

MECHANICAL & MATERIALS ENGINEERING  
COLLEGE OF ENGINEERING & APPLIED SCIENCES

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2026

PROJECT TITLE: Designing High Performance Bonds for Ultrasonic Energy Transfer

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### Project Description

This project is part of an exciting effort to create a new form of wireless power transmission that uses ultrasonic waves to deliver energy through solid metal. The goal is to power sensors that must operate in places where batteries, wiring, or traditional wireless methods simply do not work. Examples include monitoring inside nuclear waste storage containers or enabling communication with instruments mounted on the hull of submarines.

Our approach uses piezoelectric ultrasonic transducers that convert electrical energy into high frequency vibrations which can travel efficiently through metal. A matching transducer on the other side converts the vibrations back into an electrical signal. A key challenge is how these transducers are bonded to the metal surface. Even small variations in the bond thickness, uniformity, or surface finish can significantly change how much power gets through.

As a summer co-op student, you will help design and test a new process for precisely controlling the bonding layer. Your work may involve:

- Exploring and preparing epoxy formulations for ceramic to metal bonding
- Designing simple mechanical fixtures that ensure uniform bond thickness
- Inspecting bond quality using optical microscopy and surface measurement tools
- Testing ultrasonic transmission performance while varying operating conditions

This position gives you hands-on experience with ultrasonic systems, materials processing, and experimental research, and you will contribute

directly to a technology with real world impact.