

# NDIA Drexel University Technology Tour Wednesday December 13, 2023



DREXEL UNIVERSITY  
College of  
Engineering

**NDIA**

Pre-registered guests only, please. Each tour to last approximately 60 minutes.

Tours will start at 15:30 and 16:30 from the first-floor lobby of Bossone, 3140 Market Street.

We respectfully request that tour participants refrain from taking photographs during the tour. Participants will be asked for consent of the taking of photographs during the tour.

## A | Drexel Machine Shop, Enabling High-Performance Nuclear Thermal Propulsion Research

<https://machineshop.coe.drexel.edu/>

3101 Market Street, Suite 248

Mark Shiber, Director; Nick Catucci, Lab Machinist III; CJ Mills, Lab Machinist I. [Mr Joel Krakower, BS/MS '23](#), Faculty Instructor, Department of Mechanical Engineering and Mechanics (MEM), will display and highlight a team project he led on the computational modeling, simulation and fabrication of a high-performance nuclear thermal propulsion engine, sponsored by the [NASA Marshall Space Flight Center](#) and its [Propulsion Research and Development Laboratory](#). Components on the engine were machined in the Drexel University Machine Shop. The Shop and its staff, along with a digital design and advanced manufacturing instructional laboratory, and MEM and Engineering Technology faculty, play vital roles in helping to prepare students in computer-aided engineering design, modeling and simulation, and manufacturing, as part of a curriculum that is being reinvigorated to support Navy workforce development needs.

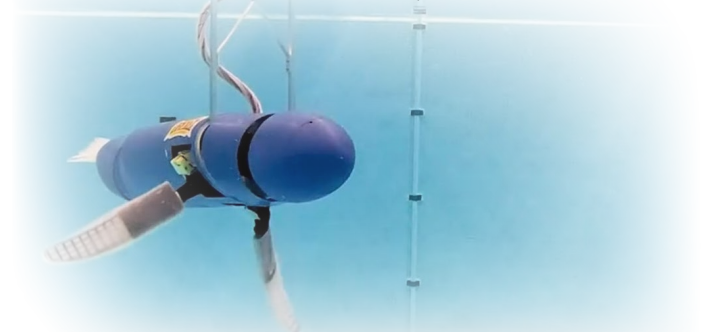


## B | Laboratory for Biological Systems Analysis

Alumni Engineering Laboratory AEL 179D

The [Laboratory for Biological Systems Analysis](#), led by [MEM Professor James Tangorra](#), applies [system-level engineering techniques to biological systems](#) with emphasis on a) the development of biorobotic models as tools for investigating hypotheses about biological systems; b) the use of system identification techniques to evaluate the functional performance of physiological systems under natural behavior conditions; and c) the design of systems that are

derived from nature and utilize novel technologies, such as electro-active polymers, to achieve superior performance and function. A long-time and continuing ONR-funded investigator, Professor Tangorra will highlight his and his students' work on a biorobotic model for investigations of multi-fin swimming, on computational fluid dynamics modeling for investigations of multi-fin swimming, on biomechanics of hydrodynamics of the flippers and body during maneuvers, and on investigating swimming gait control for bio-robotic platforms using reinforcement learning and other machine learning techniques.



## C | Laboratory for Mechanical Testing and Nondestructive Evaluation

Alumni Engineering Laboratory AEL 072

This joint laboratory overseen by the Department of Civil, Architectural and Environmental Engineering (CAEE) and MEM, hosts a range of mechanical testing and in situ analysis capabilities, including Acoustic Emission (AE), Digital Image Correlation (DIC), and more. [PhD Candidate, Nina Henderson Provost Fellow and NSF Graduate Research Fellow Sarah Malik](#) will highlight her research in using state-of-the-art structural testing equipment and sensors for nondestructive evaluation (NDE) of material specimens, with direct applications in connected aircraft and smart additive manufacturing to effectively monitor flaws and defects to ensure safe infrastructure.

Under contract support from a defense industry partner, Malik has developed an Artificial Intelligence (AI) driven system that will diagnose the current state of damage using a Digital Thread Framework. Malik is the first attendee of the [Rising Stars in Mechanical Engineering workshop hosted by Stanford University](#).

[P.C. Chou Assistant Professor Ahmad Najafi](#), of MEM,

along with CAEE Associate Professors [Amir Farnham](#) and [Christopher Sales](#), and their team members will provide a brief overview of their project as part of the [DARPA Bio-inspired Restoration of Aged Concrete Edifices \(BRACE\) program](#), to develop self-healing concrete inspired by the vasculature found in plants and the human body. BRACE is intended to create an approach that will prevent new damage, extend its service life, and reduce repair time and maintenance costs.

## D | Center for Electric Power Engineering

Curtis Hall 049

The Center for Electric Power Engineering (CEPE) is led by ONR funded investigator and [Electrical and Computer Engineering Professor Karen Miu](#), and consists of faculty members from the Department of Electrical and Computer Engineering (ECE) and MEM. The cooperative interaction of these faculty members enables state-of-the-art research in a wide variety of areas, ranging from detailed theoretical model study to experimental investigation in the Center's [laboratories](#). Owing to the range of capabilities and expertise of its members, the CEPE is ideally suited to engage in timely research and graduate training, responding to the ever-increasing and demanding needs of the Electric Power Industry and Naval shipboard power distribution systems.

## Academic Programs

Drexel Engineering offers Navy-relevant engineering BS, MS and PhD degree programs and certificates, including in mechanical engineering, electrical engineering, computer engineering, materials science and engineering, systems engineering, engineering management, engineering technology, and more. For example, undergraduate and graduate courses in data science and machine learning, non-destructive technology (NDT), robotics and autonomy, and manufacturing, are taught by full-time faculty as well as adjunct faculty scientists and engineers from Naval Air Systems Command (NAVAIR), the Naval Research Laboratory (NRL) and formerly the Naval Undersea Warfare Center (NUWC), and alumni in the defense/aerospace industry.

## Selected Other DoD Activities

Drexel University hosts the Center for Functional Fabrics (CFF), a U.S. Army Manufacturing Technology-funded effort where textiles capable of sensing, computing, communicating, transmitting and receiving. The CFF has gained national and international recognition for its groundbreaking functional fabrics research. Its methodology is defined by an integrated design thinking and doing approach that combines human-centered design with fabrication, from prototyping and product creation to full system integration. In its short history, CFF has established a highly collaborative

environment, successfully merging diverse disciplines into multi- and transdisciplinary teams. The CFF's distinct capability focuses on the fabrication of 3D knitted fabric devices and the development of simulation, modeling and design tools suitable for advanced manufacturing of textiles.

A cooperative agreement in partnership with the U.S. Army Combat Capabilities Development Command (DEVCOM) is being co-led by Drexel University and Rice University, involves investigators at Drexel and Rice and nine other universities, is engaged in developing new energy-efficient materials and devices. The effort, which involves participation of Navy scientists, is delivering next-gen materials and devices for microwave and mm-wave information and communications technologies, acoustic transducers, magnetic and electric field sensors, energy conversion, and high-temperature electronics. Recent achievements include record-breaking pyroelectric materials, ultrahigh-strain electromechanical film and bulk crystal materials for transducers, high-performance robust ferroelectromagnetic materials.

## About the University

Drexel University, founded in 1891 by Anthony J. Drexel, is a private, comprehensive Carnegie R1 research institution located in Philadelphia PA. Home to the invention of the barcode in 1948 by Norman Joseph Woodland and Bernard Silver, and honoring alumni achievements such as Paul Baran's invention of packet switching – key to the design of ARPANET, the forerunner to the internet, Drexel enrolls more than 22,000 students enrolled in over 200 degree programs, including more than 8,300 in graduate and professional programs. Drexel's cooperative education program (co-op), which was introduced in 1919, offers students the opportunity to gain up to 18 months of paid, full-time work experience in a field relevant to their field of study prior to graduation. Recording ~\$165M in research expenditures in FY2022, an increase of 35% compared with 2019, Drexel is ranked among the top 40 comprehensive research universities in the U.S. by the Dept. of Education in its 2022 College Scorecard.

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