TEXAS A&M UNIVERSITY
J. Mike Walker '66 Department of Mechanical Engineering

ABOUT THE DEPARTMENT

The J. Mike Walker '66 Department of Mechanical Engineering at Texas A&M University has a strong local, national and international reputation as a premier undergraduate and graduate research institution with a research budget of $55.5 million (FY24), with projects supported by the National Aeronautics and Space Administration, the National Science Foundation, the Department of Defense, the Department of Energy, and a multitude of companies across various industrial and service sectors. It has 73 laboratories and centers and 103 faculty, of whom nine are National Academy of Engineering members. Currently, the department has 580 graduate students, of whom 320 are Ph.D. students.

The faculty are organized into six broad cluster areas: (a) Autonomy, Controls and Robotics; (b) Design and Manufacturing; (c) Dynamics, Vibrations and Acoustics; (d) Solid, Fluid and Biomechanics; (e) Thermal Sciences, Heat Transfer and Combustion; and (f) Materials and Tribology. The department has ongoing research in a variety of applications, including advanced manufacturing, robotics and mechatronics, micro- and nanosystems, energy and environment, human health, and rotating machinery.

These students are trained at major research centers and laboratories such as the Center for Advanced Small Modular and Micro Nuclear Reactors (CASMR), Center for Autonomous Vehicles and Sensor Systems (CANVASS), Center of Innovation in Mechanics for Design and Manufacturing (CiMDM), Turbomachinery Laboratory, Energy Systems Laboratory, INVENT Lab and Starlab.

TEES | Center of Innovation in Mechanics for Design and Manufacturing
Texas A&M Engineering Experiment Station

Lecture Series in Applied Mechanics

The NSF ERC Lecture

The tribology of touch for human and robot hands

By M. Cynthia Hipwell
Oscar S. Wyatt, Jr. '45 Chair II Professor
Member, National Academy of Engineering
J. Mike Walker '66 Department of Mechanical Engineering

SEPTEMBER 30, 2025 | 301 MEOB, 11.A.M – 12 P.M.

INVENT Lab

HAND
HUMAN AUGMENTATION VIA DEXTERITY

Dr. M. Cynthia Hipwell

Professor, Mechanical Engineering
Oscar S. Wyatt, Jr. '45 Chair II Professor
Member, National Academy of Engineering

Dr. M. Cynthia Hipwell earned her B.S. in mechanical engineering from Rice University and her M.S. and Ph.D. from the University of California, Berkeley. After completing her Ph.D., Hipwell worked for Seagate Technology and later as vice president of engineering for the food and materials processing company Bühler Inc. During her nearly two decades at Seagate, she held multiple individual contributor and leadership roles, including executive director of advanced mechanical technology and executive director of advanced transducer (electrical) development, leading the electrical feasibility demonstration of heads for the radical new recording technology, Heat Assisted Magnetic Recording. In 2016, Hipwell was elected to the National Academy of Engineering (NAE) for "leadership in the development of technologies to enable areal density and reliability increases in hard disk drives." She was also elected a fellow of the National Academy of Inventors in 2018. In 2017, Hipwell was recruited to the Texas A&M University College of Engineering with a grant from the Texas Governor's University Research Initiative. Upon joining the faculty at Texas A&M, Hipwell established the INnoVation tools and Entrepreneurial New Technology (INVENT) Laboratory. The mission of the INVENT Lab is to help researchers and companies get technology developed and to market faster through the development and application of innovation-accelerating tools and new-technology feasibility demonstrations. Hipwell currently holds the Oscar S. Wyatt, Jr. '45 Chair II Professorship and is the director of the INVENT Lab at Texas A&M.

More importantly, she has built collaborative teams and pursued larger grants to help establish new research directions for the department and provide funding and growth opportunities for junior and mid-career faculty, demonstrating research leadership and influence. Since she joined Texas A&M, she has been a principal investigator or co-principal investigator for more than $21 million in funding. This includes the newly awarded National Science Foundation (NSF) Engineering Research Center (ERC) for Human AugmentatioN via Dexterity (HAND), as well as her collaboration with five Texas A&M faculty (Drs. Dion Antao, Jonathan Felts, Shoufeng Lan, Matt Pharr and Patrick Shamberger) to obtain a $5 million grant in the strategic chips area as part of the University of Texas at Austin's Texas Institute for Electronics' Defense Advanced Research Projects Agency (DARPA) NGMM 3D Heterogeneous Integration Packaging Center.

Hipwell's primary research area is nanoscale phenomena in the finger-device interface for haptics and robotics. This includes multiphysics, multiscale models that predict finger friction in products ranging from haptic touchscreens to food packaging, models that predict roughness perception of texture, tactile sensing for telehealth, novel electrostatic actuators for texture rendering and robot hands, and durable, friction-adaptive skins for dexterous robot hands. Her work has been published in high-impact-factor journals such as Science Robotics and Advanced Materials, and selected as a runner-up for best paper of 2020 in IEEE Transactions on Haptics.

Hipwell has brought her industrial innovation experience, combined with theory, to develop unique innovation curricula for students, faculty and professionals. With Drs. Arun Srinivasa and Chris Seets, she brought concepts of outcome-oriented goal setting and measurement, iterative innovation, and sharing through self-assembled co-creation to the Department of Mechanical Engineering faculty at Texas A&M for teaching innovation as part of an NSF Revolutionizing Engineering Departments grant. Thirty-five faculty and two-thirds of the sophomore and junior-level classes were affected, and there was a measurable change in teaching culture. The training was expanded to the college level. She and Seets have also adapted the curriculum for national laboratories and consult on key projects.

At the university level, Hipwell served on the Faculty Advisory Board of the Hagler Institute for Advanced Studies for three years. She currently serves on the Texas A&M Semiconductor Institute Board and the Texas A&M Innovation Partners Council of Inventors, helping these two emergent organizations become successful.

Nationally, Hipwell has been active in the NAE, serving on the peer committee as a member and chair, as well as secretary, vice chair and chair of Section 10 (Mechanical). She also co-chaired the U.S.-German Frontiers of Engineering in 2021 and served on the organizing committee for the 2024 Regional Meeting at Texas A&M.

Hipwell is deputy director of the HAND ERC. Founded in 1984, the ERC program brings technology-based industry and universities together in an effort to strengthen the competitive position of American industry while exposing students to the integrative aspects of engineered systems and industrial practice. As the flagship program of the engineering directorate, this highly competitive program involves a rigorous two-year competition cycle of proposals and site visits that narrows about 200 proposals to four awarded 10-year (five-year, renewable) centers.

HAND aims to revolutionize the ability of robots to augment human labor by developing easy-to-integrate and versatile dexterous robot hands. These hands will come equipped with a library of artificial intelligence (AI)-powered dexterous skills that grows over time and intuitive interfaces that workers can use immediately. To realize this vision, HAND research centers around three thrusts: robot hands (sensing, actuation, design), intelligent dexterity (simulation, AI, machine learning and control), and human interface (multimodal interfaces, programming, and social, legal and industrial studies). Application test beds enable engagement of the innovation ecosystem and assessment of impact in high-mix manufacturing, food preparation, caregiving and assistance, high-consequence manipulation and other fields. Societal impact includes enabling individuals with motor impairments, improving the quality and productivity of manufacturing jobs, making supply chains shorter and less susceptible to disruption, increasing the productivity of small and medium enterprises, and creating a workforce that shares in the benefits of robotics.