LAUNCH A PARTNERSHIP WITH U of T ENGINEERING TODAY

U of T Engineering is partnering with industry and government to find ways to reduce the environmental impact of aviation. We can bring the same energy to your industry. Whether you're a sector-leading company, a nimble startup or an innovative entrepreneur, U of T Engineering delivers solutions to help you succeed. We have a strong track record — of success, of entrepreneurship, of patents, of inventions, of solutions.

HERE'S WHAT PARTNERING WITH U OF T ENGINEERING DELIVERS:

- An inside track to breakthrough technologies
- Customized solutions to industrially relevant problems
- An extra spark of innovation to your company
- Collaboration with U of T Engineering's world-leading researchers, including top graduate students, undergraduate students and alumni

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RESEARCH IN FOCUS:

SUSTAINABLE AVIATION

CHALLENGE:

How do we reduce the environmental impact of aviation?

SOLUTION:

Cut aircraft emissions and noise.

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THE POWER OF PARTNERSHIP

The aviation industry has launched various green initiatives, including a target for cutting net carbon emissions in half by 2050 compared to 2005 levels.

Professor David Zingg, director of the University of Toronto Institute for Aerospace Studies (UTIAS), has built a team of high-level researchers working with industry and government to meet this target and others. In partnership with Bombardier, they are developing alternative aircraft designs to reduce the environmental impact of commercial jets.

Zingg, Canada Research Chair in Computational Aerodynamics and Environmentally Friendly Aircraft Design, has long championed such green aviation partnerships. His own research in aerodynamics and computational fluid dynamics targets aircraft drag, which in turn reduces fuel consumption and emissions.

Professor Sam Sampath is helping to create one of the top groups in the world focused on combustion research in aviation. He holds UTIAS's Industrial Research Chair in Aviation Gas Turbine Combustion/ Emissions Research and Design System Optimization. Funded by both the Natural Sciences and Engineering Research Council (NSERC) and Pratt & Whitney Canada, the Chair reflects the deep commitment of U of T and its partners to collaboration that strengthens research.

THE DETAILS

"UTIAS has developed a strong international reputation for research that reduces the aerospace industry's carbon footprint. We are capitalizing on that expertise by offering new training to our students, which in turn will be taken into industry and put into practice."

Professor David Zingg
Director of UTIAS, Canada Research Chair in Computational Aerodynamics and Environmentally Friendly Aircraft Design and J. Armand Bombardier Foundation Chair in Aerospace Flight

Emissions created by burning jet fuel cause air pollution and account for 5 per cent of total human contributions to climate change. And people living near airports are subject to noise pollution during takeoff and landing. With air passenger kilometres doubling every 15 years, we must rise to these environmental challenges now.

"Aircraft fly for 30 years, so the new technologies we develop now will be with us through 2050," says Zingg. "In order to meet the growing demand for air travel, research that reduces aviation's environmental footprint is urgently needed. And it is equally urgent that we educate the next generation of engineers so they are equipped to address this challenge."

University of Toronto's engineers are doing just that. They are researching aircraft designs to reduce drag and weight, which will in turn decrease fuel burn and emissions. They are also testing designs for more efficient, quieter engines and aircraft configurations, and uncovering important insights into the combustion of hydrocarbon and biofuels.

UTIAS's recently established Centre for Research in Sustainable Aviation (CRSA) is teaching students to reduce the industry's environmental impact. Through a unique and multifaceted program, students learn from top-level researchers about everything from atmospheric science to emissions trading systems. They also benefit from the CRSA's $1.65-million NSERC Collaborative Research and Training Experience (CREATE) program in Environmentally Sustainable Aviation, which boasts interdisciplinary technical training and collaborative research opportunities with leaders in academia and industry.

PROFESSOR OMER GULDER HIGH-PRESSURE FUEL COMBUSTION

We must better understand the physics and chemistry of high-pressure combustion — of both hydrocarbon and biofuels — in order to reduce emissions and increase energy output. Even though we've been using hydrocarbon fuels for more than 150 years, there are significant gaps in our knowledge of how they burn.

Filling those gaps is particularly tricky when it comes to aircraft engines. It's also one of Gulder's specialties. The challenge is that fuel must combust efficiently during flight at high altitudes where air pressure is low, and also during taxiing at ground level where air pressure is high.

Professor Omer Gulder, UTIAS's associate director, is collaborating with major Canadian gas turbine engine manufacturers on boosting the efficiency of aircraft fuel combustion and reducing emissions of soot aerosols, which contribute to global warming.

PROFESSOR CRAIG STEEVES AIRCRAFT DESIGN

A heavier aircraft requires more lift to keep it aloft. But that lift comes with costs — greater thrust and higher fuel consumption.

Professor Craig Steeves works with lightweight materials to create efficient designs that can be used to build lighter planes, which in turn reduces fuel use and emissions. He leads UTIAS's Multifunctional Structures Lab, where researchers are designing and testing high-performance materials configured as geometrically complex structures.

His goal is to create designs for the aerospace industry that integrate multiple functions in a lightweight, low-volume package for even greater improvements in performance.

PROFESSOR ALIS EKMEKCI QUIETER LANDING GEAR

Air flowing through landing gear breaks into fluctuating patterns during takeoff and landing. These airflow patterns interact in ways we don't yet completely understand. But we do know they cause noisy vibrations.

Professor Alis Ekmekci is working to reduce this noise and the damage it does to people's health. She leads the Experimental Fluids Lab at UTIAS, where she and her team test alternative landing gear designs in partnership with Bombardier and Messier-Bugatti Dowty.

They simulate airflow by immersing various landing gear models in a large-scale channel filled with re-circulating water. While the fluctuating patterns are the same in water and air, the frequency is slower in water. This makes it easier to decipher noise-inducing patterns, leading to a better understanding of how to build quieter landing gear.

PROFESSOR MURRAY THOMSON BIOFUEL ENGINE DESIGN

While biofuels can help the aircraft industry reduce its carbon footprint, jet engines must first be optimized to handle the alternative fuel.

Enter Professor Murray Thomson, a mechanical engineer and director of the NSERC CREATE Program in Clean Combustion Engines. He is developing and testing new models for jet engines that use biofuels.

Working in partnership with Pratt & Whitney Canada, he is also creating tools that will allow the industry to predict how novel engine designs affect soot emissions. While such tools currently do not exist, they promise to significantly affect the industry's ability to lower emissions.