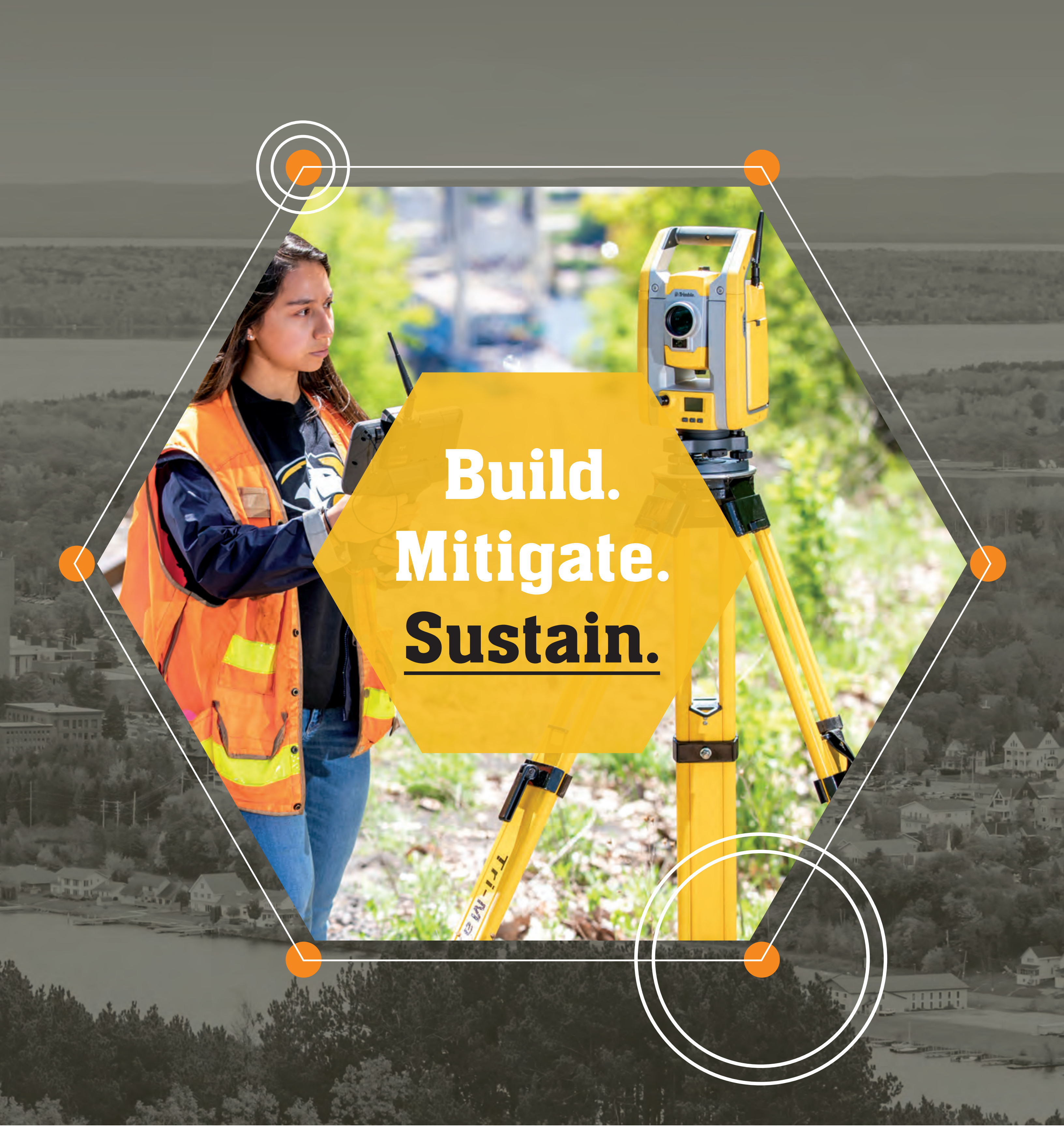


Michigan Technological University

1885

COLLEGE OF ENGINEERING
ENVIRONMENTAL RESPONSE
INITIATIVES

Hands in. Join us.

Advance the Future of Environmental Response

Instrument

SYSTEMS ON DISPLAY

From optimizing renewable energy sources to building products from recycled waste, we're devoted to seeking sustainable solutions through hands-on education and innovative research.

We partner with external agencies to forecast and detect disasters, reuse waste and water, create sustainable building solutions, analyze models, and optimize travel here on Earth—and in outer space.

Our new research facility is focused on human-centered engineering. The H-STEM Engineering and Health Technologies Complex features a LEED-certified building with sustainability, energy consumption, and optimized water management factored into its design.

Instrumented for students and faculty to monitor energy consumption, the facility ties in elements of industry 4.0 and big data.

To achieve our vision of a collaborative and data-driven workspace, we need support in instrumenting the building, deploying new systems, collecting data, and visualizing data usage patterns.

Construct

GAME-CHANGING ADVANCEMENTS

> We're contributing to new infrastructure that is integral to smart and sustainable development.

Our work on urban planning models, enhanced large-scale timber structures, and recycled building elements all help secure our sustainable future.

We partner with a torrefaction facility located near campus that transforms municipal solid waste and household trash into a renewable fuel source. We also develop ways to turn plastic waste into building materials, including studs and interior household products like furniture.

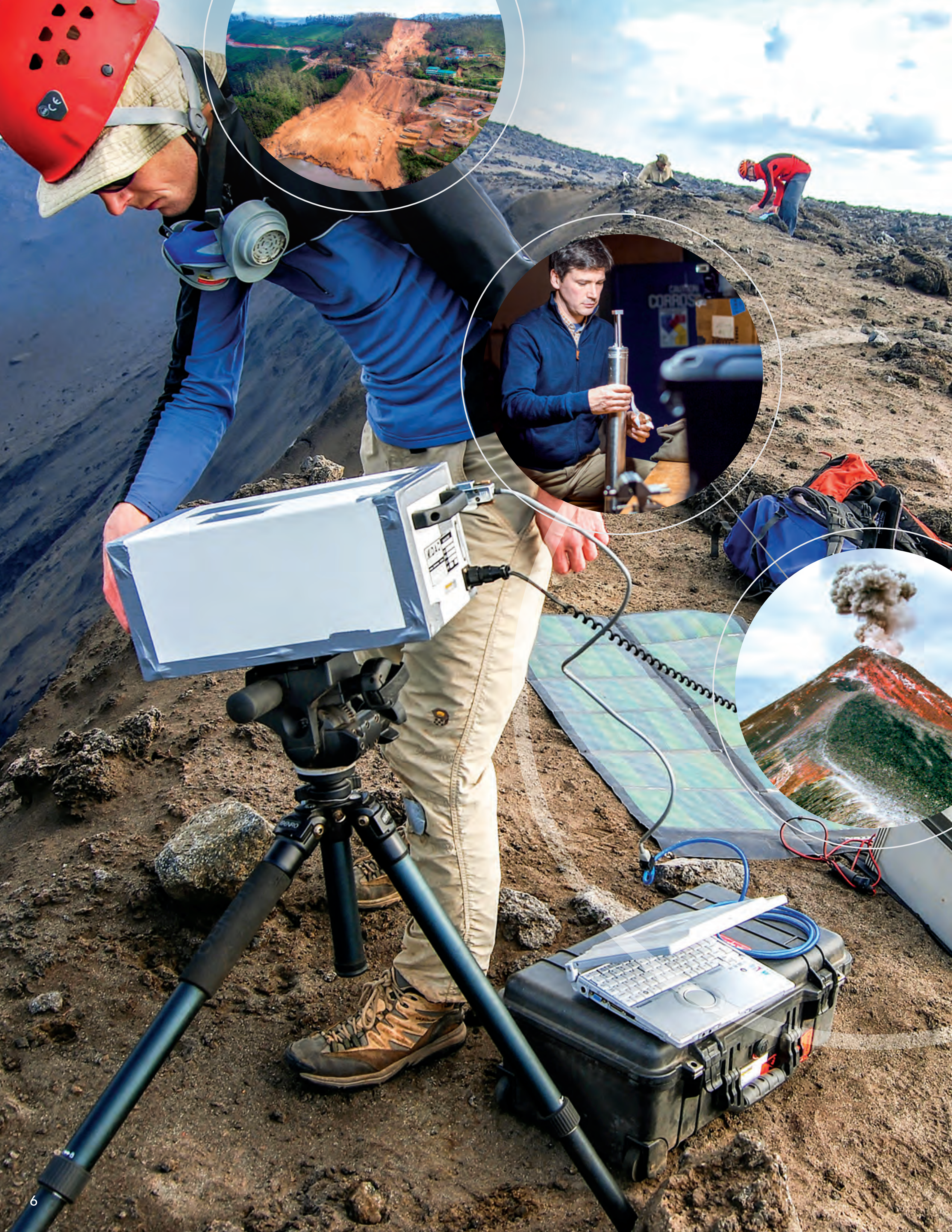
We analyze water intake for cooling electric power plants to determine its effect on water scarcity, as well as impacts on life and organisms in water bodies when higher temperature water is returned.

We model, analyze, and test new materials for deep space exploration—strong, lightweight composites.

These new materials can also be applied to enhance the sustainability of automotive applications or adapted for wind turbine blades that must withstand tremendous forces, weather, and temperatures.

As we move toward autonomous transportation, the US military needs soil strength characterization for off-road mobility. In many regions there are no maps of soil properties. We analyze thermal inertia as a function of soil density to direct expensive military equipment away from impassable areas.

Our society relies on computational infrastructure to better understand and develop energy efficient and eco-friendly solutions. We need computational support—and graduate student support—to expand modeling capabilities and guide future, sustainably-driven minds.



Sense

MITIGATING DISASTER

Using forecasting, modeling, and detection methods, researchers are uncovering ways to reduce risks during disasters.

With catastrophic damage from floods and landslides increasing across the globe, geohazard characterizations are critical. An example of this near Michigan Tech: the Houghton Father's Day Flood of 2018.

Predictive remote sensing techniques we develop take a proactive approach to support areas impacted by landslides. In railways, we implement early warning signals via satellite-based radar technologies. We can now detect millimeter-scale movement at the ground level—near railways, through building movement, and in groundwater.

We're focused on categorizing earthquake hazards and seismic signals from volcanoes, as well. These can determine the depth of seismic signals emitted and offer further insights on the depth of the lava lake.

We deploy drone and satellite-based multispectral cameras to forecast volcanic eruptions. Using sulfur dioxide as an indicator of volcanic activity, satellites monitor the atmosphere to keep air traffic in active volcano regions safe.

Because volcanic particulates can impact air quality, we employ remote sensing tools to analyze air quality locally in disastrous situations and globally as particulate flows through the atmosphere.

In addition we study infrastructure risk-management, exploring wind as a hazard and modeling the effects, while also using LIDAR to inspect buildings, bridges, and new construction for stability, using ultra-precise methods.

We conduct satellite-based geohazards work at high-fidelity temporal and spatial resolution, and also contribute to substantial advancements in drone-based sensing with hyperspectral capabilities. In order to further advance our research, we need funding to obtain LIDAR sensors for finer spatial scale, plus new thermal and optical sensors for traditional outputs.

Analyze

ASSESSING DATA

Through machine learning, geospatial surveying, and high-density modeling, we gather, analyze, and interpret data to better understand global climate change.

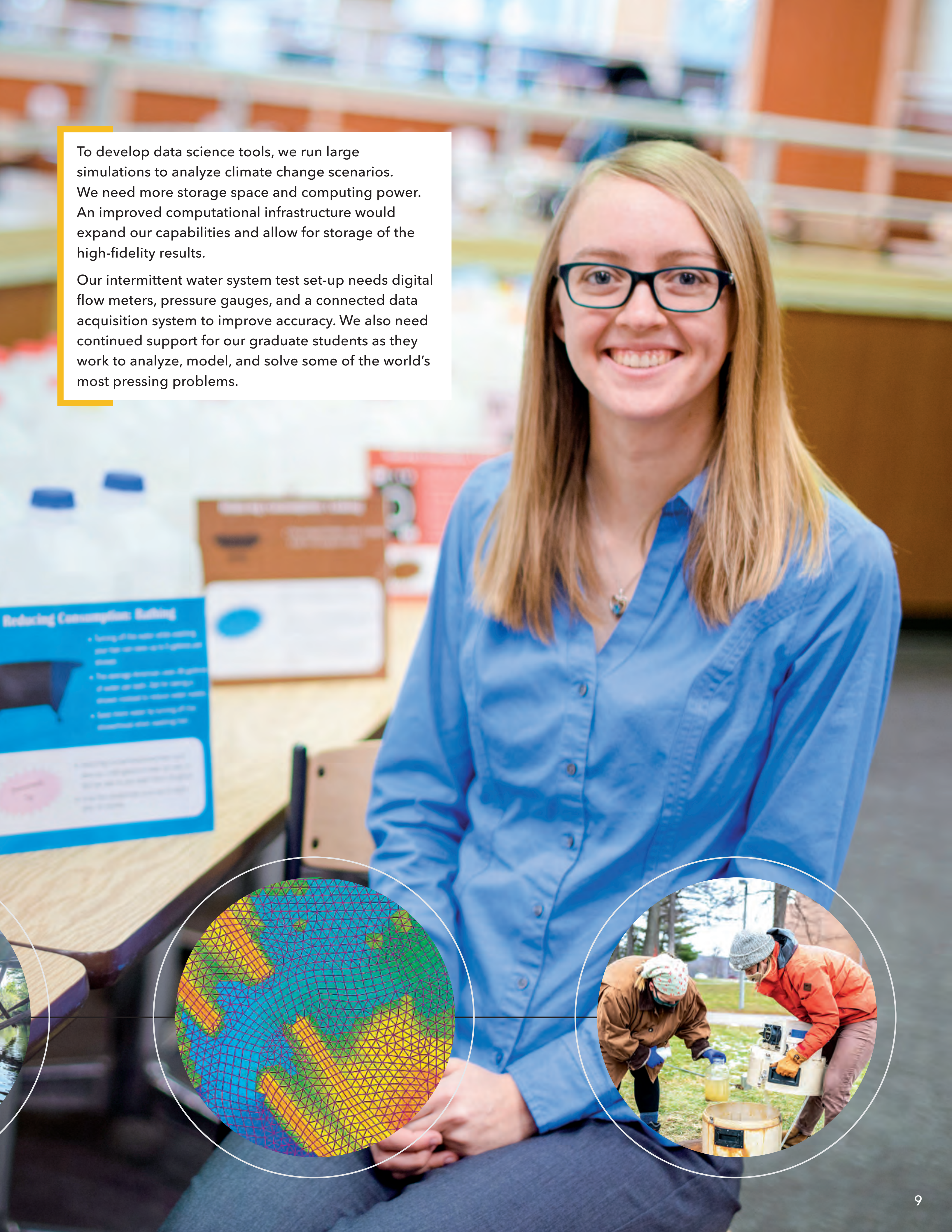
We constantly update hydrodynamic models to understand lakes, rivers, and floodplains. Our efforts lead to remote sensing and digital terrain modeling used to isolate problem areas and identify floodplains from larger rain events.

Understanding lake watershed atmospheric interactions help improve local weather models, while also analyzing nutrient transport that occurs under various conditions.

Water transport is another focus of our research—compiling waste and flow measurements for local COVID wastewater sampling, as well as assessing the fate of forever chemicals, like PFAS, in natural systems. Our work has resulted in a nodal network that provides concentration, load, and flow for accurate tracing.

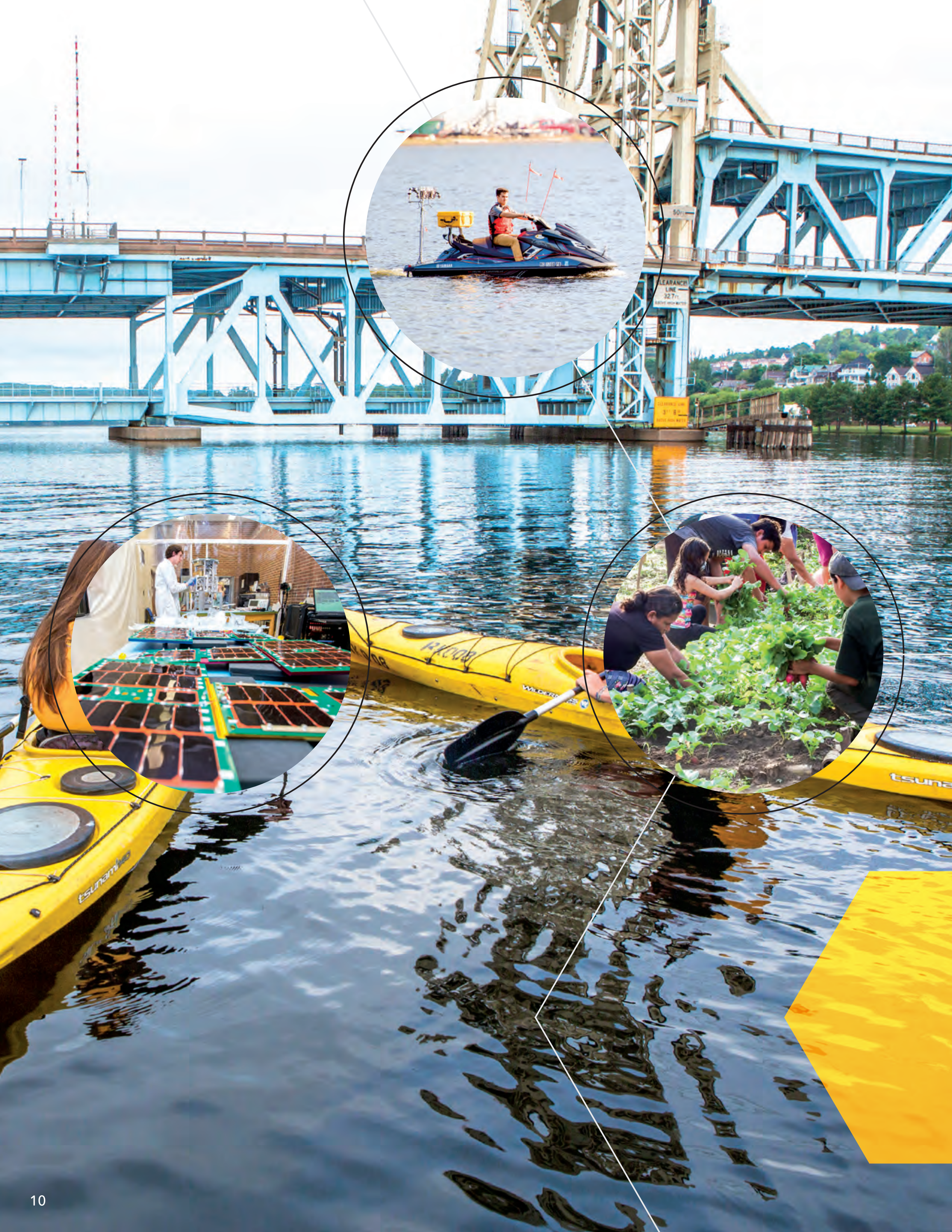
When managing water resources, we often see two extremes—floods and droughts. With the gradual improvement of our forecasting models, we can look into the future and help prepare those who face intermittent water supply issues.

We set up a pipe network that models intermittent water systems. Working with a modeling partner, we artificially define elevation, which can then be easily manipulated and reconfigured. The goal: equalizing the intermittent water systems in developing countries.



To develop data science tools, we run large simulations to analyze climate change scenarios. We need more storage space and computing power. An improved computational infrastructure would expand our capabilities and allow for storage of the high-fidelity results.

Our intermittent water system test set-up needs digital flow meters, pressure gauges, and a connected data acquisition system to improve accuracy. We also need continued support for our graduate students as they work to analyze, model, and solve some of the world's most pressing problems.



Act

IMPROVING TOMORROW TODAY

We develop sustainable solutions for water, urban planning, space exploration, and autonomous systems.

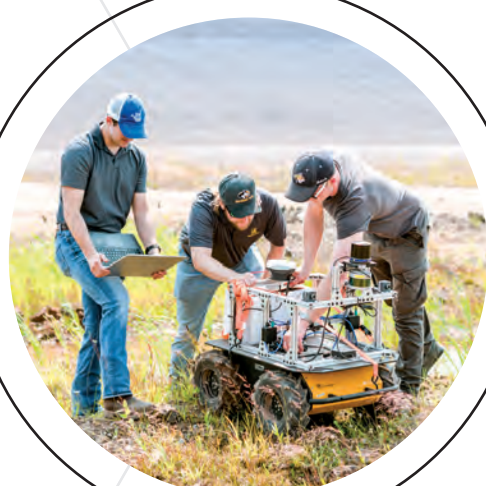
That includes creating autonomous microgrid solutions to provide power in times of disaster and in hostile combat areas. We use the hands-on lab that Lake Superior provides to test and deploy additional autonomous water systems from the Great Lakes Research Center.

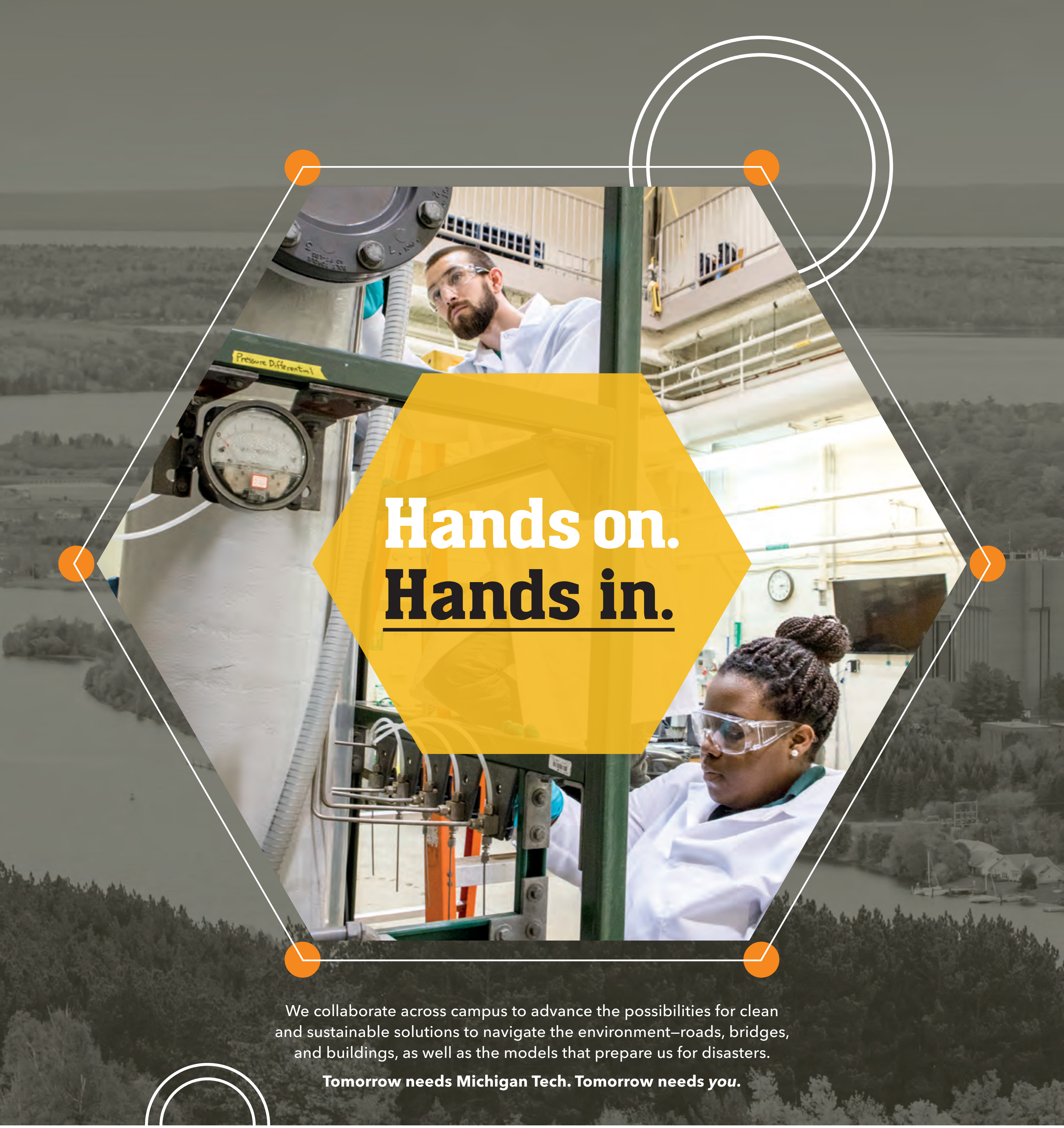
We study wave energy converters, similar in some ways to unstructured environments, as a renewable energy source. And while water security is a global challenge, one of the ways we address the emerging water crisis is with an innovative, prize-winning solar desalination process.

To ensure a sustainable future, we must also cultivate effective urban planning—from roads to rails and the vehicles that drive on them. We use UAVs and drones for road, bridge, and rail inspections, and also explore ways to minimize road noise created by vehicle tires.

The future of humans isn't just here on Earth, it's also in space. We investigate options for extracting water from rock and ice, as well as the satellites and thrusters involved in getting there. Ground penetrating radar technology in subterranean environments enables us to identify optimal locations for ice and water extraction.

We rely on sensors, radar, and computational power to advance the future through education and research. Your support for this technology, and for our graduate students, will enable them to impact the communication, movement, and sustainable solutions of tomorrow.





Michigan Technological University
1885

906.487.2005
ENGINEERING@MTU.EDU