Welcome!

EXPO Planning Committee

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## Building Name Abbreviations

- ECB: Engineering Centers Building
- ME: Mechanical Engineering
- MS&E: Materials Science & Engineering
- E-Hall: Engineering Hall
We appreciate the generosity and support of our corporate sponsors who help make this event possible. Thank you!
Isthmus Engineering

Isthmus Engineering & Manufacturing designs, builds and integrates custom automation equipment for applications worldwide. Located in Madison, WI, the company provides value-added engineering and manufacturing from concept to completion.

Milwaukee Tool

Since the company began in 1924, Milwaukee Tool has led the industry in developing innovative solutions that deliver increased productivity and unmatched durability for professional construction users. Whether it is through our world-leading M12™ and M18™ cordless systems, the ground-breaking performance of our M12 and M18 FUEL™ products, jobsite lighting, time-saving accessories, or innovative hand tool and storage products, we are dedicated to delivering a continuous flow of advanced, trade-specific solutions.

We invest the time to work side-by-side with real users to understand the demands of a constantly changing workplace and how we can best deliver solutions for a safer, more productive jobsite. Through a thorough evaluation of the job at hand – the frustrations, needs, and previous limitations – we set out to completely rethink a solution and deliver the game-changing innovation seen across all our product lines. Milwaukee Tool is not simply a manufacturer – we are progressive problem solvers.
Mead & Hunt

Mead & Hunt is a full-service engineering, architecture, and planning firm with a team of 900 professionals located throughout the nation. Working closely with clients and partners, the firm is dedicated to providing forward-thinking solutions that help shape the future by meeting the changing needs of the communities they serve.

KLA

KLA is a global leader in diversified electronics for the semiconductor manufacturing ecosystem. Virtually every electronic device in the world is produced using our technologies. No laptop, smartphone, wearable device, voice-controlled gadget, flexible screen, VR device or smart car would have made it into your hands without us. KLA invents systems and solutions for the manufacturing of wafers and reticles, integrated circuits, packaging, printed circuit boards and flat panel displays. The innovative ideas and devices that are advancing humanity all begin with inspiration, research and development. KLA focuses more than average on innovation and in 2019 we invested 15% of sales back into R&D. Our expert teams of physicists, engineers, data scientists and problem-solvers work together with the world’s leading technology providers to accelerate the delivery of tomorrow’s electronic devices. Life here is exciting and our teams thrive on tackling really hard problems. There is never a dull moment with us.
Industry Spotlight

Amcor .................................................... Lobby – ME
We are a global leader in developing and producing responsible packaging for food, beverage, pharmaceutical, medical, home and personal-care, and other products.

Oshkosh .................................................... Lobby – ME
Over 100 years in business, Oshkosh Corporation is a leading designer, manufacturer, and marketer of a broad range of access equipment, commercial, fire & emergency, military, and specialty vehicles and vehicle bodies. Oshkosh Corporation manufactures, distributes, and services products under the brands of Oshkosh®, JLG®, Pierce®, McNeilus®, Jerr-Dan®, FrontlineTM, CON-E-CO®, London®, and IMT®. Oshkosh products are valued worldwide where high quality, superior performance, rugged reliability, and long-term value are paramount.

J.H. Findorff & Son Inc .............................
Findorff’s breadth of knowledge has led us to become one of the Midwest’s most trusted builders. From minor renovations to program management of the most sophisticated and complex facilities, Findorff is committed to bringing the highest level of service and craftsmanship to every project we build.
Speakers

Madison PD SWAT

Friday: 11:00 AM, 11:45 AM, 12:30 PM

Saturday: 11:45 AM, 12:30 PM, 1:15 PM

Four City of Madison Police Department SWAT officers will present the robotics and technology used by SWAT during operations. They will include robotics, cameras, and other technology. There will also be the department’s armored rescue vehicle displayed on site.

Bubble Wonders

Friday: 9:30 AM, 10:30 AM, 11:30 AM

Saturday: 9:45 AM, 10:45 AM

Through demonstrative performances, storytelling, humor, and audience involvement, Steve Belliveau will explain the science of how bubbles work.

Brewster Shaw

Friday: 12:30 PM, 1:30 PM

This show will talk about “The North Star”. During this presentation, astronaut Brewster Shaw will be talking about how, with a plan, any young person can achieve their life’s dream and how the University of Wisconsin College of Engineering helped achieve his dream.

Note: Friday is reserved for invited schools only. Saturday is open to the general public.
Michael Wehner is the founder of the University of Wisconsin, Madison Machine Interaction Lab, which leverages expertise in machine design, soft systems, and human factors to develop novel robots and exoskeletons. His soft robotics work includes development of Octobot, the world’s first entirely soft robot and early crawling and jumping soft robots. His wearables work includes exoskeletons to reduce back forces during industrial lifting and rehabilitation, and the first engineered soft exosuit. Wehner has also worked extensively in industry, including consulting, medical devices, consumer products, and semiconductor capital equipment. Come listen to Professor Wehner talk about robots!

When most people think of robots, they think of large metal machines that are not good around people. What if we had robots that move less like a crab, and more like an octopus and didn’t pose a threat to humans or their environment? That is the goal of the emerging field, Soft Robotics. In this talk, we will discuss recent work and emerging research in soft robotics and human exoskeletons and how these machines interact with people.
Activities

Bottle Rockets.................................................Rm 1156 – ME
Have you ever dreamed of becoming an astronaut? Here you can launch a rocket of your very own design into the sky! See how high and how far your own rocket can fly!

Build A Bridge..................................................Rm 1163 – ME
See in action how geometry contributes to strength by building your very own bridge. Try using different shapes in your design to see which one is strongest and put them to the test! Will your bridge “crack under pressure”?

Catapult.........................................................Rm 2540 – E-Hall
The classic Catapult. They’ve been around for ages and today you can design and fire a mini one on your own! Keep designing and redesigning to get the best catapult you can so it will hit its target every time.
Activities

Coding..................................................Rm 2261 - E-Hall
Ever want to be a hacker in real life? This activity might be your first step into becoming one! We’ll walk you through making your very own code and after that see what you can create on your own.

Marble Roller Coaster.........................Rm 2341 – E-Hall
Huge scary drops, twisting and turning, and the famous Loopy loops! Become a roller coaster engineer for the day and see if you can get a marble to stay on track through all the thrill and launch them into the target.

Tube Paper Airplane.........................Rm 2534 – E-Hall
Do you believe that a paper tube can fly in the air??? Make one for yourself and see how a tube can fly further than a normal paper airplane!
Activities

Rubber Band Helicopter..........................Rm 1153 – ME
Ever wondered how can a helicopter fly? Learn how by creating and flying your own helicopter. You might be surprised at how easy it actually is to make a helicopter fly.

Slingshot Cars........................................Rm 2305 – E-Hall
Crash test a slingshot-powered car into a tower of plastic cups! Engineer your car body to withstand the take-off and impact force! Whose car can destroy the tower the most?

Tin Foil Boats..............................................Outdoor
Set sail a boat of your own creation. Will it stay afloat as passenger pennies come aboard or will it sink under the pressure???
UW Biomechanics.................................................................Rm 1152 – ME
UW Biomechanics will return again to present our exhibit "The Human Machine". We will have several stations exhibiting a demo on biomechanics. Such as: looking at the electricity in muscles, controlling a robot arm with hand gestures, walking on force plates to assess ground reaction forces, find jump height using motion capture system, and looking at fracture patterns of broken bones (plus a few more!).

Materials Research Science and Engineering Center (MRSEC).........................................................General Atrium – ECB
Materials Scientists and Engineers create new things to solve problems and make the world a better place. Come get hands-on experience with amazing materials that have changed your world. You'll explore metal with a memory, metallic and other glasses, devices that convert motion to electricity, and many cool types of magnets and magnetic devices. Plus, you can talk to the researchers here at the university who are creating better things from computer chips to better medications to super strong glass using Materials Science.

American Society of Mechanical Engineering.............Rm 1164 – ME
ASME promotes student development in the Mechanical Engineering discipline through industry, academic, and community involvement.
Student Exhibits

ASABE-American Society of Agriculture and Biological Engineers.................................................General Atrium - ECB
Biological Systems Engineering combines natural resource management, machinery systems, and food and bio process engineering to help feed and power the world sustainably. Come explore how engineering is involved in the production and processing of one of the most abundant crops grown in Wisconsin: Corn! Check out some of the processes agricultural and biological engineers in each of our three disciplines use, thermal cameras, UAVs, and more.

Badger High Speed Rail Group.................................General Atrium – ECB
Imagine traveling at 300 mph on a train that floats. That is what they are building in Japan and it is called the Chuo Shinkansen. Our group will be explaining how this magnetically levitating train technology works, and when you will be able to ride on it.

Biomedical Engineering Graduate Student Association.......................................................General Atrium – ECB
Biomedical engineers use engineering and medicine to improve healthcare. Biomedical engineers can study a broad range of topics, from understanding how our cells communicate, to helping athletes achieve the best performance. And let’s not forget all the cool technology we use, like microscopes, 3D printers, and robots. Come explore the many exciting things biomedical engineering has to offer...there is something for everyone!
**Student Exhibits**

**Biomedical Engineering Society (BMES).................General Atrium – ECB**
Come make hydrogel beads with us! We will combine two materials that are used in the medical field (Alginate and Calcium Chloride) to make "medical" Orbeez. Essentially, there will be different colored solutions of the two materials so you can pick the colors you want, combine the solutions and make your own Orbeez in seconds!

**BMES Diversity & Inclusion Committee.................General Atrium – ECB**
There are currently many designs on the market that are not able to be used by underrepresented individuals because they were not thought of during the design process. Our exhibit will highlight some of these designs. You will have the opportunity to think like an engineer and brainstorm ideas on how they could make one of these designs more inclusive for users. Our hope is to emphasize the importance of diversity in engineering. More diversity in engineering not only means more opportunities for historically underrepresented groups, but it also means that more ideas can be brought to the table to help solve problems for all people.

**Boydston Group...........................................................Rm 265 – MS&E**
Ever wonder why some plastics are flexible and others shatter? Or why some are clear and others cloudy? In interactive demonstrations featuring 3D printing, active experiments, and real-world examples, scientists from the Chemistry Department will help you understand plastics all the way down to the atomic scale! Also, sneak a peek into the future of plastics through demonstrations with shape-memory, light-responsive, and self-healing materials.
CMaT..........................................................General Atrium – ECB
Do you ever wonder how the stem cells in our bodies know how to become unique cell types? Could we manipulate the stem cells to transform into a new cell type? Find out the answers at our interactive exhibit by learning about the genetic modifications stem cells experience during development!

Department of Chemical and Biological Engineering........................................General Lobby – E-Hall
Come learn about the UW-Madison Department of Chemical and Biological Engineering. At this table you will meet current faculty, graduate and undergraduate students who will share about research being conducted in the department. The table will include hands-on activities to teach about our current research efforts.

Digital and Robotic Construction..........................General Atrium – ECB
Learn how computing techniques are shaping the construction industry! Two prototype demos will be made: the first demo will show how people use eye trackers and wearable sensors to interact with autonomous construction vehicles and the second demo will show how the detection of people could determine STOP/SLOW signs to guide the traffic on a construction site.
Student Exhibits

INFORMS UW-Madison Student Chapter.............General Atrium – ECB
Find the shortest route connecting various cities across Wisconsin such that the route visits each city exactly once and returns to the origin city!

Institute of Transportation Engineers (ITE) UW Madison Student Chapter............................................................Rm 1003 – ECB
In our Self-Driving Car Lab, you will get a hands-on the tools, components and technologies that support self-driving cars. A small-scale self-driving car along with a complete transportation environment will be presented to showcase how these vehicles would operate in real-life and what are the underlying applications/theory/and challenges behind this technology.

Lee Lab (ECE).......................................................................General Lobby – E-Hall
Participants can play with modern AI algorithms and how they work (language generation, speech generation, and image generation). They will also witness why the current AI algorithms are not always trustworthy.

NSQ......................................................................................General Atrium – ECB
Learn about diversity in engineering from the NSBE, SHPE, and QTE student organizations!
Student Exhibits

Pfleger Research Group ............................................ General Lobby – E-Hall
Enzymes can do amazing functions like turn sunlight into sugar and biomass into fuel! Stop by our booth to learn how enzymes are both incredibly fast and extremely selective. Compete against your peers and see if you can be faster than an enzyme!

Schreier Group ...................................................... General Lobby – E-Hall
Come learn about the basics of electrochemistry, and how electricity can be used to split water into hydrogen and oxygen gas! Watch in real time as hydrogen and oxygen are generated from water sitting in a petri dish.

Tau Beta Pi .......................................................... Rm 2255 – E-Hall
Demonstrate your vertical jumping skills as well as learn how to improve your maximum jump height with this hands-on jumping exhibit! Participants will perform different types of vertical jumps in order to learn the biomechanics of jumping. The investigation focuses on the vertical jump gait, leg muscles, and the length of leg bones. The activity consists of data collection, hypothesis making, and data analysis as well as it will allow you to measure your maximum vertical jump height. The activity is run by Tau Beta Pi (Engineering Honor Society) and is sponsored by UW-Madison’s Biocore.
Student Exhibits

**Thompson Research Lab**
General Atrium – ECB
Why do rainbows exist? How do polarized sunglasses work? In this exhibit, we play around with lasers to understand how light interacts with matter. We explore phenomena like refraction and reflection, which illustrate a few key concepts: (1) light slows down when it passes through a material, (2) light is a wave, and (3) light has a polarization. These characteristics explain so much about our natural world and the technologies we use every day. So sit back and relax, and let’s see what answers await just beneath the surface...

**Triangle Fraternity**
General Atrium – ECB
Come play with the Kinetic Sand Art Table! The Kinetic Sand Art Table is capable of receiving patterns and drawing them on a sand surface. It does this by using magnets on a 2D belt system.

**UW ARC Lab**
Rm 1003 – ECB
How can a quadrotor fly autonomously and land precisely without human intervention? What is feedback controls and real-time optimization? The Autonomous & Resilient Controls (ARC) Lab look forward to showing you the math and engineering behind autonomous quadrotor flying.
UW-Madison AIAA……………………………………………..Rm 1413 - E-Hall
The UW-Madison chapter of AIAA (American Institute of Aeronautics and Astronautics) is the main aerospace club here at UW-Madison. One of the main competitions the club is participating in this year is called the Midwest High-Powered Rocket Launch Competition. For this competition, the team is required to design, build, launch and recover eight rockets! Each of the rockets are expected to vary from each other in many ways such as how tall they are, how many fins they have or how wide they are. Come check out our exhibit to learn more about this exciting competition and see the work we have been doing!

Acoustic Sensing and Functional Materials Laboratory..........Outdoor
We will demonstrate the design, fabrication and characterization of acoustic metamaterials (which are materials that have unusual acoustic properties that do not exist in nature), and demonstrate their applications in acoustic imaging.

American Institute of Chemical Engineers (AIChE)...............Outdoor
Ice Fishing??? See if you can "fish" some ice only using strings and salt! How much ice can you fish and how can adding the salt stick the ice to your string?

American Society of Civil Engineers........................................Outdoor
Come visit to learn about how Civil Engineers design and build the world around us!
Concrete Canoe Team

Come see how we do the impossible, not only make concrete float, but how we make it a canoe! Get acquainted with our process from hull design, to concrete mixing. We will have pieces of previous boats, projects and more!

Engineers for a Sustainable World

Engineers for a Sustainable World is here to teach kids about water filtration! We will have an example display set of different layered soils and rocks that have holes that connect to a clean water tank. We will pour dirty water into the filtration display for water to trickle down and pour into the clean water tank- thus showing kids how filtration can be achieved using natural materials. As a take-home activity, we will also let kids pot their own dixie cup plant using soil, sand, and pebbles, to mimic the filtration device they saw earlier. Kids can pot their own plant with a bean sprout seed and when it grows enough, they can repot the plant at home.

Formula SAE/Formula SAE Electric

Our latest competition cars will be available to look at and learn about, maybe even snap some photos with! Current members will give a short background presentation on our org, then answer any questions they may have about how we run a collegiate racing team.
Student Exhibits

Water Resources Engineering..............................Outdoor
We will demonstrate hydrology principles and flood processes using a hands-on demonstration with a stand-alone flood tank. The tank includes a rainmaker, various surfaces to compare runoff processes (wetland vs parking lot vs retention basin), and a river with houses located on the banks. Visitors will participate by making it rain, exploring the effects of various surfaces, building barriers to protect homes, etc. Key concepts include hydrology, development impacts, and downstream impacts.

Fluid Dynamics Lab..............................................Rm 1269 - E-Hall
Laboratory demonstrations of various fluid dynamics: Flow visualizations around airfoils and renewable energy devices, how waves cause nearshore erosion, and how seals use their whiskers to navigate in the ocean.

Lab for Printed Electronics and Sensors....................Rm 3147 - ME
Come interact with printed electronics! The lab for printed electronics and sensors will have printer demonstrations and four different interactive activities. The interactive demos include:
1. Drawing your own take-home paper circuits
2. Playing a printed and flexible piano
3. Investigating the smaller side of printed electronics with a microscope
4. Using capacitive sensors to measure water levels
Have you ever wondered what Bucky would like if he was made from silver nanoparticles? Come to our lab to find out!
Material Advantage/American Foundry Society

Liquid Nitrogen Frenzy

Foundry Fun

**Liquid Nitrogen Frenzy**: Ever wonder what happens when you cool something down to -196°C? Join us for some liquid nitrogen-ofied delicacies: from ice cream to graham crackers, marshmallows, and bananas. Maybe even crush a ping pong ball in the palm of your hand, or watch a balloon shrink like a raisin. (Almost) anything is possible with liquid nitrogen. Come stop by and have some frozen fun!

**Foundry Fun**: Things get toasty when there’s fire involved. In the MSE Foundry, we have that and more! Watch music come to life with our Ruben’s tube, where we show you what soundwaves look like through a flaming pipe. Feel what it’s like to hold fire with air bubble-powered Fire Hands and see how metals move with Shape Memory Alloys. Join us for some foundry fun!

**Multiscale Metal Manufacturing Processes Lab**

For those who thought science was boring and monotonous, we present The Heavy Metal group. Look around yourself, do you observe how many different metal parts are there! We will show you many cool ways to make fancy parts with metal. We literally rock and roll!!

**Polymer Engineering Center**

Learn about lightweight composite materials for aircraft, marine, and automotive applications!
Student Exhibits

Wisconsin Autonomous*…………………………………………………..Rm 1170 – ME
Come see a self-driving RC car that drives inside a set of cones!

Wisconsin Robotics…………………………………………………..General Lobby – ME
Come and see our robots! We will display our mock Mars rover and let you drive around some of our smaller robots. Wisconsin Robotics is a competitive student organization at the University of Wisconsin-Madison. We compete with other teams to build the best mock Mars rover, which we test in the Utah desert.

Badgerloop……………………………………………………………..General Lobby - E-Hall
We will be showing off the design and fabrication of our solar powered electric vehicle and VR simulations!

Geological Engineering Student Chapter*…………………..Rm 2211 – E-Hall
A demonstration of liquefaction - when soil behaves like water. This phenomenon can occur during earthquakes under certain soil conditions.

Graham Group……………………………………………………………..Rm 2321 – E-Hall
Hands on activities to visualize different types of complex fluids.

* = Present Friday Only
Student Exhibits

Society of Women Engineers

Come visit the Society of Women Engineers and join us in hands-on activities to explore the wonders of computer science, engineering, and robotics! With SWE you can investigate the basics of programming by creating a binary code bracelet, test conductivity of materials using Makey Makey boards, and get hands-on with robotics by creating a motorized brush bot. Additionally, we will also have a presentation from our Boeing Tech Team and their project: "Boating Accessibility with Mercury Marine." We look forward to sharing our passion for engineering with you!

Metals Design and Manufacturing Laboratory

High-speed x-ray imaging videos showing the dynamics of laser-material interaction will be played. The transient dynamics of laser melting, vaporization, vapor cavity fluctuation, powder spattering and rapid solidification will be presented. The application of laser melting for 3D printing will be discussed.

Stellar Tech Girls

Stellar Tech Girls provides an inclusive, fun environment for girls and nonbinary kids in Wisconsin to learn about engineering through hands-on experiments. Programs include summer day camp, private events, and afterschool clubs located onsite in Middleton, WI. Join our exhibit to meet the UW Founders and learn more!
Student Exhibits

Severson Research Group*.......................................................Rm 1413 - E-Hall
Participants will learn to use the [magnetic] force! At this interactive experimentation station, participants build their own electromagnets, make compass needles and paper clips jump, and shoot marbles -- all in the name of studying electromagnetism and magnetic forces.

The Polymer Engineering Center...........................................B331 - E-Hall
Currently, research interests at the Polymer Engineering Center range from traditional plastics and polymericmetal composites to bio-based polymers, and composites; from conventional to emerging and innovative processes. The MARVEL AVENGERS will be our theme for this year’s EXPO and we will have hands-on experiments that include: Avenger mask fabrication stations, 3D printing stations of Avengers, plastic shrinking experiments for keychain making and Oobleck experiments to understand how plastics behave during processing experiments.

Engineers Without Borders...................................................Outdoor
Have you ever wondered how water is purified? Do you want to purify water yourself? Students will build their very own water filtration system using cotton balls, sand, gravel, activated charcoal, and other materials and use it to clean muddy water. They will also learn about universal access to safe drinking water.

* = Present Friday Only
Student Exhibits

UW-Madison Makerspace…………………………………..…Makerspace
We are a community of designers and builders at UW-Madison within
the College of Engineering (CoE). The Makerspace facilities include
25,000 ft2 of shop and flex space with a wide range of rapid
prototyping equipment. Largely student run, the Makerspace strives
to empower students by creating a community immersed in
emerging technologies, focused on creating innovative products.
Come walkthrough the state of art facility to learn more about 3D
Printing, Laser Cutting, Electronics, and more. Following a brief tour,
students may build, learn about, and take home their own spinning
top!

Engineering Representations and Simulation Lab……..Rm 2324 - E-Hall
Lego like building blocks called primitives are used for generating
models used for 3D printing. We demonstrate how the models are
created using boolean operations (union, intersection, subtraction)
on these primitives, through an online fun quiz. Also, other
applications of 3D printing in design and product development for
real world problems to high-end research projects are shown through
some printed parts.
Student Exhibits

Prof. David Lynn Research Group........................................Outdoor
We will be giving a 2-part exhibit. The first part will involve dissolving sugar in water. Participants will be allowed to choose sugar cubes, some of which are coated with a transparent hydrophobic film, and then attempt to dissolve the cubes in water. This will be used to explain the concept of hydrophobicity. The second part will involve using the hydrophobic nature of surfaces we make in the Lynn lab to create pre-stenciled images using paint and plexiglass. Participants will be asked to choose from a small selection of plexiglass samples that we will then cover in paint to reveal the stenciled image.