Curriculum Vitae: Geoffrey R. Spedding

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, 1st class) in Zoology from the Department of Zoology, University of Bristol, Bristol, England.

CURRENT POSITION

2017 – now Professor, AME, University of Southern California

PREVIOUS EMPLOYMENT

2010-2017 Professor and Chairman, AME, University of Southern California

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

RESEARCH INTERESTS

1. *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.
2. *Geophysical fluid dynamics*. Experimental investigation of fluid flows 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.
3. *Advanced imaging and data analysis*. Significant advances in whole-field 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.

AWARDS

2021 Fellow of the Royal Physiographic Society of Lund, Sweden

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.

Refereed Journal Articles

1. Klose BF, Spedding GR & Jacobs GB 2023 Direct numerical simulation of cambered airfoil aerodynamics at Re = 20 000. *Phys. Rev. Fluids* (in prep.)
2. Huyssen RJ & Spedding GR 2023 On the existence of a hitherto untested, optimal aircraft configuration. *J. Aircraft.* (in prep.)
3. Kornbluh R, Kirkwood G, West, M, Hanna Y, Spedding GR & Kudva J 2023 Application of electrolaminates for the development of biomimetic morphing unmanned aerial vehicles. *J. Comp. Mat.*;0(0) 1-11. doi:10.1177/00219983221150335
4. Chinta VK, Ohh, C-Y, Spedding GR & Luhar M 2022 Regime identification for stratified wakes from limited measurements: a library-based sparse regression formulation. *Phys. Rev. Fluids* **7**, 033803. [doi: 10.1103/PhysRevFluids.7.033803]
5. Ohh C-Y & Spedding GR 2022 Wake identification of stratified flows using Dynamic Mode Decomposition. *Phys. Rev. Fluids* **7**, 024801 [doi: https://doi.org/10.1103/PhysRevFluids.7.024801] (editors choice: https://journals.aps.org/prfluids/highlights)
6. Madison T, Xiang X & Spedding GR 2022 Laboratory and numerical experiments on the near wake of a sphere in a stably stratified ambient. *J. Fluid Mech.* **933**, A12 [doi:10.1017/jfm.2021.1037]
7. Tank JD, Klose BF, Jacobs GB & Spedding GR 2021 Flow transitions on a cambered airfoil at moderate Reynolds number. *Phys. Fluids* **33**, 093105, [doi: 10.1063/5.0061939]
8. Spedding GR & Hedenström A 2021 C.J. Pennycuick, 11 June 1933 – 8 December 2019 *Biographical Memoirs of the Royal Society* [doi: https://doi.org/10.1098/rsbm.2021.0023]
9. Smith L, Craig KJ, Meyer JP & Spedding GR 2019 Numerical investigation of the aerodynamic performance for an alternative wing-body-tail configuration. *J. Aircraft* 56, No.1, 250-261 [doi: 10.2514/1.C034595]
10. Meunier,P, le Dizes S, Redekopp L & Spedding GR 2018 Internal waves generated by a stratified wake: experiment and theory. *J. Fluid Mech.* **846**, 752-788. [doi:10.1017/jfm.2018.278]

11. Chen KK & Spedding GR 2017 Boussinesq global modes and stability sensitivity to base flow modifications, with applications to stratified wakes. *J. Fluid Mech.* **812**, 1146-1188. [doi: https://doi.org/10.1017/jfm.2016.847**]**
12. Xiang X, Chen KK & Spedding GR 2017 Dynamic mode decomposition identifies vortical modes and internal waves in stratified fluids. *Exp Fluids* 58:56. [doi: 10.1007/s00348-017-2344-8]
13. Smith L, Craig KJ, Meyer JP & Spedding GR 2017 Modifying low-drag bodies to generate lift: a computational study. *J. Aircraft* **54** 1150-1161 [doi: /10.2514/1.C034051]
14. Tank J, Smith L & Spedding GR 2017 On the possibility (or lack thereof) of agreement between experiment and computation of flows over wings at moderate Reynolds number. *J. R. Soc. Interface Focus* 2017 **7** (1) 20160076; [doi: 10.1098/rsfs.2016.0076]
15. Huyssen RJ, Mathews EH Liebenberg L & Spedding GR 2016 On the wing density and the Inflation Factor of aircraft. *Aero. J.* **120**, 291-312.
16. Xiang X, Madison TJ, Sellappan P & Spedding GR 2015 The turbulent wake of a towed grid in a stratified fluid. *J. Fluid Mech.* **775**, 149-177. [doi: https://doi.org/10.1017/jfm.2015.299]
17. Orr TS, Domaradzki JA, Spedding GR, Constantinescu, GS. 2015. Description of the near wake of a sphere moving in a steady, horizontal motion through a linearly stratified fluid at Re=1000. *Phys. Fluids* **27**, 035113. [doi: 10.1063/1.4915139]
18. Yang SL & Spedding GR 2014 Local acoustic forcing of a wing at low Reynolds numbers. *AIAA. J.* **52**, 2867-2876 [doi: http://arc.aiaa.org/doi/abs/10.2514/1.J052984]
19. Spedding GR 2014 Wake signature detection. *Ann. Rev. Fluid Mech.* **46**, 273-302. [doi: 10.1146/annurev-fluid-011212-140747]
20. Yang SL & Spedding GR 2013 Passive separation control by acoustic resonance. *Exp. Fluids* **54**, 1603 [doi: 10.1007/s00348-013-1603-6]
21. 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]
22. 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]
23. 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.
24. Muijres FT, 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].
25. 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. [doi: https://doi.org/10.1017/S0022112010005549]
26. Spedding GR & McArthur J 2010 Span efficiencies of wings at low Reynolds number. *J. Aircraft* **47**, 120-128. [doi: 10.2514/1.44247]
27. Hedenström A, Muijres FT, von Busse R, Johansson LC, Winter Y & Spedding GR 2010 High-speed stereo DPIV measurement of wakes of two bat species flying freely in a wind tunnel. In: Taylor GK,

Triantafyllou MS, Tropea C (eds) *Animal Locomotion*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-11633-9_28

28. 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]
29. Spedding GR & Hedenström A 2009 PIV-based investigations of animal flight. *Exp. Fluids* **46**, 749–763. [doi: 10.1007/s00348-008-0597-y]
30. Spedding GR, Hedenström A & Johansson LC 2009 A note on wind-tunnel turbulence measurements with DPIV. *Exp. Fluids* **46**, 527-537.
31. 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
32. Hedenström A & Spedding GR 2008 Beyond robins: aerodynamic analyses of animal flight. *J. R. Soc. Interface* **5**, 595-601.
33. 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.
34. 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.
35. 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]
36. Hedenström A, Johansson LC, Wolf M, von Busse R, Winter Y & Spedding GR 2007 Bat flight generates complex aerodynamic tracks. *Science* **316**, 894-897.
37. 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]
38. Meunier P, Diamessis PJ & Spedding GR 2006 Self-preservation in stratified momentum wakes. *Phys. Fluids* **18**, 106601
39. Gallet S, Meunier P & Spedding GR 2006 Empirical scaling of antisymmetric stratified wakes. *J. Fluid Struct.* **22**, 941-947.
40. Hedenström A, Griethuijsen L, Rosén M, & Spedding GR 2006 Vortex wakes of birds: recent results using particle imaging velocimetry. *Animal Biol.* **56**, 535-549.
41. 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.
42. Meunier P & Spedding GR 2006 Stratified propelled wakes. *J. Fluid Mech.* **552**, 229-256. [doi: https://doi.org/10.1017/S0022112006008676]
43. 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.
44. Meunier P & Spedding GR 2004 A loss of memory in stratified wakes. *Phys. Fluids* **16**, 298-305.
45. Spedding GR 2003 Comparing fluid mechanics models with experiment. *Phil. Trans. R. Soc. Lond. B* **358**, 1567-1576.

46. 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.

47. 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.

48. Spedding GR 2002 The streamwise spacing of adjacent coherent structures in stratified wakes. *Phys. Fluids* **14**, 3820-3828.

49. Spedding GR 2002 Vertical structure in stratified wakes at high initial Froude number. *J. Fluid Mech.* **454**, 71-112. [doi: https://doi.org/10.1017/S0022112001007182]

50. 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.

51. Spedding GR 2001 Anisotropy in turbulence profiles of stratified wakes. *Phys. Fluids* **13**, 2361-2372.

52. Spedding GR & Pennycuick CJ 2001 Uncertainty analysis for experimental and theoretical power curves. *J. Theor. Biol.* **208**, 127-139.

53. 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.

54. Spedding GR & Lissaman PBS 1998 Technical aspects of microscale flight systems *J. Avian Biol.,* **29**, 458-468.

55. Spedding GR 1997 The evolution of initially-turbulent, bluff-body wakes at high internal Froude number. *J. Fluid Mech*. **337**, 283-301.[DOI: https://doi.org/10.1017/S0022112096004557]

56. 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]

57. 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. [doi: https://doi.org/10.1017/S0022112096000237]

58. 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.

59. Fincham AM, Maxworthy T & Spedding GR 1996 Energy dissipation and vortex structure in freely-decaying, stratified grid turbulence. *Dyn. Atmos. Ocean* **23**, 155-169.

60. Spedding GR & Rignot EJM 1993 Performance analysis and application of grid interpolation techniques for fluid flows. *Exp. Fluids* **15**, 417-430.

61. 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.

62. Lai RJ, Huang NE, Long SR & Spedding GR 1993 Blocking and trapping of waves in an inhomogeneous flow. *Dyn. Atmos. Oceans* **20**, 79-106.

63. Spedding GR 1993 On the significance of unsteady effects in the performance of flying animals. *Contemp. Math*. **141**, 401-419.

64. 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.
65. Narimousa S, Maxworthy T. & Spedding GR 1991 Experiments on the structure of forced quasi-*2D* turbulence. *J. Fluid Mech*. **223**, 113-133. [doi: https://doi.org/10.1017/S0022112091001362]
66. Karpouzian G, Spedding GR & Cheng HK 1990 Lunate-tail swimming propulsion. Part 2. Performance analysis. *J. Fluid Mech.* **210**, 329-351. [doi: 10.1017/S0022112090001318]
67. Spedding GR 1987 Dislocations and three-dimensional instabilities of Kelvin-Helmholtz waves. *Weather* **43**, 25-29.
68. Spedding GR 1987 The wake of a kestrel (*Falco tinnunculus*) in flapping flight. *J. Exp. Biol*. **127**, 59-78.
69. Spedding GR 1987 The wake of a kestrel (*Falco tinnunculus*) in gliding flight. *J. Exp. Biol*. **127**, 45-57.
70. Spedding GR & Maxworthy T 1986 The generation of circulation and lift in a rigid two-dimensional fling. *J. Fluid Mech*. **165**, 247-272. [doi: https://doi.org/10.1017/S0022112086003087]
71. Spedding GR 1986 The wake of a jackdaw (*Corvus monedula*) in slow flight. *J. Exp. Biol*. **125**, 287-307.
72. Spedding GR, Rayner JMV & Pennycuick 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)

1. Spedding GR 2011 The cost of flight in flocks. *Nature* **474**, 458-459. (commentary)
2. 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.
3. 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.
4. 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)

1. Spedding GR 2009 Flight at small scales. *Mechanical Technology*, March 2009, 30-33.
2. Spedding GR 2009 Flight at small scales. *Innovate* **3**, 80-83.
3. 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

1. Klose B, Spedding GR & Jacobs G 2021 What is the effect of self-induced pressure waves and their wall reflections on low Reynolds number airfoil flow in wind tunnels? AIAA SciTech Forum, AIAA-2021-1195 doi:10.2514.2021-1195

2. Hanna YGT, West MN, Kudva J & Spedding GR 2020 Stepped wings at moderate Re with implications on multipoint wing design. AIAA SciTech Forum 6-10 Jan, Orlando FL. AIAA 2020-0803 https://doi.org/10.2514/6.2020-0803

3. Hanna YGT & Spedding GR 2019 Aerodynamic performance improvements due to porosity in wings at moderate Re. 2019 AIAA Aviation and Aeronautics Forum and Exposition, 17-21 June 2019, Dallas, Texas. AIAA 2019-3584 https://doi.org/10.2514/6.2019=3584

4. Tank J, Klose B, Jacobs G & Spedding GR 2019 Computer and laboratory studies on the aerodynamics of the NACA 65(1)-412 at Reynolds number 20 000 AIAA SciTech Forum, AIAA-2019-2162

5. Kamphuis MH, Jacobs GB, Chen KK, Spedding GR, and Hoeijmakers HWM. 2018 Pulse actuation and its effects on separated Lagrangian coherent structures for flow over a cambered airfoil, *2018 AIAA Aerosp. Sci. Mtg.*, AIAA SciTech Forum, (AIAA 2018-2255) https://doi.org/10.2514/6.2018-2255

6. Smith L, Craig KJ, Meyer JP & Spedding GR 2016 Numerical Simulations of a Proposed Wing-body-tail Configuration. 54rd AIAA Aerospace Sciences Meeting, AIAA 2016-0800, San Diego, CA.

7. Davis, TW & Spedding GR 2015 Lift and drag measurements of a gull-wing aircraft. SciTech15, AIAA Conference, AIAA 2015-0027

8. 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

9. 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.

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

11. 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. 26th Symp. Naval Hydrodynamics*, Rome, Italy, Sept 17-22 2006.

12. 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*.

13. 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. *15th Australasian Fluid Mechanics Conference*, University of Sydney, Australia, December 13-17th, 2004.

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

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

16. 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

17. Spedding GR, Klinke J & Long SR 1996 Estimating ω(*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.
18. 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).
19. 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*
20. 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. 34th ICTAM*, Grenoble, August 1988.

Technical Reports -- copies available on request

1. 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.
2. 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.
3. 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.
4. Spedding GR 1997 *Spinup at Coriolis.* Technical Report to Institute Mechanique Grenoble.
5. 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

1. Ohh C-Y, Oliver M & Spedding GR 2022 Asymmetric stratified wakes. *Bull. Am. Phys. Soc.* **67**, Z33.00009
2. Luhar M, Chinta VK, Ohh, C-Y & Spedding GR 2021 Regime identification for stratified wakes from limited measurements using a library=based sparse regression formulation. *Bull. Am. Phys. Soc.* **66**, E30.00004
3. Ohh C-Y & Spedding GR 2021 Coherent structures in the stratified near-wake of an inclined 6:1 prolate spheroid. *Bull. Am. Phys. Soc.* **66**, E30.00006
4. Singer EK & Spedding GR 2021 The effect of chordwise flexibility on the aerodynamic performance of micro-robot-inspired flapping wings. *Bull. Am. Phys. Soc.* **66**, P25.00001
5. Singer EK & Spedding GR 2020 Scaled experiments on rigid and flexible wings for micro-robots. *Bull. Am. Phys. Soc.* **65**, S02.00024

6. Tu JH, Ohh, C-Y & Spedding GR 2020 Machine learning classification of stratified wakes using dynamic mode decomposition and decision trees. *Bull. Am. Phys. Soc*. **65**, U05.00004
7. Ohh C-Y & Spedding GR 2020 Automated stratified wake classification using Dynamic Mode Decomposition. **Bull. Am. Phys. Soc. 65**, U05.00021
8. Ohh C-Y & Spedding GR 2019 Wake identification of stratified flows using Dynamic Mode Decomposition. *Bull Am. Phys. Soc.* **64**, No. 13, Q39.00006
9. Hanna Y & Spedding GR 2019 Holey wings can improve aerodynamics at bioscales. *Bull. Am. Phys. Soc.* **64**, No. 13, A27.00005.
10. Hanna Y, Spedding G, West M, Kornbluh R, Kirkwood G & Kudva J 2019 Enabling biomimetic morphing UAVs. *Proc. 22nd Int. Conf. on Composite Materials* (ICCM22), Paper#2110-1.
11. Spedding GR, Tank J, Klose, B & Jacobs G 2018 Surprises and disagreements in wing performance at moderate Reynolds number. *Bull. Am. Phys. Soc.* **63**, M14.00001
12. Ohh C-Y, Xiang X, Madison T & Spedding GR 2018 Near-wake structure in a stably-stratified fluid using Dynamic Mode Decomposition. *Bull Am. Phys. Soc.* **63**, G35.00006
13. Klose B, Jacobs G, Tank J & Spedding GR 2018 Low Reynolds number airfoil dynamics: three different flow patterns within a small range of angles of attack. *Bull Am. Phys. Soc*. **63**, D32.00008
14. Tank J, Jacobs G & Spedding GR 2017 Detailed comparison between DNS and wind tunnel experiment for an airfoil at Re = 20000 with a view towards control. *Bull. Am. Phys. Soc.* **62**, A17.2
15. Madison T, Xiang X & Spedding GR 2017 Comparing laboratory and numerical experiments on stratified wakes of bluff bodies. *Bull Am. Phys. Soc.* **62**, D34.3
16. Madison, T, Xiang X, Sellappan P,& Spedding GR 2016 Near-wake characteristics in a stably-stratified fluid. *Bull. Am. Phys. Soc.* **61**, No. 22, 128.
17. Xiang X, Chen K, Madison T & Spedding GR 2016 Experiments and simulations of low Re sphere wakes with and without stratification. *Bull. Am. Phys. Soc.* **61**, No. 22, 129.
18. Chen K & Spedding GR 2016 The sensitivity of stratified flow stability to base flow modifications. *Bull. Am. Phys. Soc.* **61**, No. 22, 129
19. Chen K & Spedding GR 2015 Stability sensitivity to gravity and base flow density modifications. *Bull. Am. Phys. Soc.* **60**, No. 21, 252.
20. Xiang X, Chen K, Madison T,& Spedding GR 2015 Dynamic mode decomposition identifies internal wave and vortical modes in stably stratified wakes. *Bull. Am. Phys. Soc.* **60**, No. 21, 158.
21. Madison T, Sellapan P, P Xiang X & Spedding GR 2015 Density overturns and local stability measures in early stratified wakes. *Bull. Am. Phys. Soc.* **60**, No. 21, 159.
22. Xiang X, Madison T, Sellapan, P & Spedding GR 2014 The near wake of a towed grid in a stratified fluid. *Bull. Am. Phys. Soc.* **59**, No. 20, 133.
23. 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.
24. 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.

25. Nagar RK, Meyer JP, Alam M & Spedding GR 2013 The turbulent wakes of smooth and dimpled pin fins. ISABE-2013-1221, AIAA

26. Nagar RK, Meyer JP, Alam M & Spedding GR 2013 Numerical investigation of surface enhancement configurations for pin fins. ISABE-2013-1222, AIAA

27. Yang S & Spedding GR 2012 Separation control by external acoustic excitation on a finite wing at low Reynolds numbers. *Bull. Am. Phys. Soc.* **57**, No. 17, 284.

28. Yang S & Spedding GR 2011 Spanwise drag variation on low Re wings - revisited. *Bull. Am. Phys. Soc.* **56**, No. 18, 287.

29. Nagar, R & Spedding GR 2011 Fluid Dynamics around a Dimpled Pin Fin. *Paper#63427, IMECE Conference of ASME, Denver, Colorado*

30. Nagar, R & Spedding GR 2011 Flow field around dimpled pin fins in a staggered array. *Paper#63485, IMECE Conference of ASME, Denver, Colorado*

31. Huyssen RJ & Spedding GR 2010 Should Planes Look Like Birds? *Bull. Am. Phys. Soc.* **55**, No. 16, 63.

32. Spedding GR & McArthur J 2009 Span efficiency of wings at moderate Reynolds number. *Bull. Am. Phys. Soc.* **54**, No. 19, 198.

33. Muijres FT, Johansson LC, Barfield R, Wolf M, Spedding GR & Hedenström A 2008 The unsteady flow over a bat wing in mid-downstroke. 2008 APS March Meeting, *Bull. Am. Phys. Soc.* **53**, No. 1, Abstract A9.00010

34. 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.

35. Rottman JW, Broutman D, Spedding GR & Diamessis PJ 2006 A model for the internal wavefield produced by a moving object and its turbulent wake in a stratified fluid. *Proc. 6th Int. Symp. Strat. Flows*, Perth, Australia, Dec 11-14 2006.

36. Diamessis PJ & Spedding GR 2006 Scaling and structure of stratified turbulent wakes at high Reynolds numbers. *Proc. 6th Int. Symp. Strat. Flows*, Perth, Australia, Dec 11-14 2006.

37. Gallet S & Spedding GR 2006 Vertical propagation of submerged wakes in stratified fluids. *Bull. Am. Phys. Soc.* **51**, 63.

38. McArthur J, Spedding GR & Rosen M 2006 Aerodynamic instabilities on small scale wings. 15th *US National Congress on Theoretical and Applied Mechanics (USNCTAM)*, University of Colorado, Boulder, June 25th

39. McArthur, J & Spedding GR 2006 Complex flows over simple wings. *Bull. Am. Phys. Soc.* **51**, 73.

40. 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.

41. Spedding GR, McArthur J & Rosen M 2005 Estimating fluid forces from PIV measurements. *Proc. 6th Int. Symp. On Particle Imaging Velocimetry*, Pasadena, CA. Sept. 21st-23rd.

42. Spedding GR & Meunier P 2004 Self-propelled wakes in a stratified fluid. *Bull Am. Phys. Soc.* **49**, 204.

43. Rosen M, McArthur J & Spedding GR 2004 Aerodynamic performance measurements at moderate Re. *Bull Am. Phys. Soc.* **49**, 21.

44. 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. *Bull Am. Phys. Soc.* **49**, 60.

45. Spedding GR, Rosen M, Hedenstrom A & McArthur J 2004 Force Measurements and Flow Structure for Fixed and Flapping Wings at Low Reynolds Number Proc. 11th International Symposium on Flow Visualization, University of Notre Dame, Notre Dame, Indiana.

46. Meunier P, Redekopp L & Spedding GR 2003 Prediction and measurement of body-generated waves by submerged bodies in a stratified fluid. *Bull Am. Phys. Soc.* **48**, 177.

47. Spedding GR & Meunier P 2003 Momentumless and almost momentumless wakes in a stratified fluid. *Bull Am. Phys. Soc.* **48**, 77.

48. Hedenstrom A, Rosen M & Spedding GR 2003 New estimates of wake momentum for freely-flying birds in a wind tunnel. *Bull Am. Phys. Soc.* **48**, 25.

49. Spedding GR 2003 Vortex wakes of flying birds. *Proc. SIAM Conf. App. Dyn. Sys.*, Snowbird, Utah, p188.

50. 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.

51. Spedding GR, Hedenstrom A & Rosen M 2002 BPIV: Quantitative studies of bird wakes in free flight in a wind tunnel. *Bull Am. Phys. Soc.* **47**, 176.

52. Meunier P & Spedding GR 2002 Memory of initial conditions in stratified wakes at late times? *Bull Am. Phys. Soc.* **47**, 161.

53. Spedding GR 2002 The aerodynamics of bird flight. *Bull Am. Phys. Soc.* **47**, 120.

54. Hedenstrom A, Rosen M & Spedding GR 2002 A family of vortex wakes for bird flight at different speeds. *Bull Am. Phys. Soc.* **47**, 97.

55. 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. *Paper No. 02S-93*, Spring Technical Meeting, Western States Section/Combustion Institute, University of California San Diego, San Diego, CA.

56. Spedding GR 2001 The geometry and origin of late-wake eddies in stratified wakes. *Bull Am. Phys. Soc.* **46**, 86.

57. Egolfopoulos FN, Dong Y, Spedding GR, Cuenot B & Poinsot T 2001 Quantitative Studies on the Propagation and Extinction of Near-Limit Premixed Flames Under Normal- and Micro-Gravity. *Sixth International Microgravity Combustion Workshop*, Cleveland, Ohio, May 21-24, 2001.

58. Spedding GR 2000 Stratified Wakes. *Proc. 5th Int. Symp. on Stratified Flows.* (invited presentation).

59. Spedding GR, Browand FK, Bell R & Chen J 2000 Internal waves from intermediate, or late-wake vortices. *Proc. 5th Int. Symp. on Stratified Flows.* **1**, 113-118.

60. Spedding GR, Browand FK & Bell R 1999 Internal waves from coherent structures in the late wake. *Bull Am. Phys. Soc.* **44**, 64.

61. Spedding GR & Fincham AM 1998 Strong asymmetries in stratified wakes with weak rotation. *Bull. Am. Phys. Soc.* **43**, 2047.

62. Bell R, Spedding GR & Browand FK 1998 Internal wave generation by vortex wakes in stratified fluids. *Bull. Am. Phys. Soc.* **43**, 2026.

63. Spedding GR Bell R & Browand FK 1997 The decay of an initially-turbulent bluff-body wake in quiescent and disturbed stratified fluids. *Bull. Am. Phys. Soc.* **42**, 2132.

64. Bell R, Spedding GR & Browand FK 1997 Interactions between pancake vortices and internal waves in stably stratified fluids. *Bull. Am. Phys. Soc.* **42**, 2199.

65. 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.

66. Spedding GR & Browand FK 1996 The collapse of fluid turbulence in a stable stratification: evidence for a universal non-equilibrium regime. *Bull. Am. Phys. Soc.* **41**, 1752.

67. Spedding GR & Browand FK 1995 Bluff-body wakes in a stably stratified fluid at high Reynolds and Froude number. *Bull. Am. Phys. Soc*. **40**, 1969.

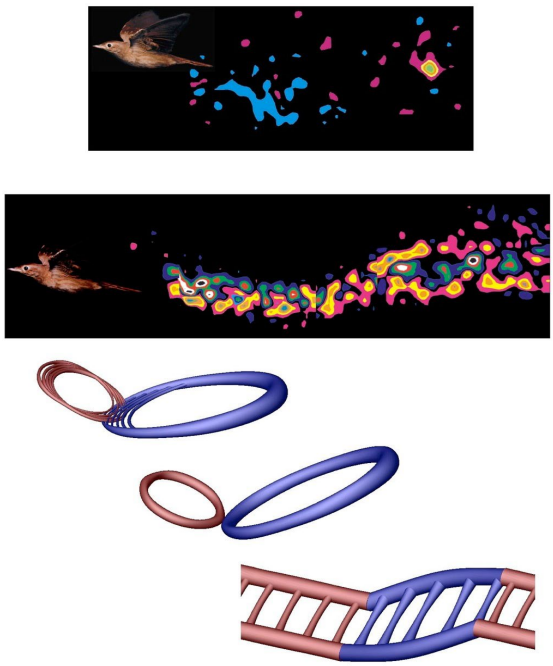
68. Bell R, Spedding GR & Browand FK 1995 A comparative wavelet analysis of *1D* ocean measurements with DNS studies of breaking internal waves. *Bull. Am. Phys. Soc*. **40**, 1986.

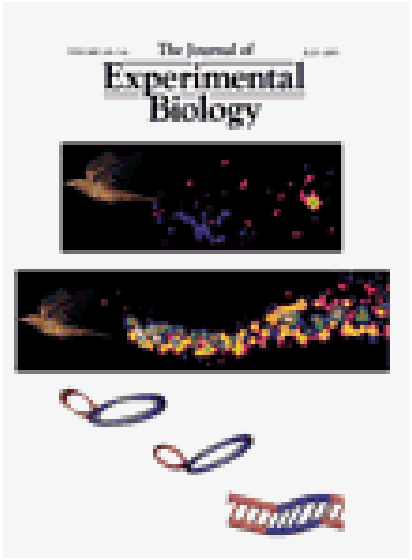
69. Fincham AM & Spedding GR 1995 Velocity bandwidth, discretization errors and peak-locking phenomena in DPIV measurements. *Bull. Am. Phys. Soc*. **40**, 2000.

70. Spedding GR, Browand FK & Fincham AM 1994 The long-time evolution and structure of vortex wakes behind towed spheres in a stable stratification. *Bull. Am. Phys. Soc*. **39**, 1951.

71. 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





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 21st 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 27th 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 20th, 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 23rd)

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
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

ABC Science 2014 *Why do some birds flap their wings while others glide?*
http://www.abc.net.au/science/articles/2014/03/11/3927566.htm

CBS, Los Angeles, Feb 19, 2016 *USC Graduate Students Work To Improve Drone Technologies*
http://losangeles.cbslocal.com/2016/02/19/only-on-2-usc-graduate-students-work-to-improve-drone-technologies/

Flying Cars — the next big thing? Quartz Pub./Atlantic (released summer 2017)

Climate Change Could Take the Air out of Wind Farms: quoted in commentary by Eric Niiler, Wired Magazine Online, Dec 13th 2017

https://www.wired.com/story/climate-change-could-take-the-air-out-of-wind-farms/

Are Superhero Capes Aerodynamic?

https://gizmodo.com/are-capes-aerodynamic-1826728817

Online Gizmodo June 18 2018.

The flying-car of the future is coming, even if no-one can agree on when

Quoted in article by Eric Olsen, Quartz Online, Sept 1, 2018

https://qz.com/1375363/the-flying-car-future-is-coming-even-if-no-one-can-agree-on-when/

Obituary: Colin Pennycuick

The Guardian, UK

https://www.theguardian.com/science/2020/feb/24/colin-pennycuick-obituary

Radio
National Public Radio, 1996
On new insect flight experiments
National Public Radio, February 29th 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 27th 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 20th)
Penn & Teller: Secrets of the Universe
Emergency Aircraft Landing

National Geographic (aired Dec 31st 2011, shot April 25th)
(Lone Wolf Productions)
Early Aircraft Aerodynamics

Swedish Public TV, Sept 20th 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

Spectrum News TV March 13th 2023
The Future of Aerospace Engineering In Southern California
https://spectrumnews1.com/ca/la-west/inside-the-issues/2023/03/14/southern-california-s-aerospace-industry-#

Invited Talks (from 2000 onwards)

On Aerodynamics

Aeronautics at Bio-Scales
Invited Seminar (50 minutes)
Department of Mechanical Engineering
Johns Hopkins University, Baltimore, MD
March 28th, 2019

Aeronautics at Bio-Scales
Invited Seminar (50 minutes)
Department of Aerospace Engineering and Mechanics
University Minnesota, MN
February 22nd, 2019

Aerodynamics at Small Scale
Invited Seminar (50 minutes)
Department of Aerospace Engineering
Embry-Riddle Aeronautical University, Daytona Beach, FL
January 31st, 2019

Drone Design: from Aerodynamic Details to System Integration

Keynote talk at *The Future of Drones:Technologies, Applications, Risks and Ethics*
International Workshop, Lund University, Sweden
September 25-26, 2018

New and Old Thoughts on Wings at Moderate Reynolds Number
Fluid Mechanics Seminar (50 minutes)
Department of Mechanical Engineering
Stanford University, CA
October 17th, 2017

Old and New Problems in Low Reynolds Number Aerodynamics
Chair's Distinguished Seminar Series (50 minutes)
Department of Aeronautics and Astronautics
University of Washington, Seattle, WA
May 1st, 2017

Old and New Problems in Low Reynolds Number Aerodynamics
Seminar (50 minutes)
MAE Department
UC San Diego, CA
April 17th, 2017

Do Large and Small Wings Work the Same Way?
Invited talk (50 minutes)
Gordon Research Conference
Ventura, CA
March 20th, 2017

Does an Optimal Aircraft Configuration Exist?
Invited talk (50 minutes)
Aerovironment Inc.
Simi Valley, CA
December 1st, 2015

Design and Evolution in Flying Devices (large and small)
Seminar (50 minutes)
Mechanical Engineering Department
UC Riverside
May 9th, 2014

Aerodynamic Efficiency in Small and Large Aircraft
Seminar (50 minutes)
Mechanical and Aerospace Engineering Department
University of Florida
Apr 15th, 2014

Bird Design and Aircraft Evolution
Seminar (50 minutes)
Mechanical Engineering, Fluid Mechanics Seminar Series
Stanford University
Apr 8th, 2014

On Bird Flight
Invited Talk (15 minutes)
Micro Air Vehicle Workshop
AIAA SciTech Meeting
Jan 11th, 2014

Design and Evolution in Flying Devices
Seminar (50 minutes)
Engineering School Technical Seminar
Cal State Long Beach
Nov 7th, 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 10-11th, 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 31st, 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 25th, 2013

Bird Design and Aircraft Evolution
Seminar (50 minutes)
Mechanical Engineering
UC Santa Barbara
April 3rd, 2013

Bird Design and Aircraft Evolution
Seminar (50 minutes)
Aerospace and Mechanical Engineering
Princeton University
February 22nd, 2013

Bird Design and Aircraft Evolution
Seminar (50 minutes)
Applied Mechanics Colloquium
Harvard University
October 10th, 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 4t^{h} 2012

On Unmanned Systems
Invited talk (50 minutes)
Northrop Grumman Unmanned Systems Research Day
Northrop Grumman Technical Services, Sierra Vista, AZ
June 12th, 2012

How Many More Years of Tube and Wing?
Seminar (50 minutes)
Department of Ecology and Biological Sciences
Lund University, Sweden
May 15th, 2012

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

Design and Evolution of Birds and otherFlying Machines
Invited Talk (50 minutes)
NextGen, Torrance, CA
May 10th, 2011

Design and Evolution of Bird-Shaped Flying Machines
Invited Talk (50 minutes)
Advanced Project Group (Skunkworks), Lockheed Martin, Palmdale, CA
February 21st, 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 20th, 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 1st, 2010

The Aerodynamics of Everything
Plenary Talk
SIAM Front Range Student Conference
University of Colorado, Denver
March 6th 2010

Aeronautics at Low Reynolds Number
Seminar (50 minutes)
Department of Applied Mathematics
University of Colorado, Boulder
March 5th 2010

Aeronautics at Low Reynolds Number
Seminar (50 minutes)
GALCIT
Caltech, CA
December 4th 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 12th 2009

Flight at Small Scales
Sears Lecture
Woods Hole Institute of Oceanography
Woods Hole, MA
August 6th 2009

Flight at Small Scales
Invited talk (50 min) at:
Meeting of VDI - Verein Deutscher Ingenieure of SA
Sandton, Johannesburg
RSA
May 5th 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 25th 2009

k
Department of Animal Ecology (Flight Group) Seminar
Lund University,
Lund, Sweden
Jan 26th 2009

The Aerodynamics of Simple Wings at Moderate Reynolds Number
2nd SAIAS Symposium
Stellenbosch, South Africa
Sept 14th 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 13th 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 6th 2008

Why Fly?
Invited talk (80 min) at:
Department of Mechanical & Aeronautical Engineering
University of Pretoria, (Engineering Week)
South Africa
July 2nd, 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 24th 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 18th 2008

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 24th 2007

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

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

Birds and Bats – and Other Small-Scale Flying Machines
Invited seminar (50 min) at:
Department of Mechanical and Environmental Engineering,
UCSB, USA.
May 1st 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 6th 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 24th 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 27th 2006

Interpretation of Wind Tunnel Tests of Fixed and Flapping Wing Systems
Invited presentation (15 min) at:
5th World Congress in Biomechanics
Munich, Germany
August 1st 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 28th 2006

Recent Experiments in Measurement of Low-Re Flows
Invited seminar (50 min) at:
Department of Mechanical Engineering,
Brown University, USA.
March 10th 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:
44th AIAA Aerospace Sciences Conference
Reno, Nevada
January 9th 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 25th 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 35th International Congress of Physiological Sciences
Caltech, Pasadena, CA
March 28th-30th 2005

Experiments in Low-Speed Aerodynamics
Invited seminar (50 min) at:
Center for Integrative Multiscale Modeling and Simulation (CIMMS)
Caltech, Pasadena, CA
March 8th 2005

Bird Flight for Wittgenstein
Invited seminar (50 min) at:
Department of Evolutionary and Organismal Biology
Brown University, Boston, MA
March 10th 2004

Bird Flight for Biologists and Engineers
Invited seminar (50 min) at:
Department of Integrative Biology
UC Berkeley, CA
October 30th 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 7th 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 30th 2003

Understanding Bird Flight
Invited seminar (50 min) at:
Center for Interdisciplinary Research in Fluids Seminar

UC Santa Barbara, CA
May 14th 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 2nd 2002

The Aerodynamics of Bird Flight
Invited Talk (40 min) at:
American Physical Society
Division of Fluid Dynamics Meeting, Dallas
November 21st 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 5th 2002

Modeling the Flight of Birds
Invited Talk (50 min) at:
Graduate Research Training Program
Institute of Theoretical Dynamics, UC Davis
May 3rd 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 10th 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 16th 2001

On Geophysical Fluid Mechanics

Pattern Formation and Detection in the Ocean
Seminar (50 minutes)
Mechanical Engineering Seminar Series
Department of Mechanical Engineering
Johns Hopkins University, Baltimore, MD
March 2nd, 2023

Wake Signature Detection
Seminar (50 minutes)

Fluid Dynamics Seminar Series
Department of Aerospace Engineering
Penn State, PA
April 13th, 2017

Wake Signature Detection
Seminar (50 minutes)
Center for Applied Mathematical Sciences
Department of Mathematics
USC
March 23rd, 2015

Robust Pattern Formation and Detection in Wakes in Nature
Invited Talk (40 minutes)
Fundamental Aspects of Geophysical Turbulence
Nagoya, Japan
Mar 10th, 2014

Wake Signature Detection
Seminar (50 minutes)
Laboratoire d'Hydrodynamique (LadHyX)
Ecole Polytechnique de Paris
June 6th, 2013

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 6th, 2012

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 21st, 2010

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 1st 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 22nd 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 22nd 2007

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 23rd 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 9th – 11th 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 11th – 14th 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 3rd 2004

Wakes in Stratified Fluids
Invited seminar (50 min) at:
Department of Mechanical Engineering
Stanford, CA
December 2nd 2003

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 13th 2002

Turbulent Wakes
Invited Talk (50 min) at:
Meeting of Hydrodynamics: Approaches from Russia and West

Directed Technologies, Arlington VA
June 12th 2002

Bluff Body Wakes in Stratified Oceans
UCSD seminar in MAE Department
May 14th 2001

Stratified Wakes
Invited Opening Talk (30 min.) at:
5th International Symposium on Stratified Flows
UBC, Vancouver
July 10th 2000

New Experiments in Stratified Wakes
UCSB Seminar, Mechanical & Environmental Engineering
May 9th 2000

Particular and General Characteristics of Undersea Wakes
SDSU AME Department Seminar
March 16th 2000

On Experimental/Analytical Methods

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 22nd 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 29th 2005

Estimating Forces from PIV Measurements
Invited talk (30 min, introductory keynote lecture) at:
PIV 05
6th International Symposium on Particle Imaging Velocimetry
Caltech
Pasadena, CA
Sept 21st – 23rd 2005

On Teaching and General Topics

Bias Busters in Science and Engineering
Workshop to all Staff/Faculty at USC
Jan 24, 2017

Bias Busters and Faculty Recruitment
Workshop to Faculty at USC/VSoE
Nov 29, 2016

Death by PowerPoint Rides Again!
Center for Excellence in Teaching Seminar
USC, Los Angeles, California
12:00-1:30pm, February 11th 2010

Presentation Zen
Interactive Multimedia Literacy Program/Center for Excellence in Teaching Seminar
USC, Los Angeles, California
1:00-3:30pm, November 6th 2009

Death by PowerPoint
Center for Excellence in Teaching Seminar
USC, Los Angeles, California
12:00-1:30pm, February 12th 2008

General Public/Outreach

Aeromagination
Tomorrow's Aeronautical Museum
October 7th 2011

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

The Aerodynamics of Everything
USC Engineering Honors Colloquium
January 22nd 2010

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 16th 2007

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

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 30th 2005

The Aerodynamics of (almost) Everything
Invited Talk (50 min) at:
Sigma Public Lecture
Virginia Air and Space Center
Hampton, VA
November 5th 2002

The Engineer and the Universe
USC Engineering Honors Colloquium
September 10th 2000

Research Support

[1994 – current]

Title: *Birth and control of three-dimensional Lagrangian separation: Optimal control.*
PI: GR Spedding (+ Guus Jacobs, SDSU, co-PI, Maziar Hemati), co-PI
Agency: Air Force Office of Scientific Research
Period: 04/01/21 – 09/30/24
Amount total: $359,697 (GRS share)
Grant#: AFOSR-FA9550-21-1-0434 P00001
Major objectives: New control methods for three-dimensional wing-body junction flows.

Title: *Towards realistic prediction and modeling of the hydrodynamic disturbances of complex bodies and initial conditions in a stratified ambient: laboratory experiments.*
PI: GR Spedding
Agency: Office of Naval Research
Period: 01/01/21 – 12/31/23
Amount total: $474,485
Grant#: N00014-20-1-2584
Major objectives: Direct measurement of wakes behind non-standard submerged bodies in stratified ambient at moderate to high Reynolds number.

Title: *Biomimetic Design of Morphing Micro-Air-Vehicles. Phase II*
PI: GR Spedding (STTR with Concepts2 Systems, Research International)
Agency: Air Force Office of Scientific Research
Period: 12/21/17 – 12/20/19
Amount total: $210,280 (USC part)
Major objectives: Phase II study of morphing concepts in MAV systems.

Title: *Control of Lagrangian Coherent Structures at Stagnation and Separation Locations on Airfoils.*
PI: GR Spedding (+ Guus Jacobs, SDSU, co-PI)
Agency: Air Force Office of Scientific Research
Period: 09/30/16 – 09/29/19
Amount total: $786,210
Major objectives: Novel computations and field analysis for reduced order modeling and control of unsteady, separated flows.

Title: *Numerical and Laboratory Experiments of Early Wakes in Stratified Fluids.*
PI: GR Spedding
Agency: Office of Naval Research
Period: 08/01/15 – 12/31/19
Amount total: $847,381
Major objectives: Detailed measurements and computations combined for determining importance of initial conditions in stratified wakes at high Reynolds number.

Title: *Wake Signatures and Optimal Design of Underwater Sensory Systems For Wake Detection.*

PIs: E Kanso, GR Spedding (+ Jeanette Yen, GTech)
Agency: Office of Naval Research
Period: 06/01/14 – 05/31/17
Amount total: $682,590
Major objectives: To find the necessary conditions for generation of pattern and its detection in hydrodynamic wakes.

Title: *Biomimetic Design of Morphing Micro-Air-Vehicles.*
PI: GR Spedding (STTR with Concepts2 Systems, Research International)
Agency: Air Force Office of Scientific Research
Period: 04/15/16 – 01/14/17
Amount total: $45,000 (USC part)
Major objectives: Phase I study of morphing concepts in MAV systems.

Title: *Optical Diagnostics for Flow Control on Small Wings*
PI: GR Spedding
Agency: Air Force Office of Scientific Research
Period: 07/01/15 – 06/30/16
Amount total: $46,000
Major objectives: Special support for PIV laser.

Title: *A New Facility for Study of Early Wakes in Stratified Fluids.*
PI: GR Spedding
Agency: Office of Naval Research
Period: 06/01/15 – 05/31/16
Amount total: $117,745
Major objectives: DURIP grant for construction of large equipment item associated with ONR projects.

Title: *Experiments in developing wakes in stratified fluids.*
PI: GR Spedding
Agency: Office of Naval Research
Period: 06/01/11 – 05/31/14
Amount total: $688,811
Major objectives: Measurements of mean and turbulence wake profiles in refractive-index matched, variable density fluids, for field comparisons and computations.

Title: *Flow Control at Moderate Reynolds Number through Manipulation of the Separation Streamline.*
PI: GR Spedding
Agency: Air Force Office of Scientific Research
Period: 07/01/11 – 6/30/14
Amount total: $312,585
Major objectives: To investigate natural acoustic excitation sensitivity as a means of control with no moving parts in small-scale flying devices.

Title: *The near wake of bluff bodies in stratified fluids and the emergence of late wake characteristics.*
PI: GR Spedding

Agency: Office of Naval Research
Period: 05/16/06 – 09/30/08
Amount total: $327,887
Major objectives: Show emergence of stratified wakes through new experiments in refractive-index matched, variable density fluids.

Title: *The near wake of bluff bodies in stratified fluids and the emergence of late wake characteristics.*
PI: GR Spedding
Agency: Office of Naval Research
Period: 05/16/06 – 09/30/06
Amount total: $27,887
Major objectives: Bridge funds for continuing studies in stratified wakes.

Title: *Wind Tunnel Investigations for Improving MAV Aerodynamic Performance.*
PI: GR Spedding
Agency: Air Force Office of Scientific Research
Period: 06/01/06 – 12/31/06
Amount total: $41,574
Major objectives: Pilot study on flow separation and effects of sweep on small wings.

Title: *Parallel Computations of Localised Turbulence in Stratified Flows.*
PI: GR Spedding
Agency: AMPAC Technology
Period: 07/01/05 – 06/30/06
Amount total: $154,000
Major objectives: Continuation of previous AMPAC-supported work.

Title: *Parallel Computations of Localised Turbulence in Stratified Flows.*
PI: GR Spedding
Agency: AMPAC Technology
Period: 07/01/04 – 06/30/05
Amount total: $121,698
Major objectives: Parallelise existing LES code for computation of turbulent flows in stratified wakes and perform parametric study of scale effects with internal Froude and Reynolds number.

Title: *Mechanisms for Vertical Signature Propagation from Submerged Wakes and Bodies in Stratified Oceans.*
PI: GR Spedding
Agency: Office of Naval Research
Contract#: N00014-04-1-0034
Period: 11/01/03 – 10/31/06
Amount total: $322,209
Major objectives: Provide first coherent study of physics of vertical transport of coherent signatures.

Title: *A Combined Numerical-Laboratory Investigation of Stratified Turbulence with Application to Submerged Wakes.*

PI: GR Spedding
Agency: Office of Naval Research
Contract#: N00014-03-1-0982
Period: 05/01/03 – 01/16/04
Amount total: $ 44,098
Major objectives: Special ONR Code 6.2 funding supplement to support Research Associate P. Diamessis in computational work related to stratified wakes program.

Title: Q*uantitative Studies on the Propagation and Extinction of Near-Limit Premixed Flames Under Normal and Micro-Gravity.*
PIs: FN Egolfopoulos & GR Spedding
Agency: NASA
Grant#: NCC3-678
Period: 11/04/03 – 09/30/07
Amount total: $562,741
Major objectives: Near-limit flames are studied, first with ultra-rich fuel/air flames and then on the propagation and extinction of near-limit flames resulting from the dilution of flames at various equivalence ratios with inert gases. Continuation of existing work. GRS contribution is restricted to specific sections on new data acquisition and processing techniques, adapted for this problem.

Title: *Accurate Calculation of Blood Flow from Ultrasound Images.*
PI: GR Spedding
Agency: Zumberge Individual Research Grant
Period: 07/01/03 – 06/30/04
Amount total: $ 24,000
Major objectives: Exploratory program on technological applications of accurate blood flow measurements from ultrasound imaging.

Title: *The Origin of Late-Wake Signatures in Stratified Oceans (Renewal).*
PI: GR Spedding
Agency: Office of Naval Research
Grant#: N00014-96-1-0001
Period: 10/30/01 – 10/29/03
Amount total: $300,844
Major objectives: Continue existing investigation of submerged wakes, now determining effect of initial conditions in late wake signature, together with collaboration with numerical experiment.

Title: *Fundamental Flame Properties.*
PI: FN Egolfopolous & GR Spedding
Agency: Air Force Office of Scientific Research
Period: 06/15/02 – 11/30/02
Amount total: $ 179,960
Major objectives: Special AFOSR-associated equipment grant for advanced laser diagnostics of strained flames. **Note:** GRS not officially listed as PI since DURIP-related equipment grant was appended to existing AFOSR study. However, GRS wrote and specified all the image processing/laser diagnostics.

Title: *The Origin of Late-Wake Signatures in Stratified Oceans.*
PI: GR Spedding
Agency: Office of Naval Research
Grant#: N00014-96-1-0001
Period: 11/01/99 – 10/31/01
Amount total: $395,320
Major objectives: Determine the physical origin of major wake vortex and wave structures by comparative experiments.

Title: *Quantitative Studies on the Propagation and Extinction of Near-Limit Flames Under Normal and Micro-Gravity.*
PIs: FN Egolfopoulos & GR Spedding
Agency: NASA
Grant#: NCC3-678
Period: 11/30/98 – 11/29/03
Amount total: $410,000
Major objectives: To establish extinction conditions and laminar flame speeds for plane-strained flames near the extinction limit, in normal and micro-gravity.

Title: *The Structure and Persistence of Turbulent Wake Signatures in Stratified Oceans.*
PI: GR Spedding
Agency: Office of Naval Research
Grant#: N00014-96-1-0001
Period: 11/01/97 – 10/31/99
Amount total: $360,000
Major objectives: To characterise the fluid motions behind submerged vehicles in the presence of a stabilising background density gradient to predict signatures in real applications.

Title: *Experimental and Theoretical Analysis of Small-Scale Wind-Wave Generation.*
PIs: FK Browand, GR Spedding & PK Newton
Agency: Office of Naval Research
Period: 04/01/95 – 03/31/97
Amount total: $209,352
Major objectives: To develop further theory and experiment in quantitative analysis of unsteady ocean wave generation, concentrating on the role of defects or dislocations for energy transfer between wave modes. GRS wrote 90% of this proposal, presented the talk at the organization workshop and was principal contact throughout.

Title: *The Evolution of Turbulent Wake Signatures.*
PIs: FK Browand & GR Spedding
Agency: Office of Naval Research
Period: 10/01/95 – 10/01/97
Amount total: $293,103

Major objectives: The first quantitative and rigorous study of stratified wakes. Prediction of operational parameters in wakes of submerged vehicles of navy interest. GRS wrote 90% of proposal. Role of FKB was significant, at 10%.

Title: *Turbulence and Structure in Stratified Wakes.*
PIs: FK Browand & GR Spedding
Agency: Office of Naval Research
Period: 10/01/94 – 10/01/95
Amount total: $136,983
Major objectives: Investigate particular behaviour of stratified turbulence using novel quantitative laboratory measurements. GRS wrote 80% of proposal.

Title: *The Wavelet Transform Analysis of Microstructure Profiles from the Southern Equatorial Undercurrent.*
PIs: FK Browand & GR Spedding
Agency: Office of Naval Research
Period: 06/01/93 – 05/31/96
Amount total: $115,270
Major objectives: Calculation of intermittent structure distribution in oceanographic data in order to make dynamic explanation of localised field data. Broad goal is to bring analytical methods of laboratory and field experiment closer together. GRS wrote 100% of proposal.

Title: *A Space-Scale Analysis of the Unsteady Development of Wind-Generated Surface Waves Using 2D Complex Wavelet Transforms.*
PIs: FK Browand & GR Spedding
Agency: Office of Naval Research
Period: 04/01/92 – 03/31/95
Amount total: $320,076
Major objectives: To develop new quantitative analytical methods for characterising dispersion relations in unsteady inhomogeneous wave fields. To collaborate with ONR and NASA groups in disseminating software developed. GRS wrote 95% of this proposal, giving organising workshop talk and acting as principal contact.

Note: Funding is listed from US sources only. GRS has been responsible for writing the technical core and research plan/design for several successful proposals funded in Sweden, by the Swedish government and by the Wallenberg Foundation (a private foundation). The successful proposals include two major equipment proposals (lasers, cameras, computers, interfaces, optics), two STINT programs for support of international/cross-disciplinary interaction and one grant for visiting postdoc for 14 months visit to research labs at USC. A major proposal to support a research program of this postdoc upon his return to Sweden is under consideration.

Graduate students

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, PhD)	
2010 - 2013	Shanling Yang	(Acoustic disturbance control of low Re wings, PhD)
2011 - 2016	Tyler Davis	(A new optimal aircraft design, PhD)
2011 - 2017	Xinjiang Xiang	(Models of early stratified wakes, PhD)
2013 - 2017	Lelanie Smith	(University of Pretoria, 2 other supervisors) (Low drag bodies in lift for alternative wing-body-tail configurations, PhD)
2013 - 2018	Joe Tank	(Stability of transitional flows in aerodynamics)
2013 - 2019	Yohanna Hanna	(Morphing wings for flight mission optimisation)
2011 - 2021	Trystan Madison	(Near wakes in stratified flows)
2012 – 2021	Joachim Huyssen	(University of Pretoria, 1 other supervisor) (Novel architectures for modern air transports)
2018 - 2022	Emma Singer	(Efficiency of flapping wing devices)

Current

2017 - …	Chan-Ye Ohh	(Pattern detection in complex wakes)
2021 -	Madeleine Oliver	(Vortex pattern migration in stratified flows)
2021 -	Chase Klewicki	(Feedback control of 3D separation)
2022 -	Jocelyn Mendoza	(Novel aircraft configuration)

Teaching

USC

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

UP

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

SERVICE

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, Spr18)
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, 2017-18)
Graduate Fellowship Committee (Spr05-06)
AeroDesign Team Design Review Advisor (06-07, 10-11)
Strategic Planning Committee (Chair) (Fall06 – Fall07)
APS DFD 2010 Organising Committee (Presentation to APS Exec. Comm. Fall06)
UCAR Review Committee (Chair) (Fall 07-Spring08)
UCAR Review Committee (Chair) (Fall 16-Fall17)
AME Dept Calling Program (prospective ug) Spr18

Combined School/Departmental Ambassador Functions

Society for Experimental Test Pilots talks/tours - Sept 21, 2016
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

Session Chair: *Actuation 3: Formation of Active Composites*
22nd International Conference on Composite Materials
Melbourne, Australia
August 13th, 2019

Session Chair: *Turbulence*
12th Southern California Symposium on Flow Physics
USC
April 14th, 2018

Session Chair: *Environmental Flows*
11th Southern California Symposium on Flow Physics
UC San Diego
April 22nd, 2017

Session Chair: *Internal and Solitary Waves*
8th International Symposium on Stratified Flows
San Diego,
September 1st, 2016

Session Chair: *Environmental Flows*
10th Southern California Symposium on Flow Physics
UC Irvine
April 9th, 2016

Session Chair: *Turbulence*
9th Southern California Symposium on Flow Physics
San Diego State University
April 18th, 2015

Session Chair: *Biofluids: Predicting Effective Locomotion*
67th Annual DFD Meeting of APS
San Francisco, CA
November 25th, 2014

Session Chair: *Vortex Dynamics: General*
67th Annual DFD Meeting of APS
San Francisco, CA
November 24th, 2014

Session Chair: *Turbulence*
8th Southern California Symposium on Flow Physics
UCLA
April 12th, 2014

Session Chair: *Aerodynamics and Flow Control*
7th Southern California Symposium on Flow Physics
Caltech, Pasadena
April 13th, 2013

Session Chair: *General Experiments I*
65th Annual DFD Meeting of APS
San Diego, CA
November 18th, 2012

Session Chair: *Turbulence* (morning) *and Geophysical Flows* (afternoon)
6th Southern California Symposium on Flow Physics
University of California, Santa Barbara
April 14th, 2012

Session Chair: *Low Reynolds Number Aerodynamics*
64rd Annual DFD Meeting of APS
Baltimore, MD
November 21st, 2011

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

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

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

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

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

Session Chair: *Vortices and Separated Flows*

2nd Southern California Symposium on Flow Physics
University of California, Los Angeles,
April 12th, 2008

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

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

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

Session Chair: *Stratified Wakes I*
5th International Symposium on Stratified Flows
University of British Columbia, Vancouver
July 10th, 2000

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

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

Conference/Symposium Organiser

8th International Symposium on Stratified Flows
San Diego, California
August 28 — September 1, 2016
Co-Organizer

17th US National Conference on Theoretical and Applied Mechanics
Organizer: 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

6th International Symposium on Particle Image Velocimetry (PIV05)
California Institute of Technology, September 21st – 23rd, 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. 14th – 15th 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 14th, 1995.
Invited participants: Westerweel (Delft, Netherlands), Cowen (Stanford), Gharib (Caltech.), Fincham (USC).
GRS gave introductory talk: *Fundamental Limits in DPIV Accuracy*

Reviewer

Engineering/Fluid Mechanics
J. Fluid Mech., Phys. Fluids, Exp. Fluids, Phys. Rev. Fluid, Proc. Roy. Soc. Lond. A, Dyn. Atmos. Ocean, J. Geophys Res., Eur., 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., Exp. Therm. Fluid Sci., Sports Eng.
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 Mechanical Engineering Education (ASME)

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

Associate Editor – European Journal of Mechanics B – Fluids (2017 – present)

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)
Schurr High School — Engineering Outreach (Nov. 2014)