley

Co-Advisor: Dr. Wafi Danesh

Abstract

The Solar Hybrid Autonomous UAV project focuses on the design, integration, and testing of an unmanned aerial vehicle that uses both battery power and onboard solar energy to improve flight endurance while maintaining autonomous operation. The primary goal of this project is to extend usable flight time beyond that of a conventional battery-powered UAV by supplementing the aircraft's electrical system with solar input and an efficient power management architecture. To achieve this, the team developed a hybrid platform that combines solar energy harvesting with battery storage, custom power regulation, and autonomous flight control. A custom printed circuit board integrating charge controller and battery management system functionality was designed to regulate power flow, protect the battery, and support the use of harvested solar energy during operation. This project was undertaken to address one of the major limitations of small UAV systems: restricted flight duration caused by limited battery capacity. By incorporating renewable energy into the aircraft and refining the systems that support flight, the team explored a practical approach to increasing endurance without sacrificing stability or mission capability. Development efforts included the mechanical design and integration of the airframe, the implementation of the onboard power system, and the configuration of an autonomous control system capable of navigation, telemetry communication, flight stabilization, and return-to-home operation. Current progress demonstrates the feasibility of a solar-assisted UAV platform and provides a strong foundation for continued refinement and testing. The significance of this work lies in its contribution to the development of more efficient and sustainable UAV systems for future long-endurance applications such as surveillance, environmental monitoring, surveying, and remote data collection. Future work will focus on further testing and optimization of the hybrid power and control architecture to improve overall aircraft performance and endurance.

Team 6

Contactless Train Power Transmission

Christopher Monvil (ME), Jake Hansen (ME), Matthew Regan (ME), Terence Tackie (EE), Puneet Mangat (EE)

Advisor: Dr. Ping-Chuan Wang

Stakeholder: IKM Technology

Abstract

This project presents a wireless power transfer system for railway applications using inductive coupling technology. Traditional electric railways require physical contact systems such as overhead catenary wires or third rails, which suffer significant limitations including mechanical wear, maintenance requirements, and safety hazards. Our solution demonstrates wireless power transmission through magnetic induction as a viable alternative, with this scaled test system serving as proof-of-concept for full-scale railway implementation. A key innovation is the implementation of automatic switching controlled by position sensors. As the vehicle moves along the track, sensors detect its location and activate only the coil section adjacent to it. This approach dramatically reduces power consumption compared to energizing the entire track continuously, while maintaining seamless power delivery through multiple sections, making it reliable and fast. The modular design demonstrates scalability from this test system to full railway installations, with each section operating independently. This proof-of-concept validates the feasibility of wireless power delivery for railway applications, offering improved safety, reduced maintenance costs, and elimination of mechanical contact systems. This technology shows promise for future implementation in urban transit systems and other railway applications.

Team 7

Throw Tracking Disc Golf

Scott Van Sise (CE), Nicholas Hutchins (CE), Garrett Grathwohl (CE), Bradley Guiteau (EE), Alexander Ouellette (ME), Stephen Kirtyan (ME)

Advisor: Graham Werner

Abstract

Disc golf players often struggle to understand why one throw performs perfectly while the next falls short. Our Throw Tracking Disc Golf product addresses this challenge by developing a smart disc that measures and analyzes how each throw behaves in flight. The project's objective is to provide both professional and recreational players with simple, actionable feedback to improve distance, accuracy, and consistency. The disc has an ESP32 microcontroller and inertial measurement unit (IMU) that senses the acceleration at release, and release angle. This data is sent wirelessly to a phone or computer where it can be viewed as numerical data with labels. From the data on pitch, roll, yaw, and Gs, users can gain insight into how different release angles, throw intensity, and stability affect flight. The system is contained within a lightweight durable 3D printed casing, which is designed to be impact and weather resistant without compromising aerodynamic qualities. The project itself involves the integration and coordination of electrical, computer, and mechanical disciplines to include sensing, processing, transmission, and design functions into one complete integrated system. Ultimately, this smart disc transforms throw evaluation into measurable insight. This further enables players to make informed adjustments and steadily improve their overall performance in the game of disc golf.

Team 8

Heart Simulator

Morgan Lanberg (ME), Luca Giammarino (ME), Sofia Sulaiman (ME), Russell Vitug (ME), Alexander Wyant (CE)

Advisors: Dr. Heather Lai, Dr. Rachmadian Wulandana

Abstract

Heart valve diseases are a significant global health concern, leading to compromised cardiac function and various adverse patient outcomes. Understanding the impact of different valve pathologies on the heart's pumping efficiency, arterial pressure, and blood flow dynamics is crucial for engineers to advance diagnostic tools, treatment strategies, and medical device development. Current methods for studying these phenomena can be invasive, ethically complex, or lack the fidelity to accurately simulate the human cardiovascular system in a controlled environment. This project displays the anatomy of the left side of the human heart, serving as an accessible demonstration platform for understanding cardiovascular function and disease. The system mimics anatomical and physiological aspects of the human heart, including the ventricular chamber, atrium, aortic, and mitral valves. The ventricular chamber and atrium utilize a motor-driven pump assembly designed to replicate physiological stroke volumes. A positive displacement mechanism was selected specifically for its ability to mimic the heart's characteristic volume-changing dynamics. The motor type was determined based on the input torque. The prosthetic valves were modeled in CAD using leaflet geometry to replicate the hemodynamics of biological heart valves. While the current iteration of the design approximates rather than precisely replicates physiological conditions, it is designed as a foundation for future work including the capability to simulate valvular pathologies and to serve as a testbed for evaluating prosthetic valve designs.

Team 9

K.A.R.E.N: Knowledge-Adaptive Robotic Execution Network

Shaima Herzallah (ME), Grace Fevola (ME), Stephanie Rhoades (ME), William Hamling (EE), Emily Thiel (EE), Ramiro Cuacuas (CE)

Advisor: Kerry Ford

Abstract

Robotic arms are increasingly used in medical, industrial, and assistive settings where precise and adaptive manipulation is required. K.A.R.E.N. is a 6-degree-of-freedom robotic arm system designed to perform tasks such as object placement and sorting through natural language commands. The system integrates computer vision, speech recognition, and robotic motion control to translate verbal instructions into coordinated physical movement. K.A.R.E.N. is built on the PAROL6, an open-source six-axis robotic arm that we constructed following the open-source design. Our contribution is a neural network-based control layer using an open Vision-Language-Action (VLA) model to process voice commands and camera input, enabling the arm to determine and execute appropriate actions. This approach allows the arm to interpret natural language instructions and visually assess its environment in real time, removing the need for manual programming of each task. Through simulation based training, the arm learns sorting tasks under varying conditions, demonstrating a shift from rigid, hard-coded automation to intelligent, adaptable robotic control. The result is a flexible, low cost platform that showcases how open-source hardware and modern AI can be combined to make intelligent robotics more accessible. K.A.R.E.N. was developed to address the limitations of traditional robotic systems that rely on hard-coded instructions and struggle in dynamic, unstructured environments. With the goal to create a robotic arm capable of understanding natural language commands and adapting its actions using integrated vision and AI-based decision-making. With this, systems can be capable of more autonomous work and handle a broader spectrum of tasks while minimizing human intervention and hardcoded solutions. K.A.R.E.N will act as a working model to start as a basis for moving in this direction, to be improved and added upon.

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Team 10

Controlling Chaos

Matthew Barraclough (EE), Larissa Mitchell (EE), Jaheem Townes (EE), Kelly Pender (ME), Shoshana Shapiro (PHY)

Advisor: Dr. Mohammad Zunoubi

Abstract

This project looks at three separate ways of utilizing and controlling non-linear systems. The three different systems are: an encryption system using a non-periodic oscillator, an inverted pendulum controlled with LQR control theory, and a seismic simulation machine that takes an analogue of a building to demonstrate different versions of building earthquake dampening system. This project takes from a varied source of engineering subjects under the umbrella of non-linear chaotic system control and utilization. The non-periodic circuit, Chua's circuit, is a circuit that has, in the past, been used as a form of analogue encryption. Our project has taken a novel approach to encryption using several of the circuits to make a larger system. This section mainly aims at audible frequencies and displays use of chaos to distort and then decode. The inverted pendulum is a classic control project. Using LQR control we hope to show nonlinear motion being controlled using applied advanced control theory techniques beyond what has been explored in the classroom. The entire system has been built from the ground up and displays aspects of many different specializations. The seismic simulator is yet another classic example of balancing nonlinearity in real life scenarios. We are showing different ways that buildings can prepare for external loads, with a focus on exaggerated earthquake loads showing the motion of buildings with different dampening techniques. All together we explore how to design for, control for, and suppress chaos in a variety of scenarios.

Team 11

Co-Linear Mecanum Drone

Edwin Yang (CE), Cole Enslen (EE), Matthew Gold (ME), Matthew Suazo (ME)

Advisor: Dr. Vincent Liao

Abstract

The Co-Linear Mecanum Drone is an autonomous platform, for a remotely operated discrete, wheeled vehicle that can move freely around in a 2D plane without requiring the vehicle to rotate. The mecanum wheels are what allows the vehicle to maneuver as such. The drone utilizes custom hub motor design with an integrated planetary gear set. The drivetrain of the vehicle is placed on a single linear axis, helping to decrease its overall profile. To power the drone, a custom PCB distribution board was designed and fabricated in house to ensure an efficient and compact power delivery system. The means to control the drone utilizes an ESP32 to remotely operate it with a controller and uses Wi-Fi to send data and other information back to any controlling devices. A Raspberry Pi is used to run video streaming and machine vision software. The goal is to provide a concept for a cheap and useful tool for internal security and monitoring of important buildings, facilities and infrastructure such as hospitals and large database servers.

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Team 12

Standardized Ski Boot Flex Test

Coltrane Fracalossi-Lail (ME), Riley Kaan (ME), John Vacca (ME), Tyler Foy (EE)

Advisor: Dr. Ping-Chuan Wang

Abstract

The lack of a standardized ski boot flex index poses significant hurdles for consumers and retailers alike. This project focuses on the design and development of a ski boot flex testing device used to measure how a ski boot resists forward bending under applied force. Ski boot flex plays an important role in skiers' comfort, control, and performance. However, standardized and accessible testing methods are limited to non-existent. This project provides a controlled system which applies a force to the ski boot, while also measuring the boot's response throughout its range of motion. The testing device uses a motor-driven mechanism to simulate the forward flexion of a ski boot while a force sensor records the reaction at different angles. Data collected during testing is transmitted to a control computer which displays a force versus angle plot along with a moment versus angle plot, for real-time data acquisition and display. This system provides a previously lacking capability to compare boots, evaluate performance characteristics, and observe differences in design across companies and their offered boot models. Early testing has demonstrated that the system can repeatedly measure boot flex in a controlled and consistent manner. The resulting data provides insight into stiffness progression and overall flex behavior, important factors for both skiers and manufacturers. Future iterations should be refined with improved calibration methods and expanded testing conditions to better simulate real-world skiing forces. This project presents a practical, reliable and economic approach to evaluating ski boot flex using an integrated system.

Team 13

Matrix Audio Hub

Colton Arenella (CE), Ian Brady (EE), Peter Harvill (ME), Eric Rosenfield (EE)

Advisor: Dr. Mahdi Farahikia

Co-Advisor: Kerry Ford

Abstract

Venues lack a switch which can dynamically toggle various inputs to both speaker level and line level outputs. They also lack a programmable, customizable ability to define speaker location. This negatively affects audio fidelity, which detracts from their customers' experience. We aimed to create a rack-mounted solution for ¼" input and output line level and speaker level signals that would have customizable signal pathing and could offer basic phase correction. To meet these goals, we designed a 2x2 speaker level input/output matrix as well as a 4x4 line level matrix which could be controlled from a laptop via a GUI. We designed a device that was able to fit in a 19" rack mount following the "u" convention and taking into account the actual space between mounting ears. We also added analog-to-digital conversion to bring the signals into the digital realm and phase-correct the signals so that different speaker emplacements could be utilized by the venue without negatively impacting sound fidelity. Finally, we did some basic calculations and designed for proper thermal management within the device. The project has taught us that time and cost budgets are essential to development projects, and that organization and cooperation between interdisciplinary teams is essential to creating a good product. It is also necessary to review progress and keep communication channels open. In addition to functionality, fabrication concerns must be kept in mind so that the project is manufacturable.

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