The George W. Woodruff School of Mechanical Engineering at Georgia Tech Presents The Annual Harold W. Gegenheimer Lecture Series on Innovation

Featuring:

Dr. James DeLaurier
Professor of Aerospace Studies
University of Toronto Institute for Aerospace Studies

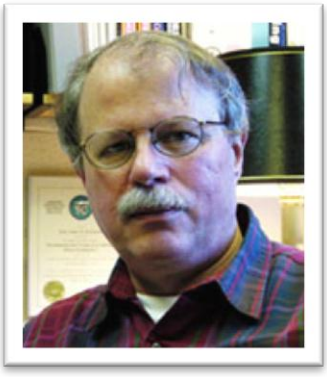
Speaking About:

Development of a Full-Scale Flapping-Wing Aircraft

Thursday, November 3, 2005, 3:30 P.M.
Van Leer (ECE) Auditorium
Georgia Tech Campus,
Atlanta, Georgia

(Reception after the lecture on the 2nd floor of the J. Erskine Love Jr. Manufacturing Building)

Biographical Sketch



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. 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.

Another major project has been the development of the SHARP (Stationary High-Altitude Remotely-Piloted Platform) airplane. 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 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 Ulm, 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.

Synopsis of the 2005 Gegenheimer Lecture

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 1/4-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.

About the Lecture Series

The Lecture Series on Innovation was established in 1995 through an endowment from Mr. Harold W. Gegenheimer (Class of 1933) to support student programs that encourage creativity, innovation, and design. Through the lecture series and support of capstone design projects, students are exposed to processes that stimulate creativity and lead to inventions and patents. The previous Gegenheimer lecturers were:

1995 **Dr. Jerry M. Woodall**	Distinguished Professor of Microelectronics at Purdue University	*Necessity Is the Mother of Invention, But Curiosity and Persistence Make It Happen*
1996 **Mr. Burt Rutan**	President and CEO of Scaled Composites, Inc.	*Innovation: Use It or Lose It*
1997 **Dr. Jim Adams**	Professor at Stanford University	*Creativity Versus Control: Their Impact on Innovation*
1998 **Dr. George N. Hatsopoulos**	Founder of Thermo-Electron Corporation	*Thermo Electron and the Spin-Out Business Design*
1999 **Mr. Richard Teerlink**	Retired President and CEO of Harley Davidson, Inc.	*Our Learning Journey*
2000 **Dr. Woodie Flowers**	Pappalardo Professor of Mechanical Engineering at MIT	*Innovator, Innovatee, or Somewhere Between?*
2001 **Dr. Leo Beranek**	Co-Founder, Past President, and CEO of BBN	*Concert Halls of the World and Their Design*
2002 **Dr. Roger L. McCarthy**	Chairman of Exponent, Incorporated	*Engineering Disasters: Those who cannot remember [innovation's] past are condemned to repeat it.*
2003 **Dr. Steven L. Stice**	Professor and Eminent Scholar at the University of Georgia	*Cloning Technology at a Crossroad: Raelians or Real Science?*
2004 **Dr. Malcolm Swinbanks**	Chief Scientist, Vibration and Sound Solutions, Ltd.	*From Mathematics to High-Speed Boats — A Shock to the System*

About the Woodruff School

The Woodruff School of Mechanical Engineering is the oldest and second largest of the ten divisions in the College of Engineering at Georgia Tech. The School offers academic and research programs in mechanical engineering, nuclear and radiological engineering/medical physics, paper science and engineering, and bioengineering. The enrollment includes 1674 undergraduates and 696 graduate students. Studies are directed by a full-time staff of 72 professors, ten joint faculty, 23 research faculty, and five academic professionals, who are supported by 43 staff members. The George W. Woodruff School of Mechanical Engineering is the only educational institution to be designated a Mechanical Engineering Heritage Site by the American Society of Mechanical Engineers. For more information about the Woodruff School contact:

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