

**EDUCATION**

- 1981 Ph.D. in Zoology (with unofficial guidance from Civil Engineering Department) from the Department of Zoology, University of Bristol, Bristol, England.
- 1978 B.Sc. (Hons, 1<sup>st</sup> class) in Zoology from the Department of Zoology, University of Bristol, Bristol, England.

**CURRENT POSITION**

- 2010-now Professor and Chairman, AME, University of Southern California
- 1998-now Visiting Research Fellow, Department of Animal Ecology, Lund University, Sweden.

**PREVIOUS EMPLOYMENT**

- 2008-2009 Professor, Department of Mechanical and Aeronautical Engineering, University of Pretoria, South Africa
- 2005-2008 Professor, AME, University of Southern California
- 2006-2008 Faculty Fellow, Center for Excellence in Teaching, University of Southern California
- 1998-2005 Associate Professor, AME, University of Southern California
- 1997 Stagiaire, Coriolis Research Laboratories, Institute de Mécanique Grenoble, France.
- 1994-1998 Research Associate Professor, Departments of Aerospace and Mechanical Engineering; University of Southern California
- 1988-1994 Research Assistant Professor, Departments of Aerospace and Mechanical Engineering; Member of Center for Neural Engineering, University of Southern California
- 1981-1988 Research Associate, Departments of Mechanical and Aerospace Engineering at University of Southern California
- 1983 Visiting Research Scholar, Department of Fisheries, Sea World, San Diego, California

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**RESEARCH INTERESTS**

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1. *Geophysical fluid dynamics.* Experimental investigation of fluid flows that are affected by the background variations in density and/or by planetary rotation. All medium and large scale flows in the ocean and atmosphere fall in this category. Although most of this research has been funded by defense sources, applications include much broader environmental issues, and fundamental problems in non-equilibrium turbulence.
2. *Advanced imaging and data analysis.* Significant advances in wholefield velocity measurements in fluid mechanics were pioneered at USC. New algorithms have been developed in analysis and control of experimental engineering, including the Correlation Imaging Velocimetry (CIV) algorithms. Original work on spline interpolation methods and two-dimensional continuous wavelet transforms continues to be used in my own research, and by the research community at large through freely-distributed and documented software.
3. *Aerodynamics at small-scales.* Fundamental properties of wings and airfoils at moderate Reynolds number. Boundary layer separation and wake analysis of simple and complex flight systems, including engineered and natural (birds, bats) designs.

## **AWARDS**

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- 2013 Chaire Joliot, ESPCI Paris, June 2013
- 2010 Fellow of American Physical Society
- 2006 Fellow of Center for Excellence in Teaching, USC
- 2005 Viterbi School of Engineering/Northrop Grumman Excellence in Teaching Award
- 2001 Honorary member of Sigma Gamma Tau
- 2001 Faculty Fellow Participation Award, USC Residential & Greek Life
- 1982 Thomas Henry Huxley Award for Original Contribution to Zoology from the Royal Society of London.

## **SERVICE**

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### **USC service**

#### **USC Level**

- Computer and Information Services Committee (2001)
- Faculty Fellow, Cardinal Gardens (Spr01)
- Committee on Academic Policies and Procedures (CAPP) (04-05, 10-12)
- USC Associates Awards Committee (Fall06)
- CET Undergraduate Council Selection Committee (Fall06)
- Fund for Innovative Undergraduate Teaching (Spr07, 08)
- Faculty Advisor: AIAA USC Student Chapter, AIAA Design Team, Sigma Gamma Tau (AE honors society), USC Aviators (business, entrepreneurs and engineers), USC Flying Club (2013)

#### **Engineering School Level**

- Advisory Board Viterbi Graduate Mentoring Program (2011)
- Engineering Writing Program Advisory Board (2004-2008)
- Task Force on Academic Integrity (2005-2008)
- Engineering Faculty Council (2004-2008)
- VSoE Staff Awards Committee (Spr 08, Spr12)
- Joint EFC-APT Merit Review Committee (2006)
- VSoE Teaching Award Committee (Spr06)
- EFC Subcommittee on Merit Review (Fall06)
- Committee for Innovative Teaching Technology (2004-2005)
- APT committee (2002-2005)

#### **Departmental Level**

- AME Seminar coordinator (Fall01-Spr02)
- Member of Dynamics & Controls search committee (Spr04)
- Member of Computational Engineering Search Committee (Spr04-05)
- Merit Review Committee (2004-2008)
- Graduate Fellowship Committee (Spr05-06)

AeroDesign Team Design Review Advisor (06-07, 10-current)  
Strategic Planning Committee (Chair) (Fall06 – Fall07)  
APS DFD 2010 Organising Committee (Presentation to APS Exec. Comm. Fall06)  
UCAR Review Committee (Chair) (Fall 07-Spring08)

### **Combined School/Departmental Ambassador Functions**

Explore USC:

- Presentations/breakout/dinners (at least 3/3/2 per yr)
- Lab Tours of Research Facilities (multiple, yearly)
- Lab Tours of BHE student (341/441) labs. (multiple, yearly)
- Lab tours of Dryden Wind Tunnel for Parents Day (2004, 2010-...)
- Faculty Marshall for Commencement (01, 03, 04)
- Gifted and Talented Education Outreach Research Laboratory tours (Jan06)
- Research lab tours for National Society of Black Engineers mentoring program (Mar06)
- Freshman Academy lab tours in Dryden Wind Tunnel (Fall06, 09- ...)
- Beyond Books -- Introduction to Aerospace and Mechanical Engineering (Fall09, 10, 12)
- Spotlight on Aerospace & Mechanical Engineering Panel (Fall06, 09, 12)
- REACH Introduction to Aerospace and Mechanical Engineering (Fall10-...)
- Tomorrow's Aeronautical Museum (2010 - ...)

### **Conference/Session Chair**

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Session Chair: *Turbulence*

8<sup>th</sup> Southern California Symposium on Flow Physics  
UCLA  
April 12<sup>th</sup>, 2014

Session Chair: *Aerodynamics and Flow Control*

7<sup>th</sup> Southern California Symposium on Flow Physics  
Caltech, Pasadena  
April 13<sup>th</sup>, 2013

Session Chair: *General Experiments I*

65<sup>th</sup> Annual DFD Meeting of APS  
San Diego, CA  
November 18<sup>th</sup>, 2012

Session Chair: *Turbulence (morning) and Geophysical Flows (afternoon)*

6<sup>th</sup> Southern California Symposium on Flow Physics  
University of California, Santa Barbara  
April 14<sup>th</sup>, 2012

Session Chair: *Low Reynolds Number Aerodynamics*

64<sup>rd</sup> Annual DFD Meeting of APS  
Baltimore, MD

November 21<sup>st</sup>, 2011

Session Chair: *Biofluids and Bioengineering*  
5<sup>th</sup> Southern California Symposium on Flow Physics  
University of Southern California  
April 16<sup>th</sup>, 2011

Session Chair: *Turbulence in Strongly Stratified Flows*  
63<sup>rd</sup> Annual DFD Meeting of APS  
Long Beach, California  
November 23<sup>rd</sup>, 2010

Session Chair: *Aerodynamics*  
62<sup>nd</sup> Annual DFD Meeting of APS  
Minneapolis, Minnesota  
November 23<sup>rd</sup>, 2009

Session Chair: *Fundamentals*  
6<sup>th</sup> International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics  
University of Pretoria, Pretoria, South Africa  
July 1<sup>st</sup> 2008

Session Co-Chair: *Thermal Properties, Equilibrium Phase Change, Stability, Solidification, Suspensions*  
6<sup>th</sup> International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics  
University of Pretoria, Pretoria, South Africa  
June 30<sup>th</sup> 2008

Session Chair: *Vortices and Separated Flows*  
2<sup>nd</sup> Southern California Symposium on Flow Physics  
University of California, Los Angeles,  
April 12<sup>th</sup>, 2008

Session Chair: *Two-Dimensional Turbulence*  
Workshop at Lorentz Centre,  
Leiden University, The Netherlands  
March 22<sup>nd</sup>, 2007

Session Chair: *Geophysical Fluid Dynamics II.*  
57<sup>th</sup> Annual DFD Meeting of APS  
Seattle, Washington  
November 21<sup>st</sup>, 2004

Session Chair: *Aerodynamics.*  
54<sup>th</sup> Annual DFD Meeting of APS  
San Diego, California  
November 19<sup>th</sup>, 2001

Session Chair: *Stratified Wakes I*  
5<sup>th</sup> International Symposium on Stratified Flows

University of British Columbia, Vancouver  
July 10<sup>th</sup>, 2000

Session Chair: *Convection and Buoyancy-Driven Flows*.  
52<sup>nd</sup> Annual DFD Meeting of APS  
New Orleans, LA  
November 21<sup>st</sup>, 1999

Session Chair: *Particle Image Velocimetry (PIV)*.  
49<sup>th</sup> Annual DFD Meeting of APS  
Irvine, California  
November 26<sup>th</sup>, 1996

## Conference/Symposium Organiser

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17<sup>th</sup> US National Conference on Theoretical and Applied Mechanics  
Minisymposium: *Bioflight II Implementation in Nature and Engineered Solutions*  
Michigan State University  
June 15-20, 2014

Division of Fluid Dynamics Meeting of the American Physical Society  
Organizing Committee  
Long Beach, CA, November 21-23, 2010

South African Conference on Computational and Applied Mechanics  
University of Pretoria, January 10-13, 2010  
Scientific Advisory Committee

6<sup>th</sup> International Symposium on Particle Image Velocimetry (PIV05)  
California Institute of Technology, September 21<sup>st</sup> – 23<sup>rd</sup>, 2005  
Secretary General.

International Union of Physical Sciences Satellite Symposium on *Biophysical and Biomechanical Adaptation and Bioinspired Engineering*, Caltech, March 28-30, 2005.  
Member of Organising Committee.

*ONR Stratified Wakes Meeting* at USC, Dec. 14<sup>th</sup> – 15<sup>th</sup> 1999  
Invited participants: Arendt (Colorado Research Associates), Brandt (Applied Physics Laboratories, JHU), Voropayev (Arizona State University), Rottman (SAIC, San Diego), Linden (UCSD), Browand (USC).

GRS gave introductory talk: *Recent Advances in Vertical and Horizontal Plane Measurements in a Stratified Wake*.

*DPIV MiniCon: An informal symposium on quantitative methods in digital particle tracking*. One day event, held at USC, March 14<sup>th</sup>, 1995.

Invited participants: Westerweel (Delft, Netherlands), Cowen (Stanford), Gharib (Caltech.), Fincham (USC).

GRS gave introductory talk: *Fundamental Limits in DPIV Accuracy*

# Reviewer

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## **Engineering/Fluid Mechanics**

*J. Fluid Mech., Phys. Fluids, Exp. Fluids, Proc. Roy. Soc. Lond. A, Dyn. Atmos. Ocean, J. Geophys Res., Eur. J. Fluid Mech., J. Turbulence, J. Aircraft, AIAA J., J. Fluids and Structures, Limnology and Oceanography, J. Aero. Eng., Comm. Nonlin. Sci. Num. Sim., J. Hydraul. Eng., J. Bioinsp. Biomim., Exp. Mech., Fluid Dynamics Res., Optics and Lasers in Eng., J. Micromech. Microeng., Math. BioSci., J. Ren. Sust. Energy, Comp. Appl. Eng. Ed.*

Guest editor: PNAS

## **Biology**

*J. Exp. Biol., Phil. Trans. R. Soc., Proc. Roy Soc. Lond, B, J. Theor. Biol., Journal of Environmental and Engineering Science, Trends in Ecology and Evolution, J. Avian Biol., J. Ornithology*

## **General**

*Nature, Science, Physics Today, Public Library of Science (PLOS), Proc. Nat. Acad. Sci. (PNAS), J. R. Soc. Interface*

## **Proposals**

NSF, ONR, AFOSR, NOAA, Science and Engineering Research Council (UK), British Biology Research Council, Wellcome Trust, Dutch Technology Foundation, Canada Foundation for Innovation

# Professional society - membership/activities

## **Member**

American Physical Society (APS)(Fellow)

American Society of Engineering Education (ASEE)

American Institute for Aeronautics and Astronautics (AIAA)

American Association for the Advancement of Science (AAAS)

European Mechanics Society (EMS)

Royal Institute of Biology (RIB)

Sigma Chi

Union of Concerned Scientists (UCS)

# Service – general

## **Panels**

Prognos Technology Report, 2006/2007; 2007/2008, 2009/2010 expert panel member. Prognos AG, Berlin

NSF CAREER Panel 2006

## **Committees**

APS Nominations Committee 2009, Awards Committee 2012

## **Outreach**

Venice High School Engineering Class (instructor: Holland) (Nov 2013)



**Refereed Journal Articles (most PDFs on <http://mysite.verizon.net/res77pzy/pub.html>)**

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- Orr TS, Domaradzki JA, Spedding GR, Constantinescu, GS. 2014. Description of the near wake of a sphere moving in a steady, horizontal motion through a linearly stratified fluid at  $Re=1000$ . *Phys. Fluids* (in press)
- Huyssen RJ, Spedding GR, Mathews EH & Liebenberg L 2014 On the existence of a hitherto untested, optimal aircraft configuration. *Aero. J.* (submitted Nov13)
- Huyssen RJ, Spedding GR, Mathews EH & Liebenberg L 2014 On the wing density and the Inflation Factor of aircraft. *Aero. J.* (submitted Nov13)
- Yang SL & Spedding GR 2014 Local acoustic forcing of a wing at low Reynolds numbers. *AIAA. J.* <http://arc.aiaa.org/doi/abs/10.2514/1.J052984>
- Spedding GR 2014 Wake signature detection. *Ann. Rev. Fluid Mech.* **46**, 273-302. (doi: 10.1146/annurev-fluid-011212-140747)
- Yang SL & Spedding GR 2013 Passive separation control by acoustic resonance. *Exp. Fluids* **54**, 1603 (DOI: 10.1007/s00348-013-1603-6)
- Yang SL & Spedding GR 2013 Separation control by external acoustic excitation on a finite wing at low Reynolds numbers. *AIAA J.* **51**, 1506-1515. (DOI: 10.2514/1.J052191)
- Yang SL & Spedding GR 2013 Spanwise variation in wing circulation and drag measurement of wings at moderate Reynolds number. *J. Aircraft* **50**, 791-797. (DOI: 10.2514/1.C031981)
- Huyssen RJ, Spedding GR, Mathews EH & Liebenberg L 2012 Wing-body circulation control by means of a fuselage trailing edge. *J. Aircraft* **49** (5), 1279-1289.
- Muijres F, Spedding GR, Winter Y & Hedenström A 2011 Actuator disk model and span efficiency of flapping flight in bats based on time-resolved PIV measurements. *Exp. Fluids* **51**, 511-525. [doi: 10.1007/s00348-011-1067-5].
- Diamessis PJ, Spedding GR & Domaradzki JA 2011 Similarity Scaling and Vorticity Structure in High Reynolds Number Stably Stratified Turbulent Wakes. *J. Fluid Mech.* **671**, 52-95.
- Spedding GR & McArthur J 2010 Span efficiencies of wings at low Reynolds number. *J. Aircraft* **47**, 120-128. [DOI: 10.2514/1.44247]
- Hedenström A, Muijres F, von Busse R, Johansson C, Winter Y & Spedding GR 2009 High-speed stereo DPIV measurement of the wakes of two bat species flying freely in a wind tunnel. *Exp. Fluids* **46**, 923–932. [DOI 10.1007/s00348-009-0634-5]
- Hedenström A, Johansson LC & Spedding GR 2009 Bird or bat: comparing airframe design and flight performance. *Bioinsp. Biomim.* **4** 015001 [doi:10.1088/1748-3182/4/1/015001]
- Spedding GR & Hedenström A 2009 PIV-based investigations of animal flight. *Exp. Fluids* **46**, 749–763. DOI 10.1007/s00348-008-0597-y)
- Spedding GR, Hedenström A & Johansson LC 2009 A note on wind-tunnel turbulence measurements with DPIV. *Exp. Fluids* **46**, 527-537.
- Johansson LC, Wolf M, von Busse R, Winter Y, Spedding GR & Hedenström A 2008 The near and far wake of Pallas' long tongued bat (*Glossophaga soricina*). *J. Exp. Biol.* **211**, 2909-2918

- Hedenström A & Spedding GR 2008 Beyond robins: aerodynamic analyses of animal flight. *J. R. Soc. Interface* **5**, 595-601. [cover, invited review; 4 referees; designed all and wrote 95%]
- Muijres FT, Johansson LC, Barfield R, Wolf M, Spedding GR & Hedenström A 2008 Leading-edge vortices increase lift in bat flight. *Science* **319**, 1250-1253.
- Henningsson P, Spedding GR & Hedenström A 2008 Vortex wake and flight kinematics of a swift in cruising flight in a wind tunnel. *J. Exp. Biol.* **211**, 717-730.
- Spedding GR, Hedenström A, McArthur J & Rosén M 2008 The implications of low-speed fixed-wing aerofoil measurements on the analysis and performance of flapping bird wings *J. Exp. Biol.* **211**, 215-223. [doi:10.1242/jeb.007823]
- Hedenström A, Johansson LC, Wolf M, von Busse R, Winter Y & Spedding GR 2007 Bat flight generates complex aerodynamic tracks. *Science* **316**, 894-897.
- Rosén M, Spedding GR & Hedenström A 2007 Wake structure and wingbeat kinematics of a house-martin *Delichon urbica*. *J. R. Soc. Interface* **4**, 659-668. (DOI 10.1098/rsif.2007.0215)
- Meunier P, Diamessis PJ & Spedding GR 2006 Self-preservation in stratified momentum wakes. *Phys. Fluids* **18**, 106601
- Gallet S, Meunier P & Spedding GR 2006 Empirical scaling of antisymmetric stratified wakes. *J. Fluid Struct.* **22**, 941-947.
- Hedenström A, Griethuijsen L, Rosén M, & Spedding GR 2006 Vortex wakes of birds: recent results using particle imaging velocimetry. *Animal Biol.* **56**, 535-549.
- Hedenström A, Rosén M, & Spedding GR 2006 Vortex wakes generated by robins *Erithacus rubecula* during free flight in a wind tunnel. *J. R. Soc. Interface* **3**, 263-276.
- Meunier P & Spedding GR 2006 Stratified propelled wakes. *J. Fluid Mech.* **552**, 229-256.
- Rosén M, Spedding GR & Hedenström A 2004 The relationship between wingbeat kinematics and vortex wake of a thrush nightingale. *J. Exp. Biol.* **207**, 4255-4268.
- Meunier P & Spedding GR 2004 A loss of memory in stratified wakes. *Phys. Fluids* **16**, 298-305.
- Spedding GR 2003 Comparing fluid mechanics models with experiment. *Phil. Trans. R. Soc. Lond. B* **358**, 1567-1576.
- Spedding GR, Rosén M & Hedenström A 2003 A family of vortex wakes generated by a thrush nightingale in free flight over its entire range of flight speeds. *J. Exp. Biol.* **206**, 2313-2344.
- Spedding GR, Hedenström A & Rosén M 2003 Quantitative studies of the wakes of freely-flying birds in a low turbulence wind tunnel. *Exp. Fluids* **34**, 291-303.
- Spedding GR 2002 The streamwise spacing of adjacent coherent structures in stratified wakes. *Phys. Fluids* **14**, 3820-3828.
- Spedding GR 2002 Vertical structure in stratified wakes at high initial Froude number. *J. Fluid Mech.* **454**, 71-112.
- Dong Y, Vagelopoulos CM, Spedding GR & Egolfopoulos FN 2002 Measurement of Laminar Flame Speeds through Digital Particle Image Velocimetry: Mixtures of Methane and Ethane with Hydrogen, Oxygen, Nitrogen, and Helium. *Proc. Comb. Inst.* **29**: 1419-1426.

- Spedding GR 2001 Anisotropy in turbulence profiles of stratified wakes. *Phys. Fluids* **13**, 2361-2372.
- Spedding GR & Pennycuik CJ 2001 Uncertainty analysis for experimental and theoretical power curves. *J. Theor. Biol.* **208**, 127-139.
- Spedding GR & Fincham AM 1999 Effects of background rotation on a towed-sphere wake in a stably-stratified fluid. *Il Nuovo Cimento* **22**, 875-883.
- Spedding GR & Lissaman PBS 1998 Technical aspects of microscale flight systems *J. Avian Biol.*, **29**, 458-468.
- Spedding GR 1997 The evolution of initially-turbulent, bluff-body wakes at high internal Froude number. *J. Fluid Mech.* **337**, 283-301.
- Fincham AM & Spedding GR 1997 Low-cost, high resolution DPIV for measurement of turbulent fluid flow. *Exp. Fluids* **23**, 449-462. [doi:10.1007/s003480050135]
- Spedding GR, Browand FK & Fincham AM 1996 Turbulence, similarity scaling and vortex geometry in the wake of a towed sphere in a stably-stratified fluid. *J. Fluid Mech.* **314**, 53-103.
- Spedding GR, Browand FK & Fincham AM 1996 The long-time evolution of the initially-turbulent wake of a sphere in a stable stratification. *Dyn. Atmos. Ocean* **23**, 171-182.
- Fincham AM, Maxworthy T & Spedding GR 1996 Energy dissipation and vortex structure in freely-decaying, stratified grid turbulence. *Dyn. Atmos. Ocean* **23**, 155-169.
- Spedding GR & Rignot EJM 1993 Performance analysis and application of grid interpolation techniques for fluid flows. *Exp. Fluids* **15**, 417-430.
- Spedding GR, Browand FKB, Huang NE & Long SR 1993 A 2D complex wavelet analysis of an unsteady wind-generated surface wave field. *Dyn. Atmos. Oceans* **20**, 55-77.
- Lai RJ, Huang NE, Long SR & Spedding GR 1993 Blocking and trapping of waves in an inhomogeneous flow. *Dyn. Atmos. Oceans* **20**, 79-106.
- Spedding GR 1993 On the significance of unsteady effects in the performance of flying animals. *Contemp. Math.* **141**, 401-419.
- Dallard T & Spedding GR 1993 2D wavelet transforms: generalisation of the Hardy space and application to experimental studies. *Eur. J. Mech B/Fluids* **12**, 107-134.
- Narimousa S, Maxworthy T. & Spedding GR 1991 Experiments on the structure of forced quasi-2D turbulence. *J. Fluid Mech.* **223**, 113-133.
- Karpouzian G, Spedding GR & Cheng HK 1990 Lunate-tail swimming propulsion. Part 2. Performance analysis. *J. Fluid Mech.* **210**, 329-351.
- Spedding GR 1987 Dislocations and three-dimensional instabilities of Kelvin-Helmholtz waves. *Weather* **43**, 25-29.
- Spedding GR 1987 The wake of a kestrel (*Falco tinnunculus*) in flapping flight. *J. Exp. Biol.* **127**, 59-78.
- Spedding GR 1987 The wake of a kestrel (*Falco tinnunculus*) in gliding flight. *J. Exp. Biol.* **127**, 45-57.

Spedding GR & Maxworthy T 1986 The generation of circulation and lift in a rigid two-dimensional fling. *J. Fluid Mech.* **165**, 247-272.

Spedding GR 1986 The wake of a jackdaw (*Corvus monedula*) in slow flight. *J. Exp. Biol.* **125**, 287-307.

Spedding GR, Rayner JMV & Pennycuik CJ 1984 Momentum and energy in the wake of a pigeon (*Columba livia*) in slow flight. *J. Exp. Biol.* **111**, 81-102.

### **Chapters in Books or Magazines (Invited contributions -- academic)**

Spedding GR 2011 The cost of flight in flocks. *Nature* **474**, 458-459. (commentary)

Spedding GR 1996 *2D Complex Wavelets for Analysis of Unsteady, Wind-Generated Surface Waves*. Nonlinear Dynamics of Ocean Waves. Special Issue of Naval Research Reviews, **58(3)**, 30-39.

Spedding GR & DeLaurier JD 1996 *Animal and Ornithopter Flight*. In: Schetz JA & Fuhs AE (eds). Handbook of Fluid Dynamics and Fluid Machinery. Volume 3: Applications of Fluid Dynamics. pp 1951-1967. John Wiley & Sons, NY.

Spedding GR 1992 *The Aerodynamics of Flight*. In: Alexander, R McN (ed). Adv. Comp. Physiol. The Mechanics of Animal Locomotion. Springer-Verlag. pp 51-111.

### **Chapters in Books or Magazines (Invited contributions – commercial/technical)**

Spedding GR 2009 Flight at small scales. *Mechanical Technology*, March 2009, 30-33.

Spedding GR 2009 Flight at small scales. *Innovate* **3**, 80-83.

Spedding GR 2007 Bat to the Future: small-scale flight: what works, what doesn't, what can be learned from the flight of animals...and how it can be adapted to Micro Air Vehicle Technology. *Aerospace Testing International*, October 2007, pp53-56,

### **Refereed Conference Proceedings**

Yang SL & Spedding GR 2013 Local acoustic forcing of a wing at low Reynolds numbers. *AIAA Applied Aerodynamics Conference* San Diego, CA June 24-27, AIAA-2013-2747

Nagar RK, Meyer JP, Alam, MM & Spedding GR 2011 Fluid dynamics around a dimpled pin fin. *Proc. ASME Int. Mech. Eng. Conf. IMECE2011-63427*. Denver, Colorado, Nov 11-17 2011.

Spedding GR & McArthur J 2008 The aerodynamics of simple wings at moderate Reynolds number. *Proc. 2<sup>nd</sup> SAIAS Symposium*, 14-16 September 2008, Stellenbosch, South Africa

Rottman JW, Broutman D, Spedding GR & Diamessis PJ 2006 A model for the internal wavefield produced by a submarine and its wake in the littoral ocean. *Proc. 26<sup>th</sup> Symp. Naval Hydrodynamics*, Rome, Italy, Sept 17-22 2006.

Spedding GR, McArthur J & Rosen M 2006 Deducing aerodynamic mechanisms from near- and far-wake measurements of fixed and flapping wings at moderate Reynolds number. *AIAA Paper #7783*.

Rottman JW, Broutman D, Spedding GR & Meunier P 2004 The internal wave field generated by the body and wake of a horizontally moving sphere in a stratified fluid. *15<sup>th</sup> Australasian Fluid Mechanics Conference*, University of Sydney, Australia, December 13-17<sup>th</sup>, 2004.

Rottman JW, Broutman D, Spedding GR & Meunier P 2004 Internal wave generation by a horizontally moving sphere at low Froude number. *25<sup>th</sup> Symp. on Naval Hydrodynamics*, St. John's, Newfoundland, Canada, August 8-13<sup>th</sup>, 2004.

Spedding GR, Rosen M, Hedenstrom A & McArthur J 2004 Force measurements and flow structure for fixed and flapping wings at low Reynolds number. *Proc. 11<sup>th</sup> Int. Symp. on Flow Vis.*, University of Notre Dame, Indiana, August 9-12 2004. (Paper#107, CDROM Proceedings ISBN 0-9533991)

Spedding GR 1999 Vortex wakes in stably-stratified fluids. *Proc. IUTAM Symp. on Simulation and Identification of Organized Structures in Flows*, Lyngby, Denmark, May 1997. (eds J.N. Sorensen, E.J. Hopfinger & N. Aubry) pp163-179. Kluwer

Spedding GR, Klinke J & Long SR 1996 Estimating  $\omega(k)$  in an unsteady, wind-generated surface wave field from the 2D complex wavelet transform of the surface slope. In: *The Air-Sea Interface: Radio and Acoustic Sensing, Turbulence and Wave Dynamics. Proc. Int. Symp. Marseille, 1993*. (eds M.A. Donelan, W.H. Hui & W.J. Plant), 373-382.

Caperan P, Maxworthy T & Spedding GR 1991 The kinematics of quasi-2D, freely decaying turbulence in a stratified fluid. *Phys Fluids* **A3**, 1449. (also *Proc. IUTAM Symp. on Fluid Mech. of Stirring & Mixing*. 20-24 August, San Diego).

Karagounis T, Maxworthy T & Spedding GR 1989 Generation and Control of Separated Vortices over a Delta Wing by Means of Leading Edge Flaps. *AIAA-89-0997*

Caperan Ph, Spedding GR & Maxworthy T 1988 The evolution of freely decaying turbulence in a shallow layer of stratified fluid, at low Froude number. *Proc. 34<sup>th</sup> ICTAM*, Grenoble, August 1988.

### **Technical Reports -- copies available on request**

Spedding GR, Hedenstrom A & Rosen M 2002 *Quantitative studies of the wakes of freely-flying birds in a low turbulence wind tunnel*. Report for AME Dept., USC and Department of Animal Ecology, Lund University.

Spedding GR 1999 *Application of high-resolution, whole field flow measurement techniques to ultrasound maps of pulsed and steady blood flow in straight tubes*. Report for Departments of Biomedical, and Aerospace and Mechanical Engineering, USC.

Spedding GR 1998 *VSV for CIV: advanced imaging analysis with Correlation Imaging Velocimetry*. Currently in use at 4 major research universities in the US and Europe.

Spedding GR 1997 *Spinup at Coriolis*. Technical Report to Institute Mechanique Grenoble.

Rignot EJM & Spedding GR 1988 *Performance analysis of automated image processing and grid interpolation techniques for fluid flows*. University of Southern California, Aerospace Engineering Report, USCAE, No. 143.

### **Non-Refereed Conference Proceedings and Abstracts**

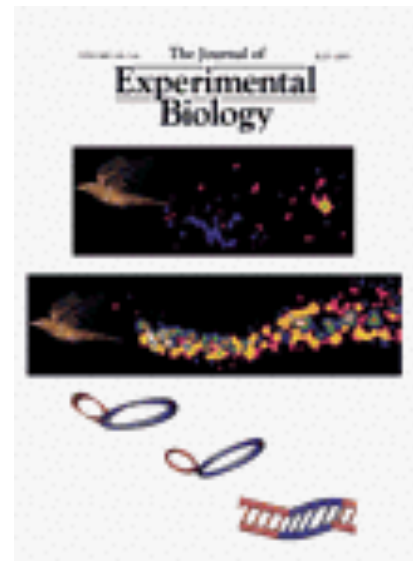
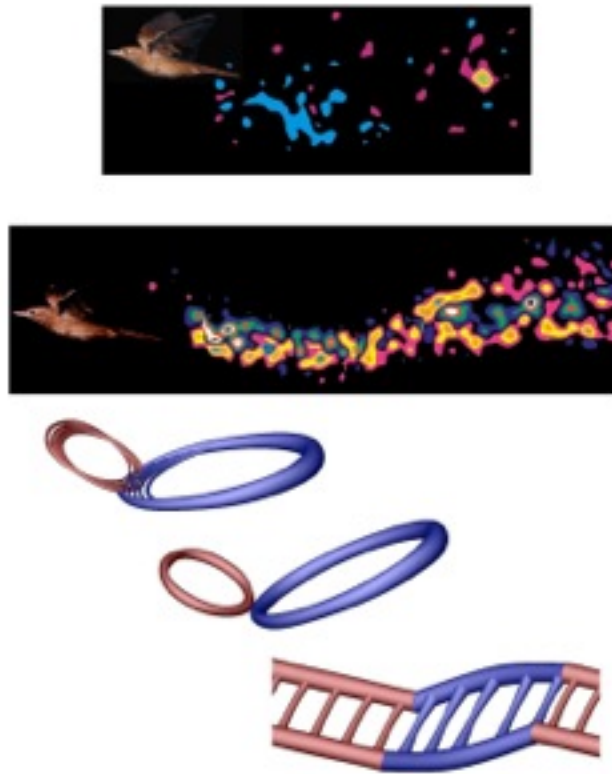
- Madison T, Xiang X, Sellapan, P & Spedding GR 2013 Experiments in stably-stratified wakes II: the early wake behind a sphere. *Bull. Am. Phys. Soc.* **58**, No. 18, 432.
- Xiang X, Madison T, Sellapan, P & Spedding GR 2013 Experiments in stably-stratified wakes I: measurement and characterization of mean and fluctuating quantities. *Bull. Am. Phys. Soc.* **58**, No. 18, 432.
- Nagar RK, Meyer JP, Alam M & Spedding GR 2013 The turbulent wakes of smooth and dimpled pin fins. ISABE-2013-1221, AIAA
- Nagar RK, Meyer JP, Alam M & Spedding GR 2013 Numerical investigation of surface enhancement configurations for pin fins. ISABE-2013-1222, AIAA
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- McArthur J & Spedding GR 2007 Effects of sweep angle on flow features and leading edge vortices of thin cambered wings at  $Re = 5000$ . *Bull. Am. Phys. Soc.* **52**, 250.
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- Gallet S & Spedding GR 2006 Vertical propagation of submerged wakes in stratified fluids. *Bull. Am. Phys. Soc.* **51**, 63.
- McArthur J, Spedding GR & Rosen M 2006 Aerodynamic instabilities on small scale wings. 15<sup>th</sup> *US National Congress on Theoretical and Applied Mechanics (USNCTAM)*, University of Colorado, Boulder, June 25<sup>th</sup>
- McArthur, J & Spedding GR 2006 Complex flows over simple wings. *Bull. Am. Phys. Soc.* **51**, 73.
- Rottman JW, Broutman D, Spedding GR & Diamessis PJ 2006 A model for the internal wavefield produced by a horizontally moving body and its wake in a stratified fluid. *Bull. Am. Phys. Soc.* **51**, 41.

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- Spedding GR, Rosen M, Hedenstrom A & McArthur J 2004 Force Measurements and Flow Structure for Fixed and Flapping Wings at Low Reynolds Number Proc. 11<sup>th</sup> International Symposium on Flow Visualization, University of Notre Dame, Notre Dame, Indiana.
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- Dong Y, Spedding GR, Egolfopoulos FN & Miller F 2003 Quantitative studies on the propagation and extinction of near-limit premixed flames under normal- and micro-gravity. *Seventh International Microgravity Combustion Workshop*, Cleveland, Ohio, June 3-6, 2003.
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- Bell R, Spedding GR & Browand FK 1997 Interactions between pancake vortices and internal waves in stably stratified fluids. *Bull. Am. Phys. Soc.* **42**, 2199.
- Spedding GR, Browand FK, Newton P, Klinke J, Long SR & Huang NE 1997 The initial growth of capillary-gravity waves due to an unsteady wind. *Proc. 21st Assembly Int. Assoc. Phys. Sci. Oceans (IAPSO)*, Honolulu, Hawaii 1995, pp382-383.
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- Bell R, Spedding GR & Browand FK 1995 A comparative wavelet analysis of *ID* ocean measurements with DNS studies of breaking internal waves. *Bull. Am. Phys. Soc.* **40**, 1986.
- Fincham AM & Spedding GR 1995 Velocity bandwidth, discretization errors and peak-locking phenomena in DPIV measurements. *Bull. Am. Phys. Soc.* **40**, 2000.
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- Fincham AM, Maxworthy T & Spedding GR 1994 Energy dissipation and vortex structure in freely decaying, stratified grid turbulence. *Bull Am. Phys. Soc.* **39**, 1915.

# COVERS

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*J. Exp. Biol.* July 2003



*Science* March 2007



*J. Exp. Biol.* March 2008

## Press

### National Newspapers

Los Angeles Times 1984

*Mechanical Models of Insect Wings*

In May 2007, following *The Aerodynamics of Bat Flight*

Reuters News Service

The Times, The Independent, The Guardian (UK)

Die Zeit (Germany)

Dagens Nyheter (Swedens biggest newspaper, print version)

The Courier-Mail (Australia)

In July 2007 following public lecture *The Aerodynamics of Everything*

Pretoria News (August 2007)

Beeld (RSA, Aug. 2007)

New York Times March 2008

*Bat flight, wheels in animals*

The Times of India, November 21<sup>st</sup> 2010

*Is it a bird? Is it a plane? It's a fuel-efficient jet*

<http://timesofindia.indiatimes.com/home/science/Is-it-a-bird-Is-it-a-plane-Its-a-fuel-efficient-jet/articleshow/6973372.cms>

L.A. Times November 27<sup>th</sup> 2010

*Flying snakes and the science of jellyfish*

<http://www.latimes.com/news/science/la-sci-bioinspiration-20101127,0,2935473.story>

### Magazines

In May 2007, following *The Aerodynamics of Bat Flight*

Science Magazine

New Scientist

Scientific American

National Geographic

Plenty Magazine (NY)

Nature News (June 20<sup>th</sup>, 2011)-- commentary in *Wing Hairs Help to Keep Bats in the Air*

<http://www.nature.com/news/2011/110620/full/news.2011.376.html>

Nature News and Views: *The Cost of Flight in Flocks* *Nature*, **474**, 458-459 (June 23<sup>rd</sup>)

### Online Science

November 2010 following *Should Planes Look Like Birds?*

APS Press Release (<http://www.aps.org/units/dfd/pressroom/index.cfm>)

LiveScience *New Airplane Design Mimics a Seagull*

(<http://www.livescience.com/technology/bird-like-airplane-101121.html>)

Yahoo News: [http://news.yahoo.com/s/livescience/20101121/sc\\_livescience/newairplanedesignmimicsaseagull](http://news.yahoo.com/s/livescience/20101121/sc_livescience/newairplanedesignmimicsaseagull)

OneIndia News: <http://news.oneindia.in/2010/11/22/comingsoon-airplanes-that-look-likebirds.html>

Discover: *It's a bird! It's a plane! It's...yeah, it's a plane.* <http://blogs.discovermagazine.com/sciencenotfiction/2010/11/22/its-a-bird-its-a-plane-its-yeah-its-a-plane/>

SmartPlanet Interview (published Dec 9th 2010): *It's a bird! It's a plane! It's both!* <http://www.smartplanet.com/people/blog/pure-genius/its-a-bird-its-a-plane-its-both/5092/?tag=shell;main>

## **Radio**

National Public Radio, 1996

*On new insect flight experiments*

National Public Radio, February 29<sup>th</sup> 2008

*Bat flight experiments and application to MAVs*

BBC News, May 2007

## **Television**

Channel 13, Los Angeles, 1996

*Mysterious rods claimed new flying device?*

CNN (International) Los Angeles Studio, November 27<sup>th</sup> 2010 News Interview: *Today's Big Idea*, with TJ Holmes

*Discovery Channel* (Canada) February 2011

<http://watch.discoverychannel.ca/daily-planet/february-2011/daily-planet---february-22-2011/#clip422355>

*Discovery Channel (US)* October 2011 (planned: shot April 20<sup>th</sup>)

Penn & Teller: *Secrets of the Universe*

*Emergency Aircraft Landing*

*National Geographic* (aired Dec 31<sup>st</sup> 2011, shot April 25<sup>th</sup>)

(Lone Wolf Productions)

*Early Aircraft Aerodynamics*

Swedish Public TV, Sept 20<sup>th</sup> 2013

Din sökning på "härma naturen"

<http://urplay.se/Produkter?q=härma+naturen>

**ENGINEERING VIEWS ON ENERGY CONVERSION IN ORGANISMS**

[\*Tales of Aerodynamic Efficiency in Birds and Planes\*](#)

## Invited Talks (from 2000 onwards)

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### On Geophysical Fluid Mechanics and Aerodynamics

*Design and Evolution in Flying Devices (large and small)*

Seminar (50 minutes)

Mechanical Engineering Department

UC Riverside

May 9<sup>th</sup>, 2014

*Aerodynamic Efficiency in Small and Large Aircraft*

Seminar (50 minutes)

Mechanical and Aerospace Engineering Department

University of Florida

Apr 15<sup>th</sup>, 2014

*Bird Design and Aircraft Evolution*

Seminar (50 minutes)

Mechanical Engineering, Fluid Mechanics Seminar Series

Stanford University

Apr 8<sup>th</sup>, 2014

*Robust Pattern Formation and Detection in Wakes in Nature*

Invited Talk (40 minutes)

Fundamental Aspects of Geophysical Turbulence

Nagoya, Japan

Mar 10<sup>th</sup>, 2014

*On Bird Flight*

Invited Talk (15 minutes)

Micro Air Vehicle Workshop

AIAA SciTech Meeting

Jan 11<sup>th</sup>, 2014

*Design and Evolution in Flying Devices*

Seminar (50 minutes)

Engineering School Technical Seminar

Cal State Long Beach

Nov 7<sup>th</sup>, 2013

*Tales of Aerodynamic Efficiency in Birds and Planes*

Keynote Address (40 minutes)

Final Workshop on Bioinspired Energy Conversion

(<http://www.pi.lu.se/research-activities/bioinspired-energy-conversion/workshop-june-10-11-2013>)

Pufendorf Institute, Lund University

June 10-11<sup>th</sup>, 2013

*Wake Signature Detection*

Seminar (50 minutes)

Laboratoire d'Hydrodynamique (LadHyX)

Ecole Polytechnique de Paris

June 6<sup>th</sup>, 2013

*Aerodynamic Efficiency in Large and Small Aircraft*

Seminar (50 minutes)

Colloquium at Physique et Mécanique des Milieux Hétérogènes (PMMH)

Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI)

May 31<sup>st</sup>, 2013

*Bird Design and Aircraft Evolution*

Invited Lecture (50 minutes)

IEEE Aerospace & Electronics, Electron Devices & Systems, Microwave Theory and Techniques  
Chapters

Vitesse Semiconductor Corp.

April 25<sup>th</sup>, 2013

*Bird Design and Aircraft Evolution*

Seminar (50 minutes)

Mechanical Engineering

UC Santa Barbara

April 3<sup>rd</sup>, 2013

*Bird Design and Aircraft Evolution*

Seminar (50 minutes)

Aerospace and Mechanical Engineering

Princeton University

February 22<sup>nd</sup>, 2013

*Bird Design and Aircraft Evolution*

Seminar (50 minutes)

Applied Mechanics Colloquium

Harvard University

October 10<sup>th</sup>, 2012

*Design and Evolution in Small and Large Flying Machines*

Keynote (50 minutes)

South African Symposium on Computational and Applied Mechanics

University of Johannesburg, Johannesburg, South Africa

Sept 4<sup>th</sup> 2012

*On Unmanned Systems*

Invited talk (50 minutes)

Northrop Grumman Unmanned Systems Research Day

Northrop Grumman Technical Services, Sierra Vista, AZ

June 12<sup>th</sup>, 2012

*The Emergence of Pattern in Stably Stratified Turbulence*

Seminar (50 minutes)

Department of Mechanical Engineering,  
Environmental Fluid Mechanics Seminar Series  
Johns Hopkins University, Baltimore, MD  
April 6<sup>th</sup>, 2012

*Bird Design and Aircraft Evolution*  
Seminar (50 minutes)  
Department of Integrative Biology  
UC Berkeley  
October 21<sup>st</sup>, 2011

*Design and Evolution of Birds and other Flying Machines*  
Invited Talk (50 minutes)  
NextGen, Torrance, CA  
May 10<sup>th</sup>, 2011

*Design and Evolution of Bird-Shaped Flying Machines*  
Invited Talk (50 minutes)  
Advanced Project Group (Skunkworks), Lockheed Martin, Palmdale, CA  
February 21<sup>st</sup>, 2011

*Special K, UAVs and Birds*  
Invited Talk (40 minutes)  
Animal Flight Mechanics and Muscle Performance: a Symposium in Honour of Prof. Ellington FRS  
Clare College, Cambridge, UK  
September 20<sup>th</sup>, 2010

*Span Efficiencies of Wings at Low Reynolds Number*  
Keynote Presentation (50 minutes)  
US National Congress of Theoretical and Applied Mechanics (USNCTAM)  
Penn State University  
State College, Pennsylvania  
July 1<sup>st</sup>, 2010

*Laboratory experiments in stably-stratified turbulence and their interpretation and extension in Re-Fr space through theory and numerical simulation.*  
Invited Talk (40 minutes)  
Euromech Colloquium 519  
Mixing and Dispersion in Flows Dominated by Rotation and Buoyancy  
Rolduc Monastery, The Netherlands  
June 21<sup>st</sup>, 2010

*The Aerodynamics of Everything*  
Plenary Talk  
SIAM Front Range Student Conference  
University of Colorado, Denver  
March 6<sup>th</sup> 2010

*Aeronautics at Low Reynolds Number*

Seminar (50 minutes)  
Department of Applied Mathematics  
University of Colorado, Boulder  
March 5<sup>th</sup> 2010

*Aeronautics at Low Reynolds Number*  
Seminar (50 minutes)  
GALCIT  
Caltech, CA  
December 4<sup>th</sup> 2009

*Aeronautics at Low Reynolds Number*  
Opening Introductory Talk (50 minutes)  
Symposium on Moving in fluids for animals and robots: physics, (bio)mechanics, control and perception  
ESPCI/CNRS - Réseaux Thématiques Pluridisciplinaires (RTP) program  
Paris, France  
November 12<sup>th</sup> 2009

*Flight at Small Scales*  
Sears Lecture  
Woods Hole Institute of Oceanography  
Woods Hole, MA  
August 6<sup>th</sup> 2009

*Flight at Small Scales*  
Invited talk (50 min) at:  
Meeting of VDI - Verein Deutscher Ingenieure of SA  
Sandton, Johannesburg  
RSA  
May 5<sup>th</sup> 2009

*Things Are Not As They Seem: Further Adventures in Flight at Small Scales*  
Invited talk (50 min) at:  
University of Pretoria Aeronautical Society Meeting  
University of Pretoria  
Pretoria, RSA  
Feb 25<sup>th</sup> 2009

*k*  
Department of Animal Ecology (Flight Group) Seminar  
Lund University,  
Lund, Sweden  
Jan 26<sup>th</sup> 2009

*The Aerodynamics of Simple Wings at Moderate Reynolds Number*  
2<sup>nd</sup> SAIAS Symposium  
Stellenbosch, South Africa  
Sept 14<sup>th</sup> 2008

*How to Build a Bird: Part 1*

Invited talk (50 min) at:  
Aeronautical Society of South Africa Meeting  
University of Pretoria  
Pretoria, RSA  
Aug 13<sup>th</sup> 2008

*The Flight of Birds, Bats and Other Small-Scale Flying Machines*

Invited talk (50 min) at:  
University of Pretoria Aeronautical Society Meeting  
University of Pretoria  
Pretoria, RSA  
Aug 6<sup>th</sup> 2008

*Why Fly?*

Invited talk (80 min) at:  
Department of Mechanical & Aeronautical Engineering  
University of Pretoria, (Engineering Week)  
South Africa  
July 2<sup>nd</sup>, 2008

*The Flight of Birds, Bats and Other Small-Scale Flying Machines*

Invited seminar (50 min) at:  
The College of Engineering  
San Diego State University  
San Diego, CA  
Apr 24<sup>th</sup> 2008

*The Flight of Birds, Bats and Other Small-Scale Flying Machines*

Invited seminar (50 min) at:  
The Mechanical and Aerospace Engineering Department  
UCLA  
Los Angeles, CA  
Apr 18<sup>th</sup> 2008

*Why Don't Planes Look Like Birds?*

Invited lecture (2 x 45 mins) for:  
AS3304 – Biomimicry: Innovation in Architecture Inspired by Nature  
Southern California Institute of Architecture (SCI-Arc)  
Los Angeles, California  
Nov 16<sup>th</sup> 2007

*Pattern Development from Initially-Turbulent Conditions in Stably Stratified Fluids*

Invited seminar (50 min) at:  
School of Civil and Environmental Engineering  
Cornell University  
Ithaca, NY  
Nov 1<sup>st</sup> 2007

*Selected Studies on Flight with Flexible, Flapping Wings at Moderate Reynolds Number*  
Seminar at Northrop Grumman Corporation  
Optimal Multi-Point Design Program for X-Plane with Wing Morphing  
El Segundo, California  
October 24<sup>th</sup> 2007

*The Aerodynamics of Everything (Almost)*  
Invited Talk (50 min) at:  
Aerosud, RSA.  
August 7<sup>th</sup> 2007

*The Aerodynamics of Everything*  
Invited Public Lecture (50 min) at:  
University of Pretoria, RSA.  
July 24<sup>th</sup> 2007

*Comparing Animal and Aircraft Flight*  
Invited lecture (1hr 45 min) at:  
Space and Aviation Camp 2007,  
University of Pretoria, RSA.  
July 4<sup>th</sup> 2007

*Birds and Bats – and Other Small-Scale Flying Machines*  
Invited seminar (50 min) at:  
Department of Mechanical and Environmental Engineering,  
UCSB, USA.  
May 1<sup>st</sup> 2007

*Experiments on Turbulence in Stably Stratified Fluids II – a Practical Application: Turbulent Wakes in Stratified Oceans*  
Invited talk (45 min) at:  
Workshop on *Two-Dimensional Turbulence*,  
The Lorentz Centre,  
University of Leiden, The Netherlands.  
March 22<sup>nd</sup> 2007

*Experiments on Turbulence in Stably Stratified Fluids I – the Evolution of Strongly Stratified Motions*  
Invited talk (45 min) at:  
Workshop on *Two-Dimensional Turbulence*,  
The Lorentz Centre,  
University of Leiden, The Netherlands.  
March 22<sup>nd</sup> 2007

*The Flight of Birds – and Other Small-Scale Flying Machines*  
Invited seminar (50 min) at:  
Department of Mechanical and Aerospace Engineering,  
University of Washington, USA.  
February 6<sup>th</sup> 2007

*Interpretation of Wind Tunnel Tests of Fixed and Flapping Wing Systems*

Invited seminar (50 min) at:  
Department of Theoretical Ecology,  
Lund University, Lund, Sweden.  
November 24<sup>th</sup> 2006

*Experiments in Low-Speed Aerodynamics: Birds and Other Micro-Air Vehicles*

Invited seminar (50 min) at:  
Department of Mechanical Engineering,  
University of Maryland, USA.  
October 27<sup>th</sup> 2006

*Interpretation of Wind Tunnel Tests of Fixed and Flapping Wing Systems*

Invited presentation (15 min) at:  
5<sup>th</sup> World Congress in Biomechanics  
Munich, Germany  
August 1<sup>st</sup> 2006

*Experiments in Low-Speed Aerodynamics: Birds and Other Micro-Air Vehicles*

Invited seminar (50 min) at:  
Department of Mathematics and Applied Mathematics,  
University of Pretoria, Pretoria, South Africa.  
July 28<sup>th</sup> 2006

*Recent Experiments in Measurement of Low-Re Flows*

Invited seminar (50 min) at:  
Department of Mechanical Engineering,  
Brown University, USA.  
March 10<sup>th</sup> 2006

*Deducing Aerodynamic Mechanisms from Near- and Far-Wake Measurements of Fixed and Flapping Wings at Moderate Reynolds Number*

Invited presentation (AIAA-2006-0033) at:  
44<sup>th</sup> AIAA Aerospace Sciences Conference  
Reno, Nevada  
January 9<sup>th</sup> 2006

*The Aerodynamics of Small Wings: Performance Measurement and Analysis*

Invited seminar (50 min) at:  
Department of Civil Engineering,  
University of Kwazulu-Natal, Durban, South Africa.  
November 25<sup>th</sup> 2005

*The Evolution of Turbulence in Stratified Oceans: Geophysical and Naval Applications*

Invited seminar (50 min – Distinguished Visitor Seminar Series) at:  
Department of Civil Engineering,  
University of Kwazulu-Natal, Durban, South Africa.  
November 23<sup>rd</sup> 2005

*Mean and Turbulence Quantities in Bluff Body Wakes in Stratified Oceans*

Invited talk (25 min) at:

Workshop on Internal Waves and Turbulence in Shelf Seas,  
School of Ocean Sciences, University of Wales, Bangor.

November 9<sup>th</sup> – 11<sup>th</sup> 2005

*Calculating Forces from DPIV Measurements : Experiments at Lund and USC*

Invited seminar (50 min) at:

Department of Theoretical Ecology,  
Lund University, Lund, Sweden.

September 29<sup>th</sup> 2005

*Estimating Forces from PIV Measurements*

Invited talk (30 min, introductory keynote lecture) at:

PIV 05

6<sup>th</sup> International Symposium on Particle Imaging Velocimetry

Caltech

Pasadena, CA

Sept 21<sup>st</sup> – 23<sup>rd</sup> 2005

*Wave and Vortex Motions in a Stably Stratified Fluid*

Invited talk (40 min) at:

GTP Workshop on Coherent Structures in Atmosphere and Ocean

National Center for Atmospheric Research

Boulder, CO

July 11<sup>th</sup> – 14<sup>th</sup> 2005

*University Research on Low Reynolds Number Aerodynamics*

Invited talk (20 min) at:

SAE Small/Micro UAV Panel Discussion – member of invited panel of 5 leading discussion on UAV technologies.

USC, Los Angeles, CA

April 30<sup>th</sup> 2005

*Vortices, Vortex Lines, Line Vortices, Vortex Filaments, Vortex Tubes, Vortex Distributions, Vortex Sheets and Vortex Wakes*

Invited talk/seminar/tutorial (3 hours) at:

Department of Animal Ecology,

Lund University, Lund, Sweden.

April 22<sup>nd</sup> 2005

*The Aerodynamics of Small Wings: Performance Measurement and Analysis*

Invited talk (30 min) at:

Biophysical and Biomechanical Adaptation and Bioinspired Engineering Symposium – an invitation only satellite symposium of the 35<sup>th</sup> International Congress of Physiological Sciences

Caltech, Pasadena, CA

March 28<sup>th</sup>-30<sup>th</sup> 2005

*Experiments in Low-Speed Aerodynamics*

Invited seminar (50 min) at:  
Center for Integrative Multiscale Modeling and Simulation (CIMMS)  
Caltech, Pasadena, CA  
March 8<sup>th</sup> 2005

*Prediction and Measurement of Turbulent Wakes in a Stratified Fluid*

Invited talk (30 min) at:  
Spring Western Section Meeting of the American Mathematical Society  
University of Southern California, Los Angeles, CA  
April 3<sup>rd</sup> 2004

*Bird Flight for Wittgenstein*

Invited seminar (50 min) at:  
Department of Evolutionary and Organismal Biology  
Brown University, Boston, MA  
March 10<sup>th</sup> 2004

*Wakes in Stratified Fluids*

Invited seminar (50 min) at:  
Department of Mechanical Engineering  
Stanford, CA  
December 2<sup>nd</sup> 2003

*Bird Flight for Biologists and Engineers*

Invited seminar (50 min) at:  
Department of Integrative Biology  
UC Berkeley, CA  
October 30<sup>th</sup> 2003

*How and Why do Birds Fly?*

Invited talk (50 min.) for:  
40th Annual Technical Meeting, Society of Engineering Science  
University of Michigan, Ann Arbor, MI  
October 12-15 2003

*What do Models of Bird Wakes Tell Us about MAV Design?*

Invited talk (50 min) for:  
2003 Bioflight Workshop presented by the National Institute of Aerospace  
NASA Langley Research Center  
August 7<sup>th</sup> 2003

*The Vortex Wakes of Flying Birds*

Invited talk (25 min) for special symposium on:  
Locomotion and Control of Biomechanical Systems in a Fluid Environment  
SIAM Conference on Applications of Dynamical Systems  
Snowbird, Utah  
May 30<sup>th</sup> 2003

*Understanding Bird Flight*

Invited seminar (50 min) at:  
Center for Interdisciplinary Research in Fluids Seminar  
UC Santa Barbara, CA  
May 14<sup>th</sup> 2003

*Models of Bird Flight and Bird Flight as a Model*

Invited seminar (50 min) at:  
Aeronautics Seminar  
Graduate Aeronautical Laboratories  
California Institute of Technology, Pasadena, CA  
December 2<sup>nd</sup> 2002

*The Aerodynamics of Bird Flight*

Invited Talk (40 min) at:  
American Physical Society  
Division of Fluid Dynamics Meeting, Dallas  
November 21<sup>st</sup> 2002

*The Aerodynamics of (almost) Everything*

Invited Talk (50 min) at:  
Sigma Public Lecture  
Virginia Air and Space Center  
Hampton, VA  
November 5<sup>th</sup> 2002

*The Aerodynamics of Bird Flight: Research Progress and Status*

Invited Talk (50 min) at:  
NASA Langley Research Center Colloquium  
Langley Research Center, Hampton, VA  
November 5<sup>th</sup> 2002

*Recent Progress in Turbulent Wakes Research*

Invited Talk (50 min) at:  
Remote Anthropogenic Sensing Project, Hydrodynamics Meeting II  
Scripps Institute of Oceanography, La Jolla, CA  
October 13<sup>th</sup> 2002

*Turbulent Wakes*

Invited Talk (50 min) at:  
Meeting of Hydrodynamics: Approaches from Russia and West  
Directed Technologies, Arlington VA  
June 12<sup>th</sup> 2002

*Modeling the Flight of Birds*

Invited Talk (50 min) at:  
Graduate Research Training Program  
Institute of Theoretical Dynamics, UC Davis

May 3<sup>rd</sup> 2002

*Comparing Fluid Dynamics Experiments with Theoretical Models*

Invited Talk (40 min.) at:

Symposium on Modeling in Biomechanics

Society for Experimental Biology, Swansea, England.

April 10<sup>th</sup> 2002

*Engineers and Insects: a Maxworthian Approach to Unsteady Aerodynamics*

Invited Talk (50 min.) at:

A Fascination with Fluids: Symposium in tribute to T. Maxworthy, USC.

November 16<sup>th</sup> 2001

*Bluff Body Wakes in Stratified Oceans*

UCSD seminar in MAE Department

May 14<sup>th</sup> 2001

*Stratified Wakes*

Invited Opening Talk (30 min.) at:

5<sup>th</sup> International Symposium on Stratified Flows

UBC, Vancouver

July 10<sup>th</sup> 2000

*New Experiments in Stratified Wakes*

UCSB Seminar, Mechanical & Environmental Engineering

May 9<sup>th</sup> 2000

*Particular and General Characteristics of Undersea Wakes*

SDSU AME Department Seminar

March 16<sup>th</sup> 2000

### **On Teaching**

*Death by PowerPoint Rides Again!*

Center for Excellence in Teaching Seminar

USC, Los Angeles, California

12:00-1:30pm, February 11<sup>th</sup> 2010

*Presentation Zen*

Interactive Multimedia Literacy Program/Center for Excellence in Teaching Seminar

USC, Los Angeles, California

1:00-3:30pm, November 6<sup>th</sup> 2009

*Death by PowerPoint*

Center for Excellence in Teaching Seminar

USC, Los Angeles, California

12:00-1:30pm, February 12<sup>th</sup> 2008

### **General**

*Aeromagination*  
Tomorrow's Aeronautical Museum  
October 7<sup>th</sup> 2011

*What Is It Like to be a Bat?*  
USC College Commons Series on the Human-Animal Divide  
September 21<sup>st</sup> 2010

*The Aerodynamics of Everything*  
USC Engineering Honors Colloquium  
January 22<sup>nd</sup> 2010

*The Engineer and the Universe*  
USC Engineering Honors Colloquium  
September 10<sup>th</sup> 2000

## Graduate students

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### Former

1998 - 2000	Robert Bell.	Left for industry before PhD, expected in 2001.
2000 - 2002	Jun Chen.	Left for industry before PhD, expected in 2003.
2004 - 2006	Tara Chlovski	(Wing design in flapping flight, MSc)
2004 - 2007	Stephane Gallet	(Vertical transport in stratified oceans, MSc)
2003 - 2008	John McArthur	(Aerodynamics of small wings, PhD)
2009 - 2013	Ravi Nagar, University of Pretoria	(Enhanced heat transfer by geometry modification in cooling fins)
2010 - 2013	Shanling Yang	(Acoustic disturbance control of low Re wings)

### Current

2011 - ...	Tyler Davis	(A new optimal aircraft design)
2011 - ...	Trystan Madison	(Near wakes in stratified flows)
2011 - ...	Xinjiang Xiang	(Models of early stratified wakes)
2012 - ...	Lelanie Smith	(Optimal fuselage/TE design) (joint, University of Pretoria)
2013 - ...	Joe Tank	(Stability of transitional flows in aerodynamics)
2013 - ...	Yohanna Hanna	(TBD)

## Teaching

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### USC

AME 341a,b	<i>Mechoptronics I &amp; II</i>	Lecture/lab course on mechanical, electrical and optical principles of modern engineering devices for control and measurement, for 3 <sup>rd</sup> year AME majors. Re-designed entire course.
ENG 102	<i>Engineering Academy</i>	2-unit introduction to principles and applications of engineering, for all first year engineering students.
AME 105	<i>Introduction to Aerospace Engineering</i>	4-unit gateway class to aerospace engineering, flight mechanics and astronautics.

### UP

MLV 420	<i>Aeronautics</i>	Optional (of 2) final year course for MAE students.
MOX 410	<i>Design</i>	Single semester course on practical design.
MSC 400	<i>Project</i>	Two semester course on experimental project.
MGM 732	<i>Advanced Fluid Mechanics</i>	Graduate course.