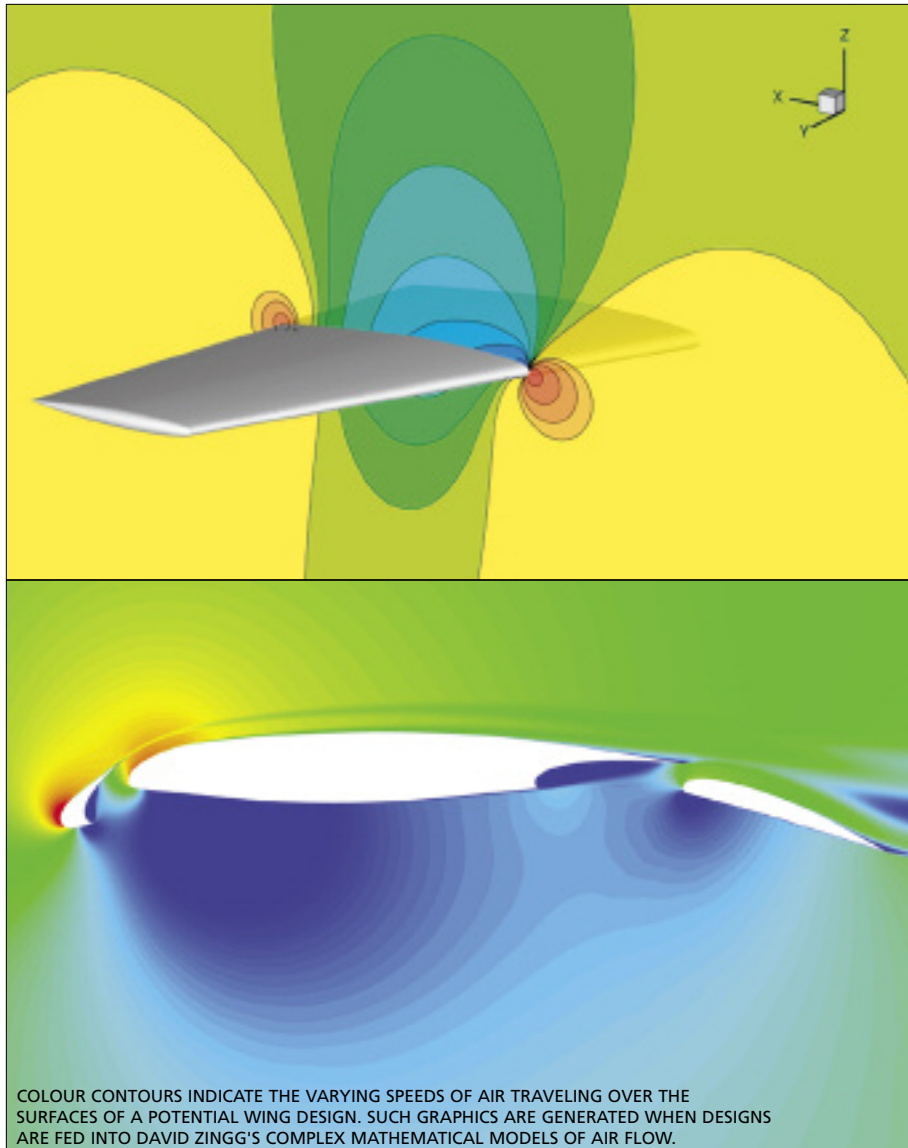


Ideas on the Edge

Thinking Outside the... Tube

COULD CHANGING THE SHAPE OF OUR AIRPLANES
HELP ADDRESS CHANGE IN OUR CLIMATE?
THE UNIVERSITY OF TORONTO'S
DAVID ZINGG THINKS SO.



Like just most other forms of transportation, aircraft are helping to heat up the planet. In fact, air travel accounts for 12 percent of transportation-related greenhouse gas emissions in the United States. And that number is predicted to go up.

That's why Dr. David Zingg, director of the University of Toronto Institute for Aerospace Studies (UTIAS), is out to literally reshape the airplane. "The current layout—a tube with wings—has been around for 50 years," he says. "It's so fully developed that it has limited room for improvement. But new designs with lower drag would help produce lower emissions."

Aircraft design used to involve long hours in the wind tunnel and lots of trial and error at the drawing board. Today, wind tunnel testing is still important at a later stage, but advanced computer modeling

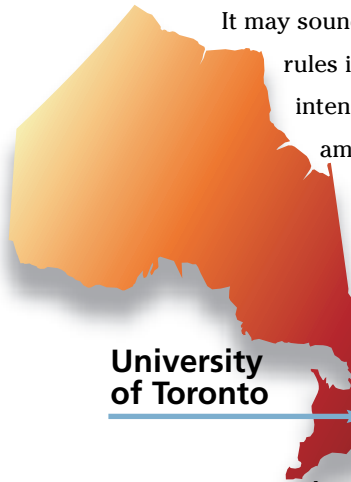
has revolutionized every step of the process. In fact,

RESEARCH THAT MATTERS
REAL-WORLD BENEFITS FOR ONTARIANS:

- more environmentally-friendly aircraft
- leadership for Ontario in the important global aerospace sector

computers do a lot of the actual design work themselves—guided by sophisticated software rules or “algorithms.”

Once those rules are defined, designers can specify objectives and constraints for a particular project, as well as some basic parameters—then step back and let the computer go to work. “Using the algorithms,” explains Dr. Zingg, “the computer searches intelligently through possible designs to find the one that satisfies all the constraints and maximizes the objectives.”



University of Toronto

It may sound easy, but developing those rules is a complex, mathematically intense process. It takes an incredible amount of talent and experience to endow long strings of 1s and 0s with the ability to design something. In Dr. Zingg’s case, that talent and experience is focused on writing algorithms that maximize how easily air will flow over the

surfaces of a proposed plane. The more “slippery” the aircraft, the less fuel it will use and the fewer emissions it will produce. Other scientists at UTIAS are looking at gas flows inside jet engines, creating their own algorithms to guide the design of a new generation of quieter, more efficient propulsion systems. All of this software development demands heavy-duty hardware; the high-powered computers used by Dr. Zingg and his UTIAS



DAVID ZINGG

colleagues have been funded in part by the Ontario Innovation Trust.

As important as silicon has become, however, the human element is far from gone in the search for more environmentally friendly aircraft. “We’re a long way from having algorithms that let you press a button to produce the perfect airplane,” says Dr. Zingg. “Usually we have to guide the process. We have to say things like ‘give me the perfect blended wing body.’ Even formulating the problem is complicated, because there are always a lot of competing objectives and many, many constraints.

“But that’s where the fun comes in.”

Project: Aerospace Flight Facility
Institution: University of Toronto
Research Sector: Engineering
Principal Investigator: Lloyd Reid (Original PI)
Trust Investment: \$1,480,000
CFI Investment: \$1,480,000
Total research investment from all sources: \$3,700,000



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Infrastructure for Innovation About the Ontario Innovation Trust

The Ontario Innovation Trust was created in 1999 by the Government of Ontario to invest in research equipment and facilities at Ontario’s universities, colleges, hospitals and other non-profit research institutions. The Trust is governed by a volunteer Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small permanent staff looks after day-to-day operations.

Since its inception, the Trust has committed almost \$843 million to strengthen Ontario’s position in the global marketplace of ideas. This represents more than a third of the \$2.44 billion in total funding that has been invested in Trust-supported projects.