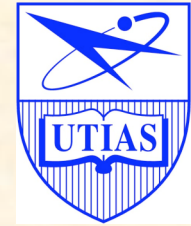




# University of Toronto Institute for Aerospace Studies

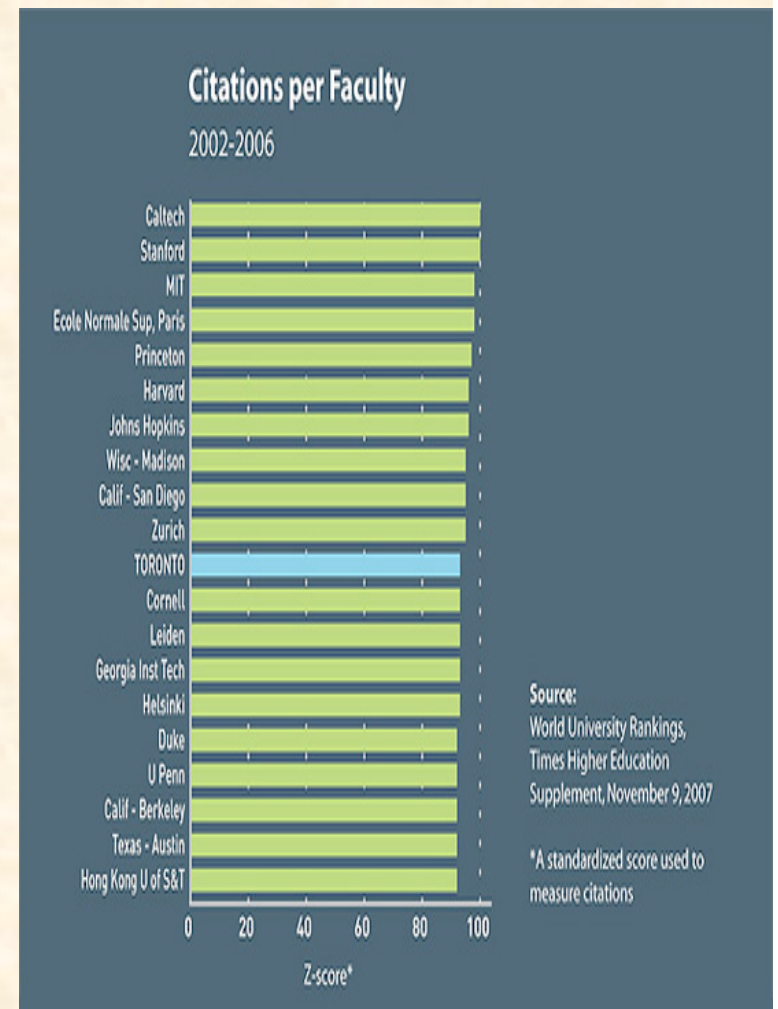


## RESEARCH & EDUCATION

*Professor David W. Zingg, Director  
Canada Research Chair in Computational  
Aerodynamics*

# University of Toronto Overview

- Canada's largest university
- Founded in 1827
- 70,143 students
- 11,807 faculty
- 433,386 living graduates
- 17 professional faculties
- 75 PhD programs



# Faculty of Applied Science & Engineering (U. of T.)

- 4,400 undergraduates
- 1,400 graduate students
- 219 faculty
- 5 departments
- 2 institutes
- Ranked 10th in world
- Last year 11th

TOP 50 UNIVERSITIES FOR TECHNOLOGY

		Country	Score	Citations
1	Massachusetts Institute of Technology	US	100	4.0
2	University of California, Berkeley	US	94.5	4.2
3	Stanford University	US	84.7	4.3
4	California Institute of Technology	US	80.0	3.7
5	University of Cambridge	UK	75.6	3.4
6	Imperial College London	UK	72.1	2.7
7	Carnegie Mellon University	US	71.0	3.6
8	Georgia Institute of Technology	US	68.0	2.9
9	University of Tokyo	Japan	65.1	2.1
10	National University of Singapore	Singapore	63.8	2.9
11	University of Toronto	Canada	60.4	3.5
12	University of Oxford	UK	60.2	3.7
13	ETH Zurich	Switzerland	59.6	2.5
14	Princeton University	US	59.2	4.7
15	Harvard University	US	58.3	5.1
16	Tsinghua University	China	58.2	1.2
17	Delft University of Technology	Netherlands	57.7	2.6
18	University of California, Los Angeles	US	57.4	4.1
19	University of Illinois	US	57.3	3.5
20	Cornell University	US	56.7	4.4
21	University of Melbourne	Australia	54.1	2.9
22	Tokyo Institute of Technology	Japan	53.8	1.8
23	Hong Kong University of Science & Technology	Hong Kong	53.6	3.1
24	Purdue University	US	53.3	2.7
25=	Technion – Israel Institute of Technology	Israel	53.1	1.8
25=	Nanyang Technological University	Singapore	53.1	2.1

# EDUCATION AND RESEARCH AT UTIAS

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- 17 full-time faculty members
- Undergraduate teaching
  - Aerospace Option of Engineering Science Program (~40 students)
- Graduate program
  - Roughly 124 M.A.Sc. and Ph.D. students
- Consistently ranked number 1 in Canada
- Ranked in top 5 public aerospace departments in North America

# Key Strategic Directions

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- **Sustainable flight:** research toward environmentally-friendly aircraft with emphasis on reducing impact on climate change
- **Space exploration:** unmanned autonomous robotic systems

# RESEARCH OVERVIEW

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- Aircraft flight systems, flight dynamics, and simulation (DeLaurier, Liu, Grant)
- Aerodynamics, fluid dynamics, and propulsion (Zingg, Gulder, Gottlieb, Groth, Sislian, Ekmekci, Lavoie)
- Structures and multidisciplinary optimization (Hansen, Martins, Steeves)
- Space systems engineering (Barfoot, D'Eleuterio, Damaren, Zee, Emami)
- Fusion energy (Haasz, Stangeby, Davis)



# Aerodynamics, Fluid Dynamics & Propulsion

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- **Computational aerodynamics (Zingg)**
  - New algorithms for aerodynamic analysis
  - New algorithms for aerodynamic optimization - application to development of environmentally-friendly aircraft
  - Novel aircraft configurations
- **Experimental fluid dynamics (Ekmekci, Lavoie)**
  - Advanced flow control for drag reduction - fundamental studies
  - MEMS actuators
- **Combustion & propulsion (Gulder, Groth)**
  - Turbulent premixed and partially-premixed combustion
  - Non-intrusive optical combustion diagnostics
  - Parallel solution-adaptive methods for combusting flows
  - Large-eddy simulation of compressible turbulent flows
  - Higher-order moment closures for micron-scale flows

# Structures and Multi-disciplinary Optimization

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- Multidisciplinary optimization of aircraft systems (Martins)
  - High-fidelity MDO for aircraft design
  - New aircraft configurations (e.g. Blended Wing-Body)
  - Strategies for MDO
- Structural mechanics and advanced materials (Steeves, Hansen)
  - Topological and shape optimization
  - Optimal design with uncertain loads
  - Multifunctional materials



# UTIAS Research Themes

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- **Sustainable flight:** research toward environmentally-friendly aircraft with emphasis on reducing impact on climate change
  - Ultra-low-drag unconventional aircraft, high-fidelity aerodynamic and multidisciplinary optimization, advanced flow control techniques, new lightweight materials, low emissions combustors, high efficiency engines
- **Space exploration:** unmanned autonomous robotic systems