STEVE ELGAR

Applied Ocean Physics & Engineering
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Education

Scripps Institution of Oceanography, Oceanography, M.S., Ph.D. 1981, 1985
University of Idaho, Mathematics & Civil Engineering, B.S., 1980

Positions

Senior Scientist, Woods Hole Oceanographic Institution, 1999-present
Assist., Assoc., Full Professor, Washington State University, 1986-1999
Visiting Assistant Professor, University of Idaho, 1985-1986

Professional Organizations

Ocean Sciences Editor, *EOS*, Transactions American Geophysical Union (1993-1997)
Associate Editor, *IEEE Transactions on Signal Processing* (1990-1993)
American Association for the Advancement of Science
American Geophysical Union (member of Ocean Science executive committee)
American Meteorological Society

Graduate Students

Thomas Berge MS 1988 *DSP Workstations*
Gloria Sebert MS 1989 *Statistics of bicoherence and biphase*
Vinod Chandran PhD 1990 *2-D Bispectral analysis*
Mary Ann Ferriole MS 1990 *Dissipation in the surf zone*
Zhenhua Liu PhD 1993 *Wave group statistics*
Barry Vanhoff PhD 1996 *Simulation of nonlinear ocean waves*
Edie Gallagher PhD 1996 (co-chair Guza) *Observations of sand bar evolution on a natural beach*
Anton Schoenbacher MS 1997 *Wave refraction/diffraction GUI*
Fernanda Hoefel PhD 2003 *Wave-induced sediment transport and morphological change*
Jim Thomson PhD (4th year student, advanced to candidacy) *Infragravity waves*

Postdoctoral Researchers

John Schneider (1990-1992)
Vinod Chandran (1990-1993)
Zhenhua Liu (1994)
Barry Vanhoff (1996-1997)
Tom Hsu (2003-2004)

Refereed Publications of Steve Elgar

1. Elgar, Steve, R.T. Guza, and R.J. Seymour, 1984 Groups of waves in shallow water, *J. Geophysical Research* **89**, 3623-3634.

2. Elgar, Steve, R.T. Guza, and R.J. Seymour, 1985 Wave group statistics from numerical simulations of a random sea, *Applied Ocean Research* **7**, 93-96.

3. Elgar, Steve, and R.T. Guza, 1985 Shoaling gravity waves: a comparison between data, linear finite depth theory and a nonlinear model, *J. Fluid Mechanics* **158**, 47-70.

4. Elgar, Steve, and R.T. Guza, 1985 Observations of bispectra of shoaling surface gravity waves, *J. Fluid Mechanics* **161**, 425-448.

5. Elgar, Steve, and R.T. Guza, 1986 Nonlinear model predictions of bispectra of shoaling surface gravity waves, *J. Fluid Mechanics* **167**, 1-18.

6. Elgar, Steve, 1987 Bias of estimates of effective degrees of freedom of a spectrum, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **113**, 77-82.

7. Elgar, Steve, 1987 Relationships involving third moments and bispectra of a harmonic process, *IEEE Acoustics, Speech, and Signal Processing* **35**, 1725-1726.

8. Elgar, Judi, and Steve Elgar, 1988 Kelvin Helmholtz instability in the atmosphere, *Eos* (**COVER**) **69**, 171.

9. Elgar, Steve, and R.T. Guza, 1988 Statistics of bicoherence, *IEEE Acoustics, Speech, and Signal Processing* **36**, 1667-1668.

10. Elgar, Steve, 1988 Comment on 'Fourier transform filtering: a cautionary note,' by A.M.G. Forbes, *J. Geophysical Research* **93**, 15755-15756.

11. Elgar, Steve, R.T. Guza, and M.H. Freilich, 1988 Eulerian measurements of horizontal accelerations in shoaling gravity waves, *J. Geophysical Research* **93**, 9261-9269.

12. Elgar, Steve, and G. Mayer-Kress, 1989 Observations of the fractal dimension of deep- and shallow-water ocean waves, *Physica* **D37**, 104-108.

13. Elgar, Steve, C.W. Van Atta, and M. Gharib, 1989 Bispectral analysis of ordered and chaotic vortex shedding from vibrating cylinders, *Physica* **D39**, 281-286.

14. Elgar, Steve, and Gloria Sebert, 1989 Statistics of bicoherence and biphase, *J. Geophysical Research* **94**, 10993-10998.

15. Elgar, Steve, C.W. Van Atta, and M. Gharib, 1990 Cross-bispectral analysis of the coupling between a vibrating cylinder and its wake in low Reynolds number flow, *J. Fluids and Structures* **4**, 59-71.

16. Mitchell, K., L. James, Steve Elgar, and M. Pitts, 1990 Characterizing cyclic water level fluctuations in irrigation canals, *ASCE J. Irrigation and Drainage* **116**, 261-272.

17. Elgar, Steve, M.H. Freilich, and R.T. Guza, 1990 Recurrence in truncated Boussinesq models for nonlinear waves in shallow water. *J. Geophysical Research* **95**, 11547-11556.

18. Pezeshki, C., Steve Elgar, and R.C. Krishna, 1990 Bispectral analysis of systems possessing chaotic motion, *J. Sound & Vibration* **137**, 357-368.

19. Freilich, M.H., R.T. Guza, and Steve Elgar, 1990 Observations of nonlinear effects in directional spectra of shoaling surface gravity waves, *J. Geophysical Research* **95**, 9645-9656.

20. Elgar, Steve, M.H. Freilich, and R.T. Guza, 1990 Model-data comparisons of moments of nonbreaking shoaling surface gravity waves, *J. Geophysical Research* **95**, 16055-16063.

21. Chandran, V. and Steve Elgar, 1990 Bispectral analysis of 2-D random processes, *IEEE Acoustics, Speech, and Signal Processing* **38**, 2181-2186.

22. Pezeshki, C., Steve Elgar, and R.C. Krishna, 1991 An examination of multi-frequency excitation of the buckled beam, *J. Sound & Vibration* **148**, 1-9.

23. Pezeshki, C., W. H. Miles, and Steve Elgar, 1991 Signal Processing for nonlinear structural dynamical systems, *ASME Applied Mechanics Reviews* **44**, S214-S218.

24. Chandran, V. and Steve Elgar, 1991 Mean and variance of estimates of the bispectrum of a harmonic random process: an analysis including effects of spectral leakage, *IEEE Signal Processing* **39**, 2640-2651.

25. Hagelberg, Teresa, Nick Pisias, and Steve Elgar, 1991 Linear and nonlinear coupling between orbital forcing and the marine δ^{18}O record during the late Neogene, *Paleoceanography* **6**, 729-746.

26. Elgar, Steve, R. T. Guza, M. H. Freilich, and M. Briggs, 1992 Laboratory simulations of directionally spread shoaling waves, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **118**, 87-103.

27. Wallerstein, G. and Steve Elgar, 1992 Shockwaves in stellar atmospheres and breaking waves on an ocean beach, *Science* **256**, 1531-1536.

28. Elgar, Steve, R.T. Guza, and M.H. Freilich, 1992 Dispersion, nonlinearity, and viscosity in shallow-water waves: Model results and laboratory comparisons, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **119**, 351-366.

29. Pezeshki, C., Steve Elgar, R.C. Krishna, and T.D. Burton, 1992 Auto- and cross-bispectral analysis of a system of two coupled oscillators with quadratic nonlinearities possessing chaotic motion. *J. Applied Mechanics* **59**, 657-663.

30. Miles, W.H., C. Pezeshki, and Steve Elgar, 1992 Bispectral analysis of a fluid elastic system; the cantilevered pipe, *J. of Fluids and Structures* **6**, 633-640.

31. Elgar, Steve, T. H. C. Herbers, M. Okihiro, J. Oltman-Shay, and R.T. Guza, 1992 Observations of infragravity waves, *J. Geophysical Research* **97**, 15573-15577.

32. Chandran, V., and Steve Elgar, 1993 Pattern recognition using invariants defined from higher-order spectra: one-dimensional inputs, *IEEE Acoustics, Speech, and Signal Processing* **41**, 205-212.

33. Liu, Z., Steve Elgar, and R.T. Guza, 1993 Groups of ocean waves: comparisons between linear theory, approximations to linear theory, and observations, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **119**, 144-159.

34. Elgar, Steve and M.P. Kennedy, 1993 Bispectral analysis of Chua's circuit, *J. Circuits, Systems, and Computers* **3**, 33-48. (Reprinted in *Chua's Circuit: A Paradigm for Chaos*, Ed R. Madan, Series on Nonlinear Science, Series B, Vol 1, 892-907, World Scientific, Singapore, 1993.)

35. Chandran, V., Steve Elgar, and C. Pezeshki, 1993 Bispectral and trispectral characterization of transition to chaos in the Duffing oscillator, *International J. Bifurcation and Chaos* **3**, 551-557.

36. Elgar, Steve and Vinod Chandran, 1993 Higher-order spectral analysis to detect nonlinear interactions in measured time series and an application to Chua's circuit, *International J. Bifurcation and Chaos* **3**, 19-34.

37. Elgar, Steve, R.T. Guza, and M.H. Freilich, 1993 Observations of nonlinear interactions in directionally spread shoaling surface gravity waves, *J. Geophysical Research* **98**, 20299-20305.

38. Elgar, Steve and Vinod Chandran, 1993 Higher-order spectral analysis of Chua's circuit, *IEEE Transactions on Circuits and Systems* **40**, 689-692.

39. Elgar, Steve, and James Kadtke, 1993 Paleoclimatic attractors: New data, further analysis, *International J. Bifurcation and Chaos* **3**, 1587-1590.

40. Chandran, V. and Steve Elgar, 1994 A general procedure for the derivation of principal domains of higher-order spectra, *IEEE Signal Processing* **42**, 229-233.

41. Chandran, V., Steve Elgar, and B. Vanhoff, 1994 Statistics of tricoherence, *IEEE Signal Processing* **42**, 3430-3440.

42. Herbers, T.H.C., Steve Elgar, and R.T. Guza, 1994 Infragravity-frequency (0.005-0.05 Hz) motions on the shelf, Part I: Local nonlinear forcing by surface waves, *J. Physical Oceanography* **24**, 917-927.

43. Elgar, Steve, T.H.C. Herbers, and R.T. Guza, 1994 Reflection of ocean surface gravity waves from a natural beach, *J. Physical Oceanography* **24**, 1503-1511.

44. Herbers, T.H.C., Steve Elgar, R.T. Guza, and W.C. O'Reilly, 1995 Infragravity-frequency (0.005-0.05 Hz) motions on the shelf, Part II: Free waves, *J. Physical Oceanography* **25**, 1063-1079.

45. Elgar, Steve, T.H.C. Herbers, V. Chandran, and R.T. Guza, 1995 Higher-order spectral analysis of nonlinear ocean surface gravity waves, *J. Geophysical Research* **100**, 4977-4983.

46. Raubenheimer, B., R.T. Guza, Steve Elgar, and N. Kobayashi, 1995 Swash on a gently sloping beach, *J. Geophysical Research* **100**, 8751-8760.

47. Herbers, T.H.C., Steve Elgar, and R.T. Guza, 1995 Generation and propagation of infragravity waves, *J. Geophysical Research* **100**, 24,863-24,872.

48. Gallagher, Edith, W. Boyd, Steve Elgar, R.T. Guza, B.T. Woodward, 1996 Performance of a sonar altimeter in the nearshore, *Marine Geology* **133**, 241-248.

49. Raubenheimer, B., R.T. Guza, and Steve Elgar, 1996 Wave transformation in the inner surf zone, *J. Geophysical Research* **101**, 25,589-25,597.

50. Chandran, V., B. Carswell, B. Boashash, and Steve Elgar, 1997 Pattern recognition using invariants defined from higher-order spectra -- two-dimensional inputs, *IEEE Transactions on Image Processing* **6**, 703-712.

51. Vanhoff, B. and Steve Elgar, 1997 Simulating quadratically nonlinear random processes, *International J. Bifurcation and Chaos* **7**, 1367-1374.

52. Vanhoff, B., Steve Elgar, and R.T. Guza, 1997 Numerically simulating nonGaussian sea surfaces, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **123**, 68-72.

53. Elgar, Steve, R.T. Guza, B. Raubenheimer, T.H.C. Herbers, and Edith Gallagher, 1997 Spectral evolution of shoaling and breaking waves on a barred beach, *J. Geophysical Research* **102**, 15,797-15,805.

54. Chen, Yongze, R.T. Guza, and Steve Elgar, 1997 Modeling spectra of breaking surface waves in shallow water, *J. Geophysical Research* **102**, 25,035-25,046.

55. Gallagher, Edith, Steve Elgar, and R.T. Guza, 1998 Observations of sand bar evolution on a natural beach, *J. Geophysical Research* **103**, 3203-3215.

56. Raubenheimer, B., Steve Elgar, and R.T. Guza, 1998 Estimating wave heights from pressure measured in a sand bed, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **124**, 151-154.

57. Feddersen, Falk, R.T. Guza, Steve Elgar, and T.H.C. Herbers, 1998 Alongshore momentum balances in the nearshore, *J. Geophysical Research* **103**, 15,667-15,676.

58. Norheim, C., T.H.C. Herbers, and Steve Elgar, 1998 Nonlinear evolution of surface wave spectra on a beach, *J. Physical Oceanography* **28**, 1534-1551.

59. Gallagher, Edith, Steve Elgar, and E.B. Thornton, 1998 Megaripple migration in a natural surfzone, *Nature* **394**, 165-168.

60. Elgar, Steve, B. Vanhoff, L. Aguirre, U. Freitas, and V. Chandran, 1998 Higher-order spectra of nonlinear polynomial models for Chua's circuit, *International J. Bifurcation and Chaos* **8**, 2425-2431.

61. Herbers, T.H.C., Steve Elgar, and R.T. Guza, 1999 Directional spreading of waves in the nearshore, *J. Geophysical Research* **104**, 7683-7693.

62. Lentz, Steve, R.T. Guza, Steve Elgar, Falk Feddersen, and T.H.C. Herbers, 1999 Momentum balances on the North Carolina inner shelf, *J. Geophysical Research*, **104**, 18,205-18,226.

63. Raubenheimer, B., R.T. Guza, and Steve Elgar, 1999 Tidal watertable fluctuations in a sandy ocean beach, *Water Resources Research* **35**, 2313-2320.

64. Herbers, T.H.C., N.R. Russnogle, and Steve Elgar, 2000 Spectral energy balance of breaking waves within the surf zone, *J. Physical Oceanography* **30**, 2723-2737.

65. Feddersen, Falk, R.T. Guza, Steve Elgar, and T.H.C. Herbers, 2000 Velocity moments in alongshore bottom stress parameterizations, *J. Geophysical Research* **105**, 8673-8686.

66. Elgar, Steve, R.T. Guza, W.C. O'Reilly, B. Raubenheimer, and T.H.C. Herbers, 2001 Wave energy and direction observed near a pier, *ASCE J. Waterway, Port, Coastal, and Ocean Engineering* **127**, 2-6.

67. Elgar, Steve, Edith Gallagher, and R.T. Guza, 2001 Nearshore sand bar migration, *J. Geophysical Research* **106**, 11,623-11,627.

68. Elgar, Steve, 2001 Coastal profile evolution at Duck, North Carolina: A cautionary note, *J. Geophysical Research* **106**, 4625-4627.

69. Raubenheimer, B., R.T. Guza, and Steve Elgar, 2001 Field observations of wave-driven setdown and setup, *J. Geophysical Research* **106**, 4629-4638.

70. Elgar, Steve, B. Raubenheimer, and R.T. Guza, 2001 Current meter performance in the surfzone, *J. Atmospheric & Oceanic Technology* **18**, 1735-1746.

71. Trowbridge, J. and Steve Elgar, 2001 Turbulence measurements in the surfzone, *J. Physical Oceanography* **31**, 2403-2417.

72. Ruessink, G., J. Miles, F. Feddersen, R.T. Guza, and Steve Elgar, 2001 Modeling the alongshore current on barred beaches, *J. Geophysical Research* **106**, 22,451-22,463.

73. Herbers, T.H.C, Steve Elgar, N.A. Sarap, and R.T. Guza, 2002 Nonlinear dispersion of surface gravity waves in shallow water, *J. Physical Oceanography* **32**, 1181-1193.

74. Noyes, T. James, R.T. Guza, Steve Elgar, and T.H.C. Herbers, 2002 Comparison of methods for estimating nearshore shear wave variance, *J. Atmospheric & Oceanic Technology* **19**, 136-143.

75. Chandran, V., Steve Elgar, and A. Nguyen, 2002 Detection of mines in acoustic images using higher-order spectral features, *IEEE J. Oceanic Engineering* **27**, 610-618.

76. Sheremet, A., R.T. Guza, Steve Elgar, and T.H.C. Herbers, 2002 Observations of nearshore infragravity waves: Part 1: Seaward and shoreward propagating components, *J. Geophysical Research* **107**, 3095, doi:10.1029/2001JC000970.

77. Schmidt, W.E., B.T. Woodward, K.S. Millikan, R.T. Guza, B. Raubenheimer, and Steve Elgar, 2003 A GPS-tracked surfzone drifter, *J. Atmospheric and Oceanic Technology* **20**, 1069-1075.

78. Trowbridge, J. and Steve Elgar, 2003 Spatial scales of stress-carrying nearshore turbulence, *J. Physical Oceanography* **33**, 1122-1128.

79. Herbers, T.H.C., Mark Orzech, Steve Elgar, and R.T. Guza, 2003 Shoaling transformation of wave frequency-directional spectra, *J. Geophysical Research* **108**, 3013, doi:10.1029/2001JC001304.

80. Feddersen, F., E.L. Gallagher, R.T. Guza, and Steve Elgar, 2003 The drag coefficient, bottom roughness, and wave breaking in the nearshore, *Coastal Engineering* **48**, 189-195.

81. Lentz, S., Steve Elgar, and R.T. Guza, 2003 Observations of the flow field near the nose of a buoyant coastal current, *J. Physical Oceanography* **33**, 933-943.

82. Coco, Giovanni, T.K. Burnett, B.T. Werner, and Steve Elgar, 2003 Test of self-organization in beach cusp formation, *J. Geophysical Research* **108**, 3101, doi:10.1029/2002JC001496.

83. Elgar, Steve, B. Raubenheimer, T.H.C. Herbers, 2003 Bragg reflection of ocean waves from sandbars, *Geophysical Research Letters* **30**, 1016, doi:10.1029/2002GL016351.

84. Hoefel, Fernanda and Steve Elgar, 2003 Wave-induced sediment transport and sandbar migration, *Science* **299**, 1885-1887.

85. Noyes, T. James, R.T. Guza, Steve Elgar, and T.H.C. Herbers, 2004 Field observations of shear waves in the surf zone, *J. Geophysical Research* **109,** doi:10.1029/2002JC001761.

86. Raubenheimer, B., Steve Elgar, and R.T. Guza, 2004 Observations of swashzone velocities: a note on friction coefficients, *J. Geophysical Research* **109**, 1027, doi:10.1029/2003JC001877.

87. Feddersen, F., R.T. Guza, and Steve Elgar, 2004 Inverse modeling of the one-dimensional setup and alongshore current in the nearshore, *J. Physical Oceanography* **34**, 920-933.

88. Coco, Giovanni, Tom K. Burnett, B.T. Werner, and Steve Elgar, 2004 The role of tides in beach cusp development, *J. Geophysical Research* **109,** 4011, doi:10.1029/2003JC002154.

89. Ciriano, Yolanda, Giovanni Coco, K.R. Bryan, and Steve Elgar, 2005 Field observations of swash zone infragravity motions and beach cusp formation, *J. Geophysical Research* **110**, 2018, doi:10.1029/2004JC002485.

90. Gallagher, Edith, Steve Elgar, R.T. Guza, and E.B. Thornton, 2005 Estimating nearshore bedform amplitudes with altimeters, *Marine Geology* **16**, 51-57, doi:10.1016/j.margeo.2005.01.005.

91. Seymour, Richard, R.T. Guza, William O'Reilly, and Steve Elgar, 2005 Rapid erosion of a small Southern California beach fill, *Coastal Engineering* **52**, 151-158, doi:10.1016/j.coastaleng.2004.10.003.

92. Noyes, T. James, R.T. Guza, F. Feddersen, Steve Elgar, and T.H.C. Herbers, 2005 Model-data comparisons of shear waves in the nearshore, *J. Geophysical Research* **110**, C05019, doi:10.1029/2004JC002541.

93. Elgar, Steve, B. Raubenheimer, and R.T. Guza, 2005 (**COVER**) Quality control of acoustic Doppler velocimeter data in the surfzone, *Measurement Science and Technology* **16**, 1889-1893.

94. Thomson, Jim, Steve Elgar, and T.H.C. Herbers, 2005 Reflection and tunneling of ocean waves observed at a submarine canyon, *Geophysical Research Letters* **32**, L10602, doi:10.1029/2005GL022834.

95. Henderson, Stephen, R.T. Guza, Steve Elgar, and T.H.C. Herbers, 2006 Refraction of surface gravity waves by shear waves, *J. of Physical Oceanography*, **36**, 629-635.

96. Farquharson, G., S.J. Frasier, B. Raubenheimer, and Steve Elgar, 2005 Microwave radar cross sections and Doppler velocities measured in the surf zone, *J. Geophysical Research*, **110**, doi:1029/2005JC003022.

97. Hsu, T.-J., Steve Elgar, and R.T. Guza, A wave resolving approach to modeling onshore sandbar migration, *Coastal Engineering*, **in press**.

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99. Henderson, Stephen, R.T. Guza, Steve Elgar, T.H.C. Herbers, and A.J. Bowen, Nonlinear generation and loss of infragravity wave energy, *J. Geophysical Research, sub judice*.

100. Apotsos, Alex, Britt Raubenheimer, Steve Elgar, R.T. Guza, and Jerry Smith, The effects of wave rollers and bottom stress on setup, *J. Geophysical Research, sub judice*.

(26 April 2006)

Conference Abstracts

Elgar, S., and R. T. Guza, Bispectra of shoaling surface gravity waves, *Eos Trans. AGU* **65**, 954, 1984.

Elgar, S., and R. T. Guza, Model predictions of shoaling surface wave bispectra, *Eos Trans. AGU* **66**, 922, 1985.

Elgar, S., and R. T. Guza, Effect of beach slope on shoaling waves, *Eos Trans. AGU* **67**, 1025, 1986.

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Freilich, M. H., S. Elgar, and R. T. Guza, Directional evolution of shoaling waves: field observations, *Eos Trans. AGU* **68**, 1309, 1987.

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Elgar, S., J. Oltman-Shay, and P. Howd, Observations of infragravity-frequency long waves, Part 1. Coupling to wind waves, *Eos Trans. AGU* **70**, 1989.

Oltman-Shay, J., Elgar, S., and P. Howd, Observations of Infragravity-frequency long waves, Part 1. Comparisons with a 2-D wave-group generation model, *Eos Trans. AGU* **70**, 1989.

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Gallagher, E. L., S. Elgar, and R. T. Guza, Field test of a new sonic altimeter, *Eos Trans. AGU* **74**, 348, 1993.

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Burnet, T., E. Gallagher, M. Okihiro, B. Raubenheimer, R. Whitsel, B. Vanhoff, S. Elgar, and B.T. Werner, Field observations of beach cusp formation, *Eos Trans. AGU* **75**, 336, 1994.

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Feddersen, F., R. T. Guza, S. Elgar, and T. H. C. Herbers, Observations of longshore current in Duck94/CooP, *Eos Trans. AGU* **76**, 282, 1995.

Elgar, S., R. T. Guza, B. Raubenheimer, T. H. C. Herbers, and E. Gallagher, Observations of wave evolution during Duck94, *Eos Trans. AGU* **76**, 282, 1995.

Raubenheimer, B., R. T. Guza, and S. Elgar, Wave transformation in the surf zone, *Eos Trans. AGU* **76**, 282, 1995.

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Norheim, C., T.H.C. Herbers, and S. Elgar, A stochastic model for shoaling waves, *Eos Trans. AGU* **77**, 400, 1996.

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Wallerstein, G., S. Elgar, D. Powell, and R. Osterhuber, Statistical analysis of snowfall at Donner Pass, California, Eos *Trans. AGU* **79**, 149, 1998.

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Feddersen, F., R.T. Guza, and Steve Elgar, Observations of nearshore circulation, *Eos Trans. AGU* **81**, 667, 2000.

Lentz, S., Steve Elgar, R.T. Guza, Observations of the flow field at the nose of a buoyant coastal current, *Eos Trans. AGU* **82**, 2001.

Guza, R.T. and Steve Elgar, Review of surfzone observations of alongshore currents, *Eos Trans. AGU* **82**, 2001.

Lippmann, T., J. Shore, Steve Elgar, and R.T. Guza, Video-based observations of surface currents in the surf zone, *Eos Trans. AGU* **82**, 2001.

Raubenheimer, B, Steve Elgar, and R.T. Guza, Swashzone fluid velocities, *Eos Trans. AGU* **82**, 2001.

Guza, R.T., T. Noyes, Steve Elgar, and T.H. Herbers, Field 0bservations of shear saves, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS51D-10, INVITED, 2002.

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Maddux, T.B., B. Raubenheimer, S. Elgar, Predictions of Cross-Shore Sediment Transport in the Inner Surf and Swash Zones, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS52E-03, 2002.

Hoefel, F. and Steve Elgar, Wave Acceleration Induced Sediment Transport in the Surf Zone, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS52E-04, 2002. (Best student paper award.)

Elgar, Steve, The Nearshore Canyon Experiment, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS62E-01, INVITED, 2002.

Kirby, J.T., Q. Chen, T.J. Noyes, Steve Elgar, and R.T. Guza, Evaluation of Boussinesq model predictions of nearshore hydrodynamics, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS62E-05, INVITED, 2002.

Sheremet, A., R.T. Guza, Steve Elgar, and T.H. Herbers, Directional properties of infragravity waves, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS62E-12, 2002.

Sheremet, A., R.T. Guza, Steve Elgar, and T.H. Herbers, Directional energy fluxes of surfzone infragravity waves, *Eos Trans. AGU* **84**, Ocean Sci. Meet. Suppl., Abstract OS12E-03, 2004.

Hsu, T. and Steve Elgar, A simple physical-based approach for nearshore sandbar migration, *Eos Trans. AGU* **84**, Ocean Sci. Meet. Suppl., Abstract OS31G-10, 2004.

Noyes, J., R.T. Guza, Steve Elgar, F. Feddersen, and T.H.C. Herbers, Field observations of shear waves, *Eos Trans. AGU* **84**, Ocean Sci. Meet. Suppl., Abstract OS12E-01, INVITED, 2004.

Henderson, S., R.T. Guza, T.H. Herbers, and S. Elgar, Refraction of surface gravity waves by shear waves, *Eos Trans. AGU* **85**, Fall Meet. Suppl., Abstract OS11A-0477, 2004.

Sheremet, A., R.T. Guza, T.H. Herbers, and S. Elgar, Energy flux balance of surfzone infragravity waves, *Eos Trans. AGU* **85**, Fall Meet. Suppl., Abstract OS11A-0492, 2004.

Lentz, S., T.H. Herbers, W. O'Reilly, P. Jessen, M. Kirk, S. Elgar, R. Guza, Observations of shoaling internal tidal waves during NCEX, *Eos Trans. AGU* **85**, Fall Meet. Suppl., Abstract OS13C-03, 2004.

Thomson, J., S. Elgar, T.H. Herbers, Observations of Wave Reflection from a Submarine Canyon, *Eos Trans. AGU* **85**, Fall Meet. Suppl., Abstract OS14B-01, 2004.

Peak, S., T. Herbers, P. Jessen, W. O'Reilly, M. Kirk, S. Elgar, Wave propagation over a submarine canyon: Field observations, *Eos Trans. AGU* **85**, Fall Meet. Suppl., Abstract OS14B-02, 2004.

Proceedings and Other Publications

Hager, Wayne, Steve Elgar, and Ping T. Sun, 1979 An Analysis of the National Mechanics Readiness Test Based on Pre- and Post-Test Scores, *American Society for Engineering Education Annual Conference*, Baton Rouge, Louisiana, #1277.

Elgar, Steve, R.T. Guza, and R.J. Seymour, 1984 Prediction of wave group statistics, *Proceedings of the 19th International Conference on Coastal Engineering*, Houston, Texas, ASCE.

Elgar, Steve and R.J. Seymour, 1985 Effects of lack of stationarity on deep water statistics, *Oceans '85*, San Diego, California.

Elgar, Steve, 1987 Bispectra of shoaling waves, *Proceedings of the Symposium of Nonlinear Interactions in Fluids, ASME*, Boston, MA.

Elgar, Steve, 1989 Bispectra of shoaling surface gravity waves, *Proceedings of the Workshop on Higher Order Spectral Analysis*, Vail, Colorado, June 1989, 206-211.

Holman, R.A., A. J. Bowen, R.A. Dalrymple, R. Dean, S. Elgar, R. Flick, M. Freilich, R. T. Guza, D. Hanes, J. Kirby, O. Madsen, R. Sternberg, and I. Svendsen, *1989 Report for the Nearshore Processes Workshop*, St. Petersburg, FL., Report OSU-CO-90-6, Oregon State University.

Elgar, Steve, M. H. Freilich, R.T. Guza, 1990 Model predictions of non breaking shoaling waves, *Proceedings of the 22nd International Conference on Coastal Engineering*, Delft, Netherlands, ASCE.

Chandran, Vinod and Steve Elgar, 1991 Shape discrimination using invariants defined from higher order spectra, *Proc. of IEEE Int'l. Conf. on ASSP (ICASSP'91)*, vol. 5, 3105-3109.

Elgar, Steve, 1990 Bispectral analysis of systems possessing chaotic motion, In *Nonlinear Dynamics of Ocean Waves*, Ed. Brandt, Ramberg, Shlesinger, World Scientific, Singapore, pp. 111-127, 1992.

Chandran, Vinod and Steve Elgar, 1992 Position, rotation, and scale invariant recognition of images using higher-order spectra, *Proc. of IEEE Int'l. Conf. on ASSP (ICASSP'92)*, vol. 5, 217-220.

Herbers, T.H.C., Steve Elgar, R.T. Guza, and W. O'Reilly, 1992 Infragravity-frequency (0.005-0.05 Hz) motions on the shelf, *Proceedings of the 23rd International Conference on Coastal Engineering*, Venice, Italy, ASCE.

Herbers, T. H. C., S. Elgar, and R. T. Guza, 1994 Longterm array observations of surface waves, *Coastal Dynamics '94*, Barcelona, 249-251.

Feddersen, F., R. T. Guza, S. Elgar, and T. H. C. Herbers, 1995 Observations of nearshore currents in Duck 94, *Coastal Dynamics '95*, 973-982. Gdansk, 38-39.

Gallagher, E., S. Elgar, and R. T. Guza, 1995 Observations of bathymetric evolution during Duck94, *Coastal Dynamics '95*, Gdansk, 46-50.

Herbers, T. H. C., M. C. Burton, S. Elgar, and R. T. Guza, 1995 Directional spreading effects on shoaling waves, *Coastal Dynamics '95*, Gdansk, 62-63.

Thornton, E., C. Soares, A. Faria, T. Lippmann, T. Stanton, R. Guza, and S. Elgar, 1995 Vertical structure of mean current profiles over a barred beach, *Coastal Dynamics '95*, Gdansk, 215-220.

Gallagher, E. L., S. Elgar, and R. T. Guza, 1996 Observations and predictions of sand bar motion, *25th Intl. Conf. on Coastal Engineering*, *Amer. Soc. Civil Eng.*, Orlando, 78-79.

Feddersen, F., R. T. Guza, S. Elgar, and T.H.C. Herbers, 1996 Cross-shore structure of longshore currents during Duck94, 25th *Intl. Conf. on Coastal Engineering, Amer. Soc. Civil Eng.*, Orlando, 418-419.

Chandran, B. Carswell, B. Boashash, and Steve Elgar, 1996 On the behaviour of trispectral features for object recognition in the presence of various types of noise, *Proc. of ISSPA'96*, Gold Coast, Australia, Aug. 26-29, 1996.

Elgar, Steve, T.H.C. Herbers, and R.T. Guza, 1997 Nearshore Observations of nonlinear ocean surface gravity waves, *Naval Research Reviews* **48**, 41-52 (INVITED).

Chandran, Vinod, M. Gollogly, and S. Elgar, 1997 Digit recognition using trispectral features, *Proc. of IEEE Int'l. Conf. on ASSP (ICASSP'97)*.

Feddersen, F., R.T. Guza, and S. Elgar, 1997 Investigating nearshore circulation using inverse methods, *Proc. of Coastal Dynamics '97*, Plymouth, ASCE.

Raubenheimer, B., R.T. Guza, and S. Elgar, 1998 Observations and predictions of water table fluctuations in a natural beach, *26th Intl. Conf. on Coastal Engineering, Amer. Soc. Civil Eng.*, Copenhagen, 3588-3600.

Raubenheimer, B., and Steve Elgar, 2000 Field Research Facility, Duck, NC, *Oceanus* **42**, 24-27.

Invited Presentations and Papers

Elgar, Steve, 1987 Bispectra of shoaling waves, *Proceedings of the Symposium of Nonlinear Interactions in Fluids, ASME*, Boston, MA.

Elgar, Steve, Bispectral analysis of systems possessing chaotic motion, Nonlinear Waves Symposium, ONR, Baltimore, 1991.

Elgar, Steve and Vinod Chandran, 1993 Higher-order spectral analysis of Chua's circuit, *IEEE Transactions on Circuits and Systems* **40**, 689-692.

Elgar, Steve and Vinod Chandran, 1993 Higher-order spectral analysis to detect nonlinear interactions in measured time series and an application to Chua's circuit, *International J. Bifurcation and Chaos* **3**, 19-34.

Elgar, Steve, Observations of nonlinear interactions in nonlinear ocean waves, Nonlinear Waves Symposium, ONR, Phoenix, 1994.

Elgar, Steve, T.H.C. Herbers, and R.T. Guza, 1997 Nearshore observations of nonlinear ocean surface gravity waves, *Naval Research Reviews* **48**, 41-52.

Elgar, Steve, 2000 Challenges in Wave Research, USGS Workshop on Community Sediment Transport Models, Woods Hole, MA. (INVITED)

Elgar, Steve, 2001 Waves Across the Continental Shelf to the Beach, Gordon Conference on Coastal Circulation, June, New Hampshire (INVITED).

Elgar, Steve, 2001 Mine Burial in the Surfzone, Keynote talk at Surfzone Mine Burial Workshop, sponsored by ONR and the Marines, Washington, DC.

Guza, R.T., T. Noyes, Steve Elgar, and T.H. Herbers, 2002 Field Observations of Shear Waves, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS51D-10 (INVITED).

Elgar, Steve, B. Raubenheimer, T.H. Herbers, 2002 Bragg Reflection of Ocean Waves from Sandbars, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS51D-11 (INVITED).

Elgar, Steve, 2002 The Nearshore Canyon Experiment, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS62E-01 (INVITED).

Kirby, J.T., Q. Chen, T.J. Noyes, Steve Elgar, and R.T. Guza, 2002 Evaluation of Boussinesq Model Predictions of Nearshore Hydrodynamics, *Eos Trans. AGU* **83**, Fall Meet. Suppl., Abstract OS62E-05 (INVITED).

Recent Professional Society Activities

- Ocean Science Editor, *EOS*, Transactions of the American Geophysical Union (1993-1997)
- Associate Editor, *IEEE Transactions on Signal Processing* (1990-1993)
- Member, Statistical Signal and Array Processing Committee (IEEE national, 1990-1995)
- Member, DUCK94 Logistics Committee (international field experiment)
- Member, SandyDuck Planning Committee (international field experiment)
- Chair, Nearshore Field Experiments, The Next 10 Years
- Member, Task Force on Future Directions of the *J. Geophysical Research*, Oceans
- Member, International Steering Committee for Large Scale Wave Experiments Conference
- Organizer, St. Petersburg meeting on Duck94
- Chair, *ICASSP '94* review of multiscale/chaos/time-frequency section submissions
- Member, *ICASSP '95* review of multiscale/chaos/time-frequency section submissions
- Member, *ICASSP '96* review of multiscale/chaos/time-frequency section submissions
- Member, NCEX logistics team
- Member, Nearshore Advisory Group

Journal referee for:

- *ASCE J. Waterways, Port, Coastal, Ocean Engr.*
- *Coastal Engineering*
- *Continental Shelf Research*
- *Experiments in Fluids*
- *Fluids and Structures*
- *International J. Bifurcation and Chaos*
- *IEEE Transactions on Biomedical Engineering*
- *IEEE Transactions on Circuits and Systems*
- *IEEE Transactions on Remote Sensing*
- *IEEE Transactions on Signal Processing*
- *IEEE Transactions on Systems and Computing*
- *J. Atms. and Ocean. Tech. (JTECH)*
- *J. Fluid Mechanics*
- *J. Coastal Research*
- *J. Geophysical Research*
- *J. Physical Oceanography*
- *Marine Geology*
- *Progress in Physical Oceanography*

Recent Service to Governmental Agencies

- Chair, Bedform working group, ONG Marine G&G Mine Burial program (2000)
- Chair, External Review committee for NRL Marine Geology and Geophysics (1999)
- Chair, Ad Hoc committee for nearshore field experiments (1998-present)
- Referee for National Science Foundation (1985-present)
- Member, NSF Physical Oceanography Review Panel (1992)
- Referee for Sea Grant (National, New York, Maryland, Maine, Hawaii) (1989-present)

- Reviewer for National Research Council (1990-present)
- Chair, Surfzone, ONR-NRC Mine Symposium (reports to National Academy) (1992)
- Reviewer for Soros Foundation (1992-1995)
- Reviewer for Coop. Grants Program U.S. Civilian Res. Develop. Foundation (CRDF)
- Chair, Waves and Surf, ONR-NRC War Symposium (reports to National Academy) (1997)
- Reviewer for National Ocean Partnership Program (ONR) (1998)
- Reviewer for Office of Naval Research (1990-present)

Field Experiments and Ocean Cruises

CERC (Coastal Engineering Research Center) laboratory (BIG tank) study of shoaling of directionally-spread waves, Oct 1988, Vicksburg, MI (chief scientist).

CERC (Coastal Engineering Research Center) laboratory (BIG tank) study of shoaling of directionally-spread waves, Mar 1989, Vicksburg, MI (chief scientist).

CERC (Coastal Engineering Research Center) laboratory (long flume) study of long-distance propagation of waves in shallow water, Mar 1989, Vicksburg, MI (co-chief scientist).

SAMSON (Sources of Acoustic MicroSesimic Ocean Noise) nearshore and inner shelf field experiment, Aug-Nov 1990, Duck, NC (CO-PI, but junior).

SWADE (Surface Waves Dynamics Experiment) mid-Atlantic Bight field experiment, Aug-Nov 1990, Duck, NC (CO-PI, but minor).

DELILAH (I refuse to write down the expansion of the acronym) surfzone field experiment, Oct 1990, Duck, NC (participating scientist).

SAMSON recovery, June 1991, Duck, NC (chief scientist, but this was a cleanup operation, so not much glory, mostly grease, slime, and hard work).

Waves in the Southern California Bight, Aug 1991, cruise on the R/V Gordon Sproul in the Santa Barbara Channel (member of scientific party).

Waves in the Southern California Bight, Nov 1991, cruise on the R/V Gordon Sproul in the Santa Barbara Channel (member of scientific party).

Waves in the Southern California Bight, Feb 1992, cruise on the R/V Gordon Sproul in the Santa Barbara Channel (member of scientific party).

Currents in the Gulf of Mexico, July 1992, cruise on the H02 Dragaminas (Mexican mine sweeper) near Veracruz in the Gulf of Mexico (member of scientific party).

SonicPilot I, nearshore field experiment, Aug 1992, Scripps Pier (chief scientist).

SonicPilot II, surfzone field experiment, June 1993, Scripps Pier (chief scientist).

Duck94 surfzone, nearshore, and inner shelf field experiment, Jun-Dec 1994, Duck, NC (co-chief scientist).

DozerDuck beach morphology manipulation experiment, Jun and Sep 1994, Duck, NC (co-chief scientist).

Mine scour and burial, swash and surfzone field experiment, Sep 1994, Duck, NC (co-chief scientist).

Dreamcruise, Dec 1994, cruise on the R/V Cape Hatteras on the continental shelf near North Carolina (member of scientific party).

Waves in the Santa Barbara Channel, Oct 1995, cruise on the R/V Point Sur from Monterey, CA to the Santa Barbara Channel (member of scientific party).

Duck94 recovery, Jul-Aug 1995, Duck, NC (chief scientist, and although this was another cleanup operation, it was the hardest in-water work any of us have done).

PIER1, nearshore field experiment, Jan-Apr 1996, Scripps Pier (co-chief scientist).

PIER2, nearshore field experiment, Jul 1996, Scripps Pier (co-chief scientist).

Torrey Pines Beach nearshore field experiment, Sep-Nov 1996, Torrey Pines Beach, San Diego, CA (co-chief scientist for offshore measurements).

PIER4, surfzone field experiment, Scripps Pier, Jan-Feb 1997 (co-chief scientist).

SandyDuck nearshore field experiment, Jun-Dec 1997, Duck, NC (co-chief scientist).

SandyDuck recovery, June 1998, Duck, NC (chief scientist, and although this was another cleanup operation, it was big (12 people, 3 weeks, lots of work)).

HYDRA instrument tests, Aug 1998, Scripps Pier (chief scientist)

XTREE surfzone velocities, Nov 1998, Scripps Pier (co-chief scientist)

TRURO morphology mapping, July 2000, Truro, Cape Cod Bay (chief scientist)

NCEX pilot model verification tests, Sep-Oct 2000, Scripps Submarine Canyon, southern California coast (chief scientist, collaborating with W. O'Reilly (SIO)).

SWASHX swash waves and currents, Sep-Oct 2000, Scripps beach (co-chief scientist)

BSRIP bottom stress/megaripple observations, Fall 2000 - Spring 2001, near Scripps pier (chief scientist, collaborating with B. Raubenheimer and J. Trowbridge).

TRURO waves & morphology, Summer-Fall 2001, Truro, Cape Cod Bay (chief scientist)

Pile-o-Sand Apr 2001-summer 2003, monitoring a large beach nourishment project in southern California (collaborating with Guza, O'Reilly, Seymour (SIO)).

TRURO waves, currents, morphology, Summer 2002, Truro, Cape Cod Bay (chief scientist)

NCEXP, fall 2002, second pilot test for the Nearshore Canyon Experiment, southern California coast, fall 2002 (chief scientist, collaborating with Guza, Herbers, O'Reilly, Raubenheimer, Lentz).

NCEX, Nearshore Canyon Experiment, 2003 (chief scientist).

HOLE-ex, evolution of a crater in the beach, fall 2005, Duck, NC (co-chief scientist, w/Raubenheimer).

External Funding of Research for Steve Elgar

Agency	Title	Amount	Period
ONR	Statistics, Interpretation and Simulation of Bispectra	$180,000	9/15/86-9/30/89
NSF	Shoaling Region Wave Models	$250,000	1/15/87-6/30/90
NSF	Research Experience for Undergraduates	$13,000	5/1/87-4/30/88
NSF	Graduate Student Support	$36,000	5/1/88-6/30/90
NSF	Research Experience for Undergraduates	$6,000	5/1/88-4/30/89
SDSC	Integration of Surf Zone Models	70 CPU Hours	7/1/86-6/30/87
NSF	Shoaling Region Models	275 CPU Hours	4/1/87-3/31/88
SDSC-NSF	Surf Zone Models	100 CPU Hours	4/1/88-3/31/89
NSF	Research Experience for Undergraduates	$6,500	5/1/89-4/30/90
SDSC-NSF	Nonlinear Wave Models	96 CPU Hours	4/1/89-3/31/90
ONR	Groups of Waves in Shallow Water	$164,000	10/1/89-9/30/91
ONR	Ocean Waves in SAMSON/SWADE	$234,000	11/16/89-11/15/92
NSF	Shoaling Region and Surf Zone Wave Models (with Freilich, Guza)	$292,000	7/1/90-6/30/93
SDSC-NSF	Shallow Water Wave Models	60 CPU Hours	4/1/90-3/31/91
SDSC-NSF	Groups of Ocean Waves	180 CPU Hours	4/1/90-3/31/91
NSF	Research Experience for Undergraduates	$8,000	5/1/90-4/30/91
SDSC-NSF	Shallow Water Wave Models	250 CPU Hours	4/1/91-3/31/92
ONR	Observations of Waves Reflected from a Natural Beach	$450,000	10/1/91-9/30/94
ONR	Nonlinear Interactions in Ocean Surface Waves (w/Herbers)	$450,000	4/1/92-3/31/95
ONR	Observations of the Spatial and Temporal Variability of the Bathymetry of a Natural Beach	$300,000	10/1/92-9/30/95
ONR	Morphological Manipulation of a Natural Beach (w/Werner)	$300,000	10/1/92-9/30/95

External Funding of Research for Steve Elgar (continued)

Agency	Title	Amount	Period
ONR	AASERT Graduate student support	$105,000	5/16/93-5/15/96
NRL	Mine Behavior in Waves/Currents	$25,000	5/1/94-12/31/95
ONR	Nearshore Morphology	$500,000	10/1/94-9/30/96
ONR	Nearshore Wave Processes	$174,000	9/1/94-8/31/97
ONR	AASERT Graduate student support	$121,000	5/16/95-5/15/98
ONR	Nonlinear Interactions in Ocean Surface Waves (w/Herbers)	$113,000	4/1/95-9/30/96
DURIP	Nearshore Processes (instrumentation, w/Guza)	$195,000	6/7/95-6/6/96
ONR	Object Classification (w/Chandran)	$113,000	1/1/96-12/31/97
NRL	Nearshore Waves and Currents	$133,000	6/1/96-12/31/97
ONR	Nearshore Processes	$608,000	10/1/96-9/30/98
ONR	Wave Evolution on the Continental Shelf (w/Herbers, O'Reilly, Guza)	$154,000	1/1/97-12/31/00
NSF	CoOp Data Analysis	$25,000	1/1/97-7/31/99
ONR	Nearshore Processes	$283,000	10/1/98-9/30/99
ONR	Object Classification (w/Chandran)	$46,000	1/1/98-9/30/98
ONR	Improved Parameterizations in Spectral Wave Models (w/Herbers, van Vledder)	$82,000	10/1/97-9/30/01
ONR MOB	Spatial Coherence and Crest Length Statistics of Waves (w/Herbers)	$80,000	9/1/98-8/31/00
ONR	Object Classification (w/Chandran)	$160,000	10/1/98-9/30/00
DURIP	Nearshore Circulation (instrumentation w/Raubenheimer, Guza)	$330,000	3/31/99-3/30/00
ARO	Onshore Sandbar Migration	$160,000	6/1/99-5/31/02
ONR	Nearshore Processes	$71,000	10/1/99-12/31/99
NOPP	Nearshore Community Model	$411,000	8/1/99-7/31/04

External Funding of Research for Steve Elgar (continued)

ONR	Nearshore Canyon Experiment (w/Guza, Herbers, O'Reilly)	$508,000	1/1/00-12/31/01
ONR	Observations of Megaripples (w/Raubenheimer)	$71,000	7/1/00-12/31/00
Mellon Found.	Nearshore Processes on Beaches w/Multiple Bars (w/Raubenheimer)	$220,000	1/1/01-12/31/02
ONR	Megaripples (w/Raubenheimer)	$235,000	1/1/01-12/31/02
UCSD	Pile of Sand (w/Seymour, Guza, O'Reilly)	$156,000	2/1/01-6/30/03
ONR	Nearshore Canyon Experiment (w/Herbers, Guza, O'Reilly)	$993,000 (Elgar share)	1/1/02-12/31/04
NSF	Nearshore Canyon Experiment (w/Herbers, Guza, O'Reilly, Lentz)	$2,000,000 (Elgar= $534,000)	1/1/02-12/31/05
DURIP	Wave and Current Array	$480,000	4/1/02-9/30/03
ARO	Sediment Transport by Fluid Acceleration	$137,000	6/1/03-5/31/06
ONR	NCEX Analysis	$659,000	10/1/04-9/30/06
ONR	Surfzone HOLE (w/Raubenheimer, Guza)	$337,000 (Elgar=$124k)	6/1/05-9/30/06
WHCOHH	Beach Pathogens (w/Raubenheimer, Gast)	$55,000	1/1/06-12/31/06