Biographical Sketch of James DeLaurier

Professor DeLaurier has had a lifelong interest in flight ever since being taken on an airplane ride at the age of two. Trips to the Chicago Public Library gave a head start to aerodynamic knowledge, which was useful for his undergraduate studies at the University of Illinois. After a year working at McDonnell Aircraft in St. Louis, he continued studies at Stanford University and received a Ph.D. in Aeronautics and Astronautics in 1970. He did postdoctoral research at the von Karman Institute in Belgium and this expertise provided employment at the G. T. Schjeldahl Corporation, which had a DARPA contract to develop large, stable, tethered aerostats. This began an interest in lighter-than-air technology.

Dr. DeLaurier had long wished for an academic position, and this was realized by an appointment in 1974 at the University of Toronto Institute for Aerospace Studies. Fundamental research on lighter-than-air vehicles covered topics such as aerodynamic modeling and the flight-dynamic performance of aerostats and airships. A simulation developed in his research group has been accepted by the CAA and FAI for airship certification.

Another major project has been the development of the SHARP (Stationary High-Altitude Remotely-Piloted Platform) airplane, which is designed to fly at 21 km for months at a time, powered only by beamed microwave energy. A low-altitude demonstration of this was achieved in 1987, which holds the FAI award of being the first free-flying aircraft to be sustained by ground-based beamed energy.

Dr. DeLaurier had a growing interest in flapping-wing flight and, in partnership with a friend at Battelle Memorial Institute, theoretical and experimental research was performed on the flight performance of ornithopters. This work started with basement wind tunnels and calculations, but it soon expanded to include Dr. DeLaurier's students, who embraced the topic in senior and graduate thesis research. This work led to the successful flight of a 1/4-scale proof-of-concept ornithopter in 1991, which was documented in the IMAX film, *Momentum*. This accomplishment was recognized by the FAI as the world's first engine-powered remotely-piloted flapping-wing aircraft, and it won several awards (*Popular Science* Best of What's New, *Popular Mechanics* Design and Engineering, Rolex Spirit of Enterprise).

Soon thereafter, work commenced on a feasibility study for a full-scale engine-powered piloted ornithopter, and construction began in 1995. The aircraft first took to the runway in 1996 and has been undergoing tests since that time. The project has received international recognition, and is the first ornithopter to be listed in Jane's *All the World's Aircraft*. Also, it received the Berblinger Prize for Innovative Aircraft from Ülm, Germany.

Dr. DeLaurier holds patents resulting from the SHARP project as well as the ornithopter project. His interests continue to embrace unique aircraft and the aerodynamic and flight-dynamic principles behind them.

Georgia Institute of Technology
Woodruff School of Mechanical Engineering
www.me.gatech.edu

The George W. Woodruff School of Mechanical Engineering

Presents the Annual

Harold W. Gegenheimer Lecture on Innovation

Dr. James DeLaurier
University of Toronto Institute for Aerospace Studies

Thursday
November 3, 2005
3:30 p.m.

Georgia Institute of Technology

Gegenheimer

Lecture Synopsis

Development of a Full-Scale Flapping-Wing Aircraft

Flight with mechanical flapping wings has been humanity's oldest aeronautical dream, with origins in mythology and the designs of Leonardo Da Vinci. However, the concept became marginalized when aircraft design embraced the sensible notion of separating the functions of lift (fixed wings) from propulsion. From that point on, ornithopters were seen only as small rubber-band powered models or the hapless pursuits of backyard inventors.

A modern effort to revisit the feasibility of such aircraft began in 1975, in partnership with Jeremy Harris of Battelle Memorial Institute. It evolved from a hobby to an avocation, eventually becoming a quest to build and test a successful, full-scale engine-powered ornithopter. The first accomplishment was a hand-launched ¼-scale remotely-piloted model in 1991, and the realization of this required considerable original research which was directly applicable to the full-scale design, built in 1996 at the University of Toronto Institute for Aerospace Studies. However, several new challenges had to be addressed such as the ground takeoff of a flapping-wing aircraft. Computer simulations have shown strategies for successful takeoff, and these have been tested on the runway. This talk will describe these tests, as well as the design, development, and construction of the aircraft. To date, the ornithopter has accelerated to over 50 mph and has achieved brief liftoffs.

Another important aspect of this project is that it has served as an excellent educational tool for students. Besides the rich variety of thesis topics on unsteady aerodynamics, aircraft flight dynamics, and optimized composite structures, it has provided a hands-on counterpart to the usual heavily-theoretical curriculum. Furthermore, students have learned to work in a team environment, with a great deal of mutual responsibility. Strong motivation is provided by the sense of being involved with a project that touches on aviation history. View www.ornithopter.ca for more details about the project.

Program

Introduction	Dr. Ward O. Winer Eugene C. Gwaltney, Jr. Chair of the Woodruff School of Mechanical Engineering
Gegenheimer Lecture	Dr. James DeLaurier Professor, University of Toronto Institute for Aerospace Studies
Question-and-Answer Session	Drs. DeLaurier and Winer
Concluding Remarks	Dr. Winer

Please join us after the lecture for a reception on the 2nd floor of the J. Erskine Love, Jr. Manufacturing Building.

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