

## Brian R. Elbing, Ph.D.

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Elbing's research focuses on identification of fluid mechanisms within complex high-Reynolds number flows with an emphasis on flow control, flow induced acoustics, and atmospheric turbulence. Many of his fundamental insights have transitioned to real-world applications (e.g., drag reduction for 2010 America's Cup, geared turbo-fan lubrication, helicopter hub design). His work has been published in top fluids and acoustic journals (e.g., *Journal of Fluid Mechanics*). In addition, his work has been featured in articles (e.g., *Physics Today*, *Wired Magazine*), radio shows (e.g., NPR's *All Things Considered*), and on the *National Geographic Channel*.

### PERSONAL HISTORY AND PROFESSIONAL EXPERIENCE

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#### EDUCATIONAL BACKGROUND

University of Michigan, Ann Arbor	Mechanical Engineering	Ph.D., 2009
University of Michigan, Ann Arbor	Mechanical Engineering	M.S.E., 2005
Western Michigan University, Kalamazoo	Mechanical Engineering	B.S., 2003

#### ACADEMIC APPOINTMENTS

Oklahoma State University, Stillwater		
Faculty Fellow for Aerospace Innovation		2023-present
Associate Professor, Mechanical & Aerospace Engineering		2019-present
Assistant Professor, Mechanical & Aerospace Engineering		2013-2019
Pennsylvania State University, State College		
Research Associate, Applied Research Laboratory		2010-2013
University of Michigan, Ann Arbor		
Postdoctoral Research Fellow, Mechanical Engineering		2009-2010

#### OTHER PROFESSIONAL EMPLOYMENTS

Consultant, Applied Research Laboratory, Pennsylvania State University, State College (2014)  
Consultant, BMW/Oracle Racing, San Francisco, CA (2009-2010)  
Consultant, Michigan Critical Care Consultants, Ann Arbor, MI (2007-2008)  
LARSS Research Assistant, NASA Langley Research Center, Hampton, VA (summer 2004)  
NSF-REU Research Assistant, Western Michigan University, Kalamazoo, MI (summer 2003)

#### HONORS AND AWARDS

*Experimental Physics Investigator, Gordon and Betty Moore Foundation, 2022*  
*President Research Fellow, Oklahoma State University, 2022*  
*Balloon-based Acoustic Seismology Study Team Award, NASA Jet Propulsion Lab, 2021*  
*Distinguished Early Career Faculty Award, Oklahoma State University, 2019*  
*John Brammer Professorship, Oklahoma State University, 2019-2023*  
*Halliburton Professorship in Engineering, Oklahoma State University, 2016-2019*  
*Excellent New Teacher Award, Oklahoma State University, College of Engineering, Architecture & Tech, 2016*  
Invited Speaker; Australian Acoustical Society, Acoustical Society of America, AIChE

#### KEY NUMBERS (ORCID 0000-0002-0818-7768)

*Scholarship:* Journal Articles: 35                      Conference Papers: 32  
                    h-index: 18                                      i-10 index: 24                      Citations: 1200+ (Google Scholar)

*Research:* Funding: \$3 million (PI) / \$1.0 million (co-PI)                      Source: NSF, NOAA, NASA, etc.  
Graduate students advised: 5 PhD (2 current, 3 graduated), 18 MS (0 current, 18 graduated)

*Teaching:* Students taught: 1000+                      Instructor Eval: 4.2/5.0                      Course Eval: 4.1/5.0

**ARCHIVED JOURNAL ARTICLES** (*underlined names are advised students*)

1. AJ Zuckerwar, GC Herring & BR Elbing (2006) "Calibration of pressure sensitivity of microphones by a free-field method at frequencies up to 80 kHz," *Journal of the Acoustical Society of America*, 119 (1), 320-329 (doi.org/10.1121/1.2141360).
2. KG Sabra, ES Winkel, DA Bourgoyne, BR Elbing, SL Ceccio, M Perlin & DR Dowling (2007) "Using cross correlations of turbulent flow-induced ambient vibrations to estimate the structural impulse response. Application to structural health monitoring," *Journal of the Acoustical Society of America*, 121 (4), 1987-1995 (doi.org/10.1121/1.2710463).
3. ES Winkel, BR Elbing, SL Ceccio, M Perlin & DR Dowling (2008) "High-Reynolds-number turbulent-boundary-layer wall pressure fluctuations with skin-friction reduction by air injection," *Journal of the Acoustical Society of America*, 123(5), 2522-2530 (doi.org/10.1121/1.2902169).
4. BR Elbing, ES Winkel, KA Lay, SL Ceccio, DR Dowling & M Perlin (2008) "Bubble-induced skin-friction drag reduction and the abrupt transition to air-layer drag reduction," *Journal of Fluid Mechanics*, 612, 201-236 (doi.org/10.1017/S0022112008003029).
5. BR Elbing, ES Winkel, MJ Solomon & SL Ceccio (2009) "Degradation of homogeneous polymer solutions in high shear turbulent pipe flow," *Experiments in Fluids*, 47, 1033-1044 (doi.org/10.1007/s00348-009-0693-7).
6. BR Elbing, DR Dowling, M Perlin & SL Ceccio (2010) "Diffusion of drag-reducing polymer solutions within a rough-walled turbulent boundary layer," *Physics of Fluids*, 22(4), 045102 (doi.org/10.1063/1.3371957).
7. BR Elbing, ES Winkel, SL Ceccio, M Perlin & DR Dowling (2010) "High-Reynolds-number turbulent-boundary-layer wall-pressure fluctuations with dilute polymer solutions," *Physics of Fluids*, 22(8), 085104 (doi.org/10.1063/1.3478982).
8. S Bian, JF Driscoll, BR Elbing & SL Ceccio (2011) "Time resolved flow-field measurements of a turbulent mixing layer over a rectangular cavity," *Experiments in Fluids*, 51(1), 51-63 (doi.org/10.1007/s00348-010-1025-7).
9. BR Elbing, MJ Solomon, M Perlin, DR Dowling & SL Ceccio (2011) "Flow-induced degradation of drag-reducing polymer solutions within a high-Reynolds number turbulent boundary layer," *Journal of Fluid Mechanics*, 670, 337-364 (doi.org/10.1017/S0022112010005331).
10. BR Elbing, S Mäkiharju, A Wiggins, M Perlin, DR Dowling & SL Ceccio (2013) "On the scaling of air layer drag reduction," *Journal of Fluid Mechanics*, 717, 484-513 (doi.org/10.1017/jfm.2012.588).
11. BR Elbing, M Perlin, DR Dowling & SL Ceccio (2013) "Modification of the mean near-wall velocity profile of a high-Reynolds number turbulent boundary layer with the injection of drag-reducing polymer solutions," *Physics of Fluids*, 25(8), 085103 (doi.org/10.1063/1.4817073).

12. S Mäkiharju, BR Elbing, A Wiggins, S Schinasi, JM Vanden-Broeck, M Perlin, DR Dowling & SL Ceccio (2013) “On the scaling of air entrainment from a ventilated partial cavity,” *Journal of Fluid Mechanics*, 732, 47-76 (doi.org/10.1017/jfm.2013.387).
13. DB Reich, BR Elbing, CR Berezin & S Schmitz (2014) “Water tunnel flow diagnostics of wake structures downstream of a model helicopter rotor hub,” *Journal of the American Helicopter Society*, 59(3), 032001 (doi.org/10.4050/JAHS.59.032001).
14. MH Krane, RS Meyer, MJ Weldon, B Elbing & DW DeVillbis (2015) “Measurements of loading and tip vortex due to large-Reynolds number flow over a rigid lifting surface,” *ASME Journal of Fluids Engineering*, 137, 071301-1 (doi.org/10.1115/1.4029723).
15. BR Elbing, AL Still & AJ Ghajar (2016) “Review of bubble column reactors with vibration,” *Industrial & Engineering Chemistry Research*, 55(2), 385-406 (doi.org/10.1021/acs.iecr.5b02535).
16. B Hemingway, AE Frazier, BR Elbing & JD Jacob (2017) “Vertical sampling scales for atmospheric boundary layer measurements from small unmanned aircraft systems (sUAS),” *Atmosphere*, 8(9), 176 (doi.org/10.3390/atmos8090176).
17. S Mohagheghian & BR Elbing (2018) “Characterization of bubble size distribution within a bubble column,” *Fluids*, 3(1), 13 (doi.org/10.3390/fluids3010013).
18. BR Elbing, L Daniel, Y Farsiani & CE Petrin (2018) “Design and validation of a recirculating, high-Reynolds number water tunnel,” *ASME Journal of Fluids Engineering*, 140(8), 081102 (doi.org/10.1115/1.4039509).
19. S Mohagheghian, AL Still, BR Elbing & AJ Ghajar (2018) “Study of bubble size, void fraction, and mass transport in a bubble column under high amplitude vibration,” *ChemEngineering*, 2(2), 16 (doi.org/10.3390/chemengineering2020016).
20. CE Petrin, B Jayaraman & BR Elbing (2019) “Characterization of a canonical helicopter hub wake,” *Experiments in Fluids*, 60(1), 9 (doi.org/10.1007/s00348-018-2655-4).
21. BR Elbing, CE Petrin & MS Van Den Broeke (2019) “Measurement and characterization of infrasound from a tornado producing storm,” *Journal of the Acoustical Society of America*, 146(3), 1528-1540 (doi.org/10.1121/1.5124486).
22. S Mohagheghian, AJ Ghajar & BR Elbing (2020) “Effect of vertical vibration on the mixing time of a passive scalar in a sparged bubble column reactor,” *Fluids*, 5(1), 6 (doi.org/10.3390/fluids5010006).
23. Y Farsiani, Z Saeed, B Jayaraman & BR Elbing (2020) “Modification of turbulent boundary layer coherent structures with drag reducing polymer solution,” *Physics of Fluids*, 32(1), 015107 (doi.org/10.1063/1.5127293).
24. BR Elbing, SD Young, ML Jonson, RL Campbell, BA Craven, RF Kunz & KL Koudela (2020) “Experimental characterization of a high-amplitude fluid-structure-interaction of a flexible hydrofoil at high Reynolds number,” *Journal of Vibration and Acoustics*, 142(4), 041014 (doi.org/10.1115/1.4046751).

25. B Hemingway, AE Frazier, BR Elbing & JD Jacob (2020) “High-resolution estimation and spatial interpolation of temperature structure in the atmospheric boundary layer using a small unmanned aircraft system,” *Boundary-Layer Meteorology*, 175, 397-416 (doi.org/10.1007/s10546-020-00512-1).
26. Y Farsiani, Z Saeed & BR Elbing (2020) “Drag reduction performance of mechanically degraded dilute polyethylene oxide solutions,” *ASME Journal of Fluids Engineering*, 142(9), 091201 (doi.org/10.1115/1.4047118).
27. BR Elbing (2021) “Impact of polymer degradation on past studies of the mean velocity profile in turbulent boundary layers,” *ASME Journal of Fluids Engineering*, 143(8), 081101 (doi.org/10.1115/1.4050517).
28. TC Wilson, J Brenner, Z Morrison, JD Jacob & BR Elbing (2022) “Wind speed statistics from a small UAS and its sensitivity to sensor location,” *Atmosphere*, 13(3), 443 (doi.org/10.3390/atmos13030443).
29. BC White, BR Elbing & I Faruque (2022) “Infrasound measurement system for real-time in-situ tornado measurements,” *Atmospheric Measurement Techniques*, 15(9), 2923-2938 (doi.org/10.5194/amt-15-2923-2022).
30. S Mohagheghian, AJ Ghajar & BR Elbing (2023) “Bubble size distribution on liquid viscosity and gas flowrate within a bubble column with a porous sparger,” *ASME Journal of Fluids Engineering*, 145(2), 021403 (doi.org/10.1115/1.4056035).
31. TC Wilson, CE Petrin & BR Elbing (2023) “Infrasound and low-audible acoustic detections from a long-term microphone array deployment in Oklahoma,” *Remote Sensing*, 15(5), 1455-23 (doi.org/10.3390/rs15051455).
32. TC Wilson, FK Dannemann-Dugick, DC Bowman, CE Petrin and BR Elbing (2023) “Seismoacoustic signatures observed during a long-term deployment of infrasound sensor at the Nevada National Security site,” *Bulletin of the Seismological Society of America*, 113(4), 1493-1512 (doi.org/10.1785/0120220240).
33. Z Saeed & BR Elbing (2023) “Polymer drag reduction: A review through the lens of coherent structures in wall-bounded turbulent flows,” *Physics of Fluids*, 35(8), 081304 (doi.org/10.1063/5.0162648).
34. RJ KC, TC Wilson, AS Alexander, JD Jacob, NA Lucido & BR Elbing (2023) “Evaluation of a serrated edge to mitigate adverse effects of a backward-facing step on an airfoil,” *Inventions*, 8(6), 160 (doi.org/10.3390/inventions8060160).
35. TD Swaim, E Hough, Z Yap, JD Jacob, S Krishnamoorthy, DC Bowman, L Martire, A Komjathy & BR Elbing (in press) “Performance characterization of heliotrope solar hot-air balloons during multihour stratospheric flights,” *Journal of Atmospheric and Oceanic Technology*, (doi.org/10.1175/JTECH-D-23-0091.1).

#### **INVITED CONFERENCE PRESENTATIONS AND PAPERS (NATIONAL)**

1. BR Elbing & RJ Gaeta (2016) “Integration of infrasonic sensing with UAS (invited),” AIAA Aviation Forum, AIAA2016-3581, Washington, DC (June 13-17) (doi.org/10.2514/6.2016-3581).
2. BR Elbing (2018) “Flow-assisted polymer degradation in turbulent boundary layers,” In: *Proceedings of the 2018 AIChE Annual Meeting*, Session 590e, 665-672, Pittsburgh, PA (Oct 28 – Nov 2).
3. BR Elbing, TC Wilson, C Petrin, RJ KC, T Swaim & B Lindsey (2023) “Tornado infrasound: Observations and potential mechanisms,” *184<sup>th</sup> Meeting of the Acoustical Society of America*, 2pCA5, Chicago, IL (May

8-12); abstract in *Journal of the Acoustical Society of America*, Vol. 153(3), A142 (doi.org/10.1121/10.0018441).

- BR Elbing, AS Alexander & RJ KC (2023) “Decoding the hidden sounds from tornadoes,” *Australian Acoustical Society and Acoustical Society of America Joint Meeting*, Sydney, Australia (Dec 4-8).

**PEER-REVIEWED CONFERENCE PAPERS** (*underlined names are advised students*)

- ES Winkel, BR Elbing, DR Dowling, SL Ceccio & M Perlin (2005) “High-Reynolds-number turbulent-boundary-layer surface pressure fluctuations with bubble or polymer additives,” *Proceedings of the 2005 ASME Int. Mechanical Engineering Congress and Exposition*, IMECE2005-79740, Orlando, FL (Nov 5-11).
- MJ Beam, BL Kline, BR Elbing, WA Straka, AA Fontaine, M Lawson, Y Li, R Thresher & M Previsic (2013) “Marine hydrokinetic turbine power-take-off design for optimal performance and low impact on cost-of-energy,” *Proceedings of the 32<sup>nd</sup> International Conference on Ocean Offshore and Arctic Engineering*, Vol 8, OMAE2013-10701, Nantes, France (June 9-14).
- L Daniel, S Mohagheghian, D Dunlap, E Ruhlmann & BR Elbing (2015) “Design of a recirculating water tunnel for the study of high Reynolds number turbulent boundary layers,” *2015 ASME International Mechanical Engineering Congress and Exposition*, IMECE2015-52030, Symposium on Fluid Measurements and Instrumentation, Houston, TX (Nov. 13-19).
- N Thorp, G Hareland, BR Elbing & R Nygaard (2016) “Modeling of a drill bit blaster,” *50<sup>th</sup> ARMA US Rock Mechanics/Geomechanics Symposium*, ARMA 16-0451, Houston, TX (June 26-29).
- Y Farsiani & BR Elbing (2016) “Characterization of a custom-designed, high-Reynolds number water tunnel,” *2016 ASME Fluids Engineering Division Summer Meeting*, FEDSM2016-7866, Track 10 Forum on Fluid Measurements and Instrumentation, Washington, DC (July 10-14).
- S Mohagheghian & BR Elbing (2016) “Study of bubble size and velocity in a vibrating bubble column,” *ASME Summer Heat Transfer Conf and Fluids Engin Summer Meeting*, HTFEICNMM2016-1056, Washington, DC (July 10-14) (doi.org/10.1115/FEDSM2016-1056).
- N Thorp, G Hareland, BR Elbing & R Nygaard (2016) “Characterization of a pulsating drill bit blaster,” *2016 ASME Fluids Eng Division Summer Meeting*, FEDSM2016-7868, Washington, DC (July 10-14).
- BR Elbing, CE Petrin & MS Van Den Broeke (2018) “Infrasound measurements from a tornado in Oklahoma,” *Proceedings of Meetings on Acoustics*, 33(1), 0450003 (doi.org/10.1121/2.0001015).
- CE Petrin & BR Elbing (2019) “Infrasound emissions from tornadoes and severe storms compared to potential tornadic generation mechanisms,” *Proceedings of Meetings on Acoustics*, 36, 045005 (doi.org/10.1121/2.0001099).
- BR Elbing, TC Wilson, CE Petrin, RJ KC, T Swaim and B Lindsey (2023) “Observations and potential mechanisms for tornado infrasound,” *Proceedings of Meetings on Acoustics*, 51(1), 022001 (doi.org/10.1121/2.0001784).
- T Swaim, K Spillman, E Hough, Z Yap, J Jacob & BR Elbing (2023) “Development and evaluation of windscreen designs for high altitude balloons,” *Proceedings of Meetings on Acoustics*, 51(1), 040002 (doi.org/10.1121/2.0001785).

**ABSTRACT-REVIEWED CONFERENCE PAPERS** (*underlined names are advised students*)

16. GC Garwood, ES Winkel, S Vanapalli, BR Elbing, DT Walker, SL Ceccio, M Perlin & MJ Solomon (2005) "Drag reduction by a homogenous polymer solution in large diameter, high shear pipe flow," *Proceedings of the 2<sup>nd</sup> International Symposium on Seawater Drag Reduction*, Busan, Korea (May 23-26).
17. BR Elbing, ES Winkel, M Perlin, DR Dowling & SL Ceccio (2007) "Investigation of drag reduction methods by air injection beneath a turbulent boundary layer at high-Reynolds-numbers," *International Conference on Multiphase Flow*, S6-Fri-A-62, Leipzig, Germany (July 9-13).
18. KA Lay, BR Elbing, R Yakushiji, M Perlin & SL Ceccio (2008) "Skin-friction drag reduction by air layers and partial cavities," *Proc of the 27<sup>th</sup> Symp on Naval Hydrodynamics*, Vol. 1, 540, Seoul, Korea (Oct 5-10).
19. BR Elbing, DR Dowling, MJ Solomon, M Perlin & SL Ceccio (2008) "Polymer degradation within a high-Reynolds-number, flat-plate turbulent boundary layer that is fully rough," *Proceedings of the 27<sup>th</sup> Symposium on Naval Hydrodynamics*, Vol. 1, 556, Seoul, Korea (Oct 5-10).
20. SL Ceccio, M Perlin & BR Elbing (2010) "A cost-benefit analysis for air layer drag reduction," *Proceedings of the International Conference on Ship Drag Reduction*, Istanbul, Turkey (May 20-21).
21. S Mäkiharju, BR Elbing, A Wiggins, DR Dowling, M Perlin & SL Ceccio (2010) "Ventilated partial cavity flows at high Reynolds numbers," *Proc of the Int Conf on Multiphase Flow*, Tampa, FL (May 30 – June 4).
22. S Mäkiharju, BR Elbing, A Wiggins, DR Dowling, M Perlin & SL Ceccio (2010) "Perturbed partial cavity drag reduction at high Reynolds numbers," *Proceedings of the 28<sup>th</sup> Symposium on Naval Hydrodynamics*, Pasadena, CA (Sept 12-17).
23. D Reich, B Elbing, C Berezin & S Schmitz (2013) "Water tunnel flow diagnostics of wake structures downstream of a model helicopter rotor hub," *Proceedings of the 69<sup>th</sup> American Helicopter Society Annual Forum & Technology Display*, 2, 933-949, Phoenix, AZ (May 21-23).
24. G Kibble, JD Jacob, BR Elbing, A Alexander, P Ireland & JAB Black (2017) "Aerodynamic investigation of the Conformal Vortex Generator," *47<sup>th</sup> AIAA Fluid Dynamic Conference, 2017 AIAA Aviation and Aeronautics Forum and Exposition*, Denver, CO (June 5-9) (doi.org/10.2514/6.2017-3117).
25. CE Petrin, T Martin, W Caire, ML Thies & BR Elbing (2018) "Modification of drag on the ear of Brazilian free-tailed bats (*Tadarida brasiliensis*) via leading-edge tubercles," *2018 AIAA Aviation and Aeronautics Forum and Exposition*, AIAA2018-2917, Atlanta, GA (June 25-29) (doi.org/10.2514/6.2018-2917).
26. RJ KC, NA Lucido, TC Wilson, AS Alexander, BR Elbing, JD Jacob, P Ireland & JA Black (2019) "Investigation of wake survey over a wing with conformal vortex generators," *2019 AIAA SciTech Forum*, AIAA-2019-0578, San Diego, CA (Jan 7-11) (doi.org/10.2514/6.2019-0578).
27. NA Lucido, RJ KC, TC Wilson, JD Jacob, AS Alexander, BR Elbing, P Ireland & JA Black (2019) "Laminar boundary layer scaling over a conformal vortex generator," *2019 AIAA SciTech Forum*, AIAA-2019-1135, San Diego, CA (Jan 7-11) (doi.org/10.2514/6.2019-1135).
28. TC Wilson, RJ KC, NA Lucido, BR Elbing, AS Alexander, JD Jacob, P Ireland & JA Black (2019) "Computational investigation of the conformal vortex generator," *2019 AIAA SciTech Forum*, AIAA-2019-2138, San Diego, CA (Jan 7-11) (doi.org/10.2514/6.2019-2138).

29. SJF Fisher, AS Alexander & BR Elbing (2020) “Computational model of flow surrounding Brazilian free-tailed bat ear tubercles,” *2020 AIAA SciTech Forum*, AIAA-2020-2021, Orlando, FL (Jan 6-10) (doi.org/10.2514/6.2020-2021).
30. BR Elbing (2020) “Comparison of turbulent boundary layer profiles modified with injection or uniform concentration of drag-reducing polymer solution,” *ASME FEDSEM*, FEDSM2020-13113, virtual (July 12-16).
31. B White, BR Elbing & I Faruque (2021) “Preliminary severe storm data from a mobile infrasound system,” *2021 AIAA SciTech Forum*, AIAA2021-0818, virtual (Jan 11-21) (doi.org/10.2514/6.2021-0818).
32. E Hough, A Ngo, T Swaim, Z Yap, A Vance, B Elbing & J Jacob (2022) “Solar balloon development for high altitude observations,” *2022 Aviation Forum*, AIAA2022-4113, Chicago, IL (Jun 27-Jul 1) (doi.org/10.2514/6.2022-4113).

#### INVITED SEMINARS, LECTURES, AND WORKSHOPS

1. BR Elbing (2009) “Skin-friction drag reduction methods for surface ships,” Aerospace and Mechanical Engineering, University of Notre Dame, South Bend, IN.
2. BR Elbing (2010) “Turbulent drag reduction: Surface ship applications,” Mechanical Engineering, University of Ontario Institute of Technology, Ontario, Canada.
3. BR Elbing (2010) “Turbulent drag reduction with addition of air or polymer additives,” Applied Research Laboratory, Pennsylvania State University, State College, PA.
4. BR Elbing (2011) “The use of acoustic measurements for analysis of drag reduced flows,” *Center for Acoustics and Vibration Luncheon Seminar*, Pennsylvania State University, State College, PA.
5. BR Elbing (2011) “High Reynolds number turbulent drag reduction,” Florida State Univ, Tallahassee, FL.
6. BR Elbing (2012) “Multiphase Flows: Drag reduction applications,” Univ of South Carolina, Columbia, SC.
7. BR Elbing (2012) “Multiphase Flows: Drag reduction applications,” Tufts University, Medford, MA.
8. BR Elbing (2012) “Multiphase Flows: Drag reduction applications,” Oklahoma State Univ, Stillwater, OK.
9. D Reich, S Schmitz & BR Elbing (2013) “Vertical lift research center of excellence: helicopter parasite drag reduction,” *Fluids & Structural Mechanics Office Seminar*, ARL-PSU, State College, PA (Feb 22).
10. BR Elbing (2015) “Advanced sensing techniques for improved tornado warning,” *CEAT Research Seminar Series*, Oklahoma State University, Stillwater, OK (April 17).
11. BR Elbing (2017) “From the field to the academy,” *AIAA MAE Professor Speaker Series*, AIAA – Oklahoma State Student Branch, Stillwater Oklahoma (March 28).
12. BR Elbing (2018) “[Alumni career conversation with Dr. Brian Elbing](#),” *University of Michigan*, Rackham Graduate School, Ann Arbor, MI (Sept 7).
13. BR Elbing (2019) “Rotor hub wake insights from high-Reynolds number water tunnel experiments,” *Aerospace Engineering Seminar*, Georgia Institute of Technology, Atlanta, GA (Feb 19).
14. BR Elbing (2019) “Rotor hub wake insights from high-Reynolds number water tunnel experiments,” *Aerospace Engineering Thursday Seminar Series*, Pennsylvania State University, State College, PA (Mar 21).
15. BR Elbing, CE Petrin and MS Van Den Broeke (2019) “Tornado infrasound observations during the CLOUD-MAP project,” *CLOUD-MAP Workshop*, Talk 10, National Weather Ctr, Norman OK (July 8-10).
16. BR Elbing (2020) “Infrasound from Oklahoma supercells,” *2020 High Altitude Conference*, Talk 14, Sandia National Laboratories, Albuquerque, NM (Jan 28).
17. BR Elbing (2020) “The silent sounds of tornadoes,” *Geography Colloquium Talk*, Western Michigan University, Kalamazoo, MI (Feb 21).
18. BR Elbing (2020) “The silent sounds of tornadoes,” *ASME Central Oklahoma Meeting*, virtual (Oct 22).
19. BR Elbing (2020) “The search for the silent sounds of tornadoes,” *Environmental Acoustics Seminar Series*, University of New Hampshire, virtual (Nov 10).
20. BR Elbing (2022) “Use of low frequency sound to study tornadoes and Venus-quakes,” *MME Departmental Seminar Series*, University of Waterloo, virtual (Feb 17).

## RESEARCH

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### GRANTS AND CONTRACTS (EXTERNALLY FUNDED)

1. S Schmitz (PI) and BR Elbing (2011) “VLRCOE: Fundamental physics of rotor hub flows towards reduction of helicopter parasite drag,” US Army VLRCOE, **\$380K**
2. M Moeny (PI), MH Krane, BR Elbing and MJ Weldon (2012) “Stereo particle image velocimetry system for measurement of high-speed water flows,” ONR DURIP, **\$357K**
3. RF Kunz (PI), BR Elbing and M Beam (2012) “Experimental facility for visualization of multiphase aerodynamics within a turbofan gearbox,” Pratt & Whitney, **\$155K**
4. BR Elbing (2013) “Use of laser-induced-cavitation (LIC) to acoustically identify cavitation events without flow noise,” Emerson Innovation Center, **\$18K**
5. JD Jamey (PI), S Smith, A Houston, P Chilson, BR Elbing et al. (2015) “RII Track-2 FEC: Unmanned aircraft systems for atmospheric physics (CLOUD-MAP),” NSF EPSCoR, **\$5.6 million**
6. BR Elbing (PI), JD Jamey and A Alexander (2015) “CVG characterization,” Edge Aerodynamix, **\$527K**
7. BR Elbing (2016) “Modification of near-wall, high-Reynolds number velocity profiles with polymer solution,” NSF CBET Fluid Dynamics, **\$297K**
8. BR Elbing (2016) “Atmospheric infrasonic sensing,” Oklahoma NASA EPSCoR, **\$2.5K**
9. BR Elbing (PI) and M Van Den Broeke (2018) “Identification of the fluid mechanism associated with tornadic storm infrasound,” National Oceanic and Atmospheric Administration (NOAA) OAR, **\$271K**
10. A Frazier (PI), B Hemingway and BR Elbing (2019) “Doctoral Dissertation Research: Spatial structure of turbulent flows in the atmospheric boundary layer,” NSF Doctoral Dissertation Research, **\$18K**
11. BR Elbing (PI), M Van Den Broeke and IA Faruque (2019) “Infrasound observations and demonstration of real-time tools,” NOAA OAR, **\$500K**
12. A Komjathy (PI), S Krishnamoorthy, J Walter, J Jackson, M Pauken, D Bowman and BR Elbing (2020) “Feedback on balloon infrasound observations of terrestrial earthquakes with applications to Venus,” NASA PSTAR, **\$1.2 million**
13. J Jacob (PI), A Houston, P Chilson, K Brewster, S Smith, C Detweiler, S Bailey, J Pinto, A Jensen, BR Elbing, I Faruque, N Fala, R Sobash, C Woolsey (2020) “Weather intelligent navigation data and models for aviation planning,” NASA ULI, **\$5.2 million**
14. A Arena (PI), BR Elbing (Sci-I) and JD Jacob (2022) “Appendix H: NASA SMD Planetary Science Division, Topic H.1.3: Infrasound noise mitigation for aerial platforms on Venus,” NASA EPSCoR R3, **\$100K**
15. BR Elbing (2022) “Identifying the fluid mechanism responsible for infrasound from tornadoes,” Gordon and Betty Moore Foundation, Experimental Physics Investigator Program, **\$1.25 million**
16. BR Elbing (PI) and Jamey Jacob (2023) “Balloon-based acoustic seismology project,” *NASA Jet Propulsion Laboratory*, PSTAR, **\$21K**



## **PHD GRADUATE STUDENT DISSERTATIONS**

1. Shahrouz Mohagheghian (2019) “Study of bubbly and annular flow using quantitative flow visualization,” Ph.D. Dissertation, Oklahoma State University, Stillwater, OK.
2. Yasaman Farsiani (2020) “Modification of a high Reynolds number turbulent boundary layer with the addition of drag-reducing polymer solution,” Ph.D. Dissertation, Oklahoma State Univ, Stillwater, OK.
3. Trevor C. Wilson (2023) “Regional infrasound monitoring: From terrestrial to celestial,” Ph.D. Dissertation, Oklahoma State University, Stillwater, OK.

## **MS GRADUATE STUDENT THESES**

1. Minna Ranjeva (2012) “Characterizing laser induced cavitation: Effects of air content, beam angle, and laser power,” M.S. Thesis, Pennsylvania State University, State College, PA.
2. David Reich (2013) “Water tunnel experiments on a model scale helicopter rotor hub,” M.S. Thesis, Pennsylvania State University, State College, PA (co-advised with Sven Schmitz).
3. Libin Daniel (2014) “Design of a high-Reynolds number, multiphase water tunnel facility,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
4. Nicholas Thorp (2016) “Characterization of a pulsating drill bit blaster,” M.S. Thesis, Oklahoma State University, Stillwater, OK (co-advised with Geir Hareland).
5. Arnesha Threatt (2016) “Investigation of natural and anthropomorphic sources of atmospheric infrasound,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
6. Geoffrey Kibble (2017) “Experimental and computational investigation of the conformal vortex generator,” M.S. Thesis, Oklahoma State University, Stillwater, OK (co-advised with Jamey Jacob).
7. Trevor Martin (2017) “Flow modification by tubercles in Brazilian free-tailed bats,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
8. Christopher E. Petrin (2017) “Frequency content in the wakes of rotating bluff body helicopter hub models,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
9. Marcus Lander (2018) “Preparation and characterization of polyethylene-oxide (PEO) solution,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
10. Nicholas Lucido (2019) “Investigation of low-profile vortex generators on low-Reynolds number propellers for small unmanned aircraft,” M.S. Thesis, Oklahoma State University, Stillwater, OK (co-advised with Kurt Rouser).
11. Real KC (2019) “Investigation of low-profile vortex generators via experimental methods,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
12. Trevor Wilson (2019) “Investigation of low-profile vortex generators via computational methods,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
13. Zeeshan Saeed (2019) “Characterization of degraded drag-reducing polymer solutions and its impact on the structure of turbulence,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
14. Sara J. Fresella Fisher (2020) “Computational and experimental investigation of Brazilian free-tailed bat ear tubercles on an airfoil leading edge,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
15. Bryce B. Lindsey (2023) “The impact of vibrations on mobile infrasound sensing and the development of a custom sensor package,” M.S. Thesis, Oklahoma State University, Stillwater, OK.

16. Taylor D. Swaim (2023) “Infrasound noise mitigation and the characterization of heliotrope flight dynamics,” M.S. Thesis, Oklahoma State University, Stillwater, OK.
17. Zachary Yap (2023) “Solar balloon communication and flight augmentation systems,” M.S. Thesis, Oklahoma State University, Stillwater, OK (co-advised with Jamey Jacob).
18. Emalee Hough (2023) “Design and operations of multi-hour stratospheric solar hot air balloons,” M.S. Thesis, Oklahoma State University, Stillwater, OK (co-advised with Jamey Jacob).

#### CONTRIBUTED CONFERENCE PRESENTATIONS AND POSTERS (INTERNATIONAL)

1. GC Herring, AJ Zuckerwar & BR Elbing (2004) “Free-field calibration of the pressure sensitivity of air-condenser, electret, MEMS, and piezoresistive microphones at frequencies up to 80 kHz,” *148<sup>th</sup> Meeting of the Acoustical Society of America*, San Diego, CA (Nov. 15-19); abstract in *Journal of the Acoustical Society of America* Vol. 116(4), 2512.
2. BR Elbing, S Bian, DR Dowling, MJ Solomon & SL Ceccio (2007) “Effect of surface roughness on polymer drag reduction with a high-Reynolds-number turbulent boundary layer,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, GE.09, Salt Lake City, UT (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 52(12).
3. SL Ceccio, BR Elbing, ES Winkel, DR Dowling & M Perlin (2008) “Air Layer Drag Reduction,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, GA.02, San Antonio, TX (Nov. 23-25); abstract in *Bull. Am. Phys. Soc.* Vol. 53(15).
4. BR Elbing, M Perlin, DR Dowling, MJ Solomon & SL Ceccio (2008) “Diffusion of drag-reducing polymers within a high-Reynolds-number, rough-wall turbulent boundary layer,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, BA.03, San Antonio, TX (Nov. 23-25); abstract in *Bull. Am. Phys. Soc.* Vol. 53(15).
5. DR Dowling, BR Elbing, S Mäkiharju, A Wiggins, M Perlin & SL Ceccio (2009) “Disturbances to air-layer skin-friction drag reduction at high Reynolds numbers,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, AK.10, Minneapolis, MN (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 54(19).
6. S Mäkiharju, BR Elbing, A Wiggins, DR Dowling, M Perlin & SL Ceccio (2009) “Partial cavity flows at high Reynolds numbers,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, AJ.03, Minneapolis, MN (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 54(19).
7. BR Elbing, MJ Solomon, M Perlin, DR Dowling & SL Ceccio (2009) “Scaling of Polymer Degradation Rate within a High-Reynolds-Number Turbulent Boundary Layer,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, MA.08, Minneapolis, MN (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 54(19).
8. S Mäkiharju, BR Elbing, A Wiggins, DR Dowling, M Perlin & SL Ceccio (2010) “Perturbed partial cavity drag reduction at high Reynolds numbers,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, HU.01, Long Beach, CA (Nov. 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 55(16).
9. BR Elbing, S Mäkiharju, A Wiggins, DR Dowling, M Perlin & SL Ceccio (2010) “Air-induced drag reduction at high Reynolds numbers: Velocity and void fraction profiles,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, LB.04, Long Beach, CA (Nov. 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 55(16).
10. ML Ranjeva, L Thompson, D Perlitz, W Bonness, D Capone & BR Elbing (2011) “Development of an acoustic localization method for cavitation experiments in reverberant environments,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, L14.05, Baltimore, MD (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 56(18).
11. S Anderson, M Ranjeva, L Thompson, D Perlitz, BR Elbing, W Bonness, D Capone (2012) “Development of an acoustic localization method for cavitation experiments in reverberant environments,” *American Society of Naval Engineers (ASNE) Day 2012*, Arlington, VA (Feb 9-10).
12. D Reich, BR Elbing & S Schmitz (2013) “Experimental investigation of a helicopter rotor hub wake,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A25.09 (Nov. 24-26), Pittsburgh, PA; abstract in *Bull. Am. Phys. Soc.* Vol. 58(18).
13. L Daniel & BR Elbing (2014) “Design of a high-Reynolds number recirculating water tunnel,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, M29.06, San Francisco, CA (Nov. 23-25); abstract in *Bull. Am. Phys. Soc.* Vol. 59(20).
14. A Threatt & BR Elbing (2015) “Acoustic localization with infrasonic signals,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D7.06, Boston, MA (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 60(21).

15. Y Farsiani & BR Elbing (2015) “Investigation of the required length for fully developed pipe flow with drag-reducing polymer solutions,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D12.08, Boston, MA (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 60(21).
16. BR Elbing, D Reich & S Schmitz (2015) “Flow structures within a helicopter rotor hub wake,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, E16.01, Boston, MA (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 60(21).
17. CE Petrin & BR Elbing (2015) “Modification of the wake behind a bat ear with and without tubercles,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, H27.03, Boston, MA (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 60(21).
18. S Mohagheghian & BR Elbing (2015) “Investigation of gas holdup in a vibrating bubble column,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, R25.04, Boston, MA (Nov. 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 60(21).
19. G Kibble, C Petrin, JD Jacob, BR Elbing, P Ireland & B Black (2016) “Aerodynamic impact of an aft-facing slat step on high Re Airfoils,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A6.07, Portland, OR (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 61(20).
20. S Mohagheghian, T Wilson, B Valenzuela, T Hinds, K Moseni, & BR Elbing (2016) “Bubble size distribution in a vibrating bubble column,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A21.08, Portland, OR (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 61(20).
21. A Threatt & BR Elbing (2016) “Characterization of atmospheric infrasound for improved weather monitoring,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, H4.04, Portland, OR (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 61(20).
22. Y Farsiani, J Baade & BR Elbing (2016) “Reexamination of the classical view of how drag-reducing polymer solutions modify the mean velocity profile: Baseline results,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, H33.01, Portland, OR (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 61(20).
23. CE Petrin, D Reich, S Schmitz & BR Elbing (2016) “Spectral analysis of the wake behind a helicopter rotor hub,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, L6.05, Portland, OR (Nov. 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 61(20).
24. S Mohagheghian & BR Elbing (2017) “Gas bubble dynamics under mechanical vibrations,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D7.9, Denver, CO (Nov. 19-21); abstract in *Bull. Am. Phys. Soc.* Vol. 62(14).
25. Y Farsiani & BR Elbing (2017) “Modification of a turbulent boundary layer within a homogeneous concentration of drag reducing polymer solution,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, Q28.5, Denver, CO (Nov. 19-21); abstract in *Bull. Am. Phys. Soc.* Vol. 62(14).
26. CE Petrin & BR Elbing (2017) “Infrasonic emissions from a tornado,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, Q19.6, Denver, CO (Nov. 19-21); abstract in *Bull. Am. Phys. Soc.* Vol. 62(14).
27. BL Hemingway, AE Frazier, BR Elbing & JD Jacob (2018) “Vertical sampling scales for atmospheric boundary layer measurements from small unmanned aircraft systems (sUAS),” *Proceedings of the American Association of Geographers Annual Meeting*, TUE-001.3, New Orleans, LA (Apr 10-14).
28. BR Elbing, CE Petrin & MS Van Den Broeke (2018) “Monitoring infrasound from a tornado in Oklahoma,” *175<sup>th</sup> Meeting of the Acoustical Society of America*, 2pPA Infrasound for Global Security II, Minneapolis, MN (May 7-11); abstract in *Journal of the Acoustical Society of America*, Vol. 143(3), 1808 (doi.org/10.1121/1.5035924).
29. BL Hemingway, AE Frazier, BR Elbing & JD Jacob (2018) “Vertical sampling scales for capturing atmospheric measurements via small unmanned aircraft systems in the boundary layer,” *International Society for Atmospheric Research using Remotely Piloted Aircraft (ISARRA) 2018*, Plenary Session 5: Boundary Layer Structure, poster session, Boulder, CO (July 9-12).
30. CE Petrin, MS Van Den Broeke & BR Elbing (2018) “Tornado and hail infrasound observations during severe storms,” *29<sup>th</sup> Conference on Severe Local Storms*, PS-2B.85, Stowe, VT (Oct 22-26).
31. Y Farsiani & BR Elbing (2018) “Effect of flow and polymer properties on near wall mean and fluctuating velocity profiles,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A17.4, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
32. CE Petrin, MS Van Den Broeke & BR Elbing (2018) “Severe storm infrasound observations during spring 2018,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A26.8, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).

33. Z Saeed, Y Farsiani & BR Elbing (2018) “Influence of mechanical degradation on polymer drag reduction,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, A36.7, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
34. NA Lucido, RJ KC, TC Wilson, JD Jacob, AS Alexander, P Ireland, JA Black & BR Elbing (2018) “Scaling of the flow over a conformal vortex generator with a laminar boundary layer,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D15.8, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
35. TC Wilson, RJ KC, BR Elbing, JD Jacob, P Ireland, JA Black & AS Alexander (2018) “Computational investigation of a low profile vortex generator,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D15.9, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
36. RJ KC, NA Lucido, JD Jacob, AS Alexander, P Ireland, JA Black & BR Elbing (2018) “Study of conformal vortex generators via wake survey,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, D15.10, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
37. S Mohagheghian & BR Elbing (2018) “Bubble induced mixing in a vertically vibrating bubble column,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, L9.2, Atlanta, GA (Nov. 18-20); abstract in *Bull. Am. Phys. Soc.* Vol. 63(13).
38. BL Hemingway, AE Frazier, BR Elbing & JD Jacob (2019) “Spatial structure of thermodynamic variables in the atmospheric boundary layer,” *American Meteorological Society Annual Meeting*, J1.1, Phoenix, AZ (Jan 6-10).
39. CE Petrin and BR Elbing (2019) “Comparison of infrasound emissions observed during a tornado with potential fluid mechanisms,” *177<sup>th</sup> Meeting of the Acoustical Society of America*, 4pPAa7 Physical Acoustics and Signal Processing in Acoustics: Infrasound II, Louisville, KY (May 13-17); abstract in *Journal of the Acoustical Society of America*, Vol. 145(3), 1901 (doi.org/10.1121/1.5101896).
40. RJ KC, NA Lucido, JD Jacob, AS Alexander, & BR Elbing (2019) “Study of conformal vortex generators via wake survey,” *Second International Conference on Applications of Mathematics to Nonlinear Sciences (AMNS-2019)*, Pokhara, Nepal (June 27-30).
41. BL Hemingway, AE Frazier, BR Elbing & JD Jacob (2019) “High Resolution Vertical Estimation of the Temperature Structure Parameter in the Atmospheric Boundary Layer,” *International Society for Atmospheric Research using Remotely Piloted Aircraft Annual Meeting*, Session 4.1, Lugo, Spain (July 15-19).
42. Y Farsiani & BR Elbing (2019) “Modification of turbulent boundary layer in the homogeneous concentration of polymer solution,” IMECE, IMECE2019-13905, Salt Lake City, UT (Nov 8-14).
43. Z Saeed, Y Farsiani & BR Elbing (2019) “Deviations in polymer drag reduction performance with mechanical degradation,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, C26.5, Seattle, WA (Nov. 23-26); abstract in *Bull. Am. Phys. Soc.* Vol. 64(13).
44. BR Elbing, C Petrin & M Van Den Broeke (2019) “Potential fluid mechanisms for low frequency sound from tornadoes,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, M02.12, Seattle, WA (Nov. 23-26); abstract in *Bull. Am. Phys. Soc.* Vol. 64(13).
45. Y Farsiani, Z Saeed & BR Elbing (2019) “Modification of turbulent boundary layer in the homogeneous polymeric drag reduced flow,” *American Physical Society – Division of Fluid Dynamics Annual Meeting*, M02.12, Seattle, WA (Nov. 23-26); abstract in *Bull. Am. Phys. Soc.* Vol. 64(13).
46. BR Elbing, CE Petrin, MS Van Den Broeke & Erik Green (2019) “Infrasound observations from the 2019 tornado season,” *178<sup>th</sup> Meeting of the Acoustical Society of America*, 1pPA3 Physical Acoustics: General Topics in Physical Acoustics II, San Diego, CA (Dec 2-6); abstract in *Journal of the Acoustical Society of America*, Vol. 146(4), 2783 (doi.org/10.1121/1.5136639).
47. B Hemingway, AE Frazier, BR Elbing & J Jacob (2019) “Evaluating the universality of the temperature structure parameter in the atmospheric surface layer using a small unmanned aircraft system,” *2019 AGU Fall Meeting*, A13T-2986, San Francisco, CA (Dec 9-13).
48. CE Petrin, RJ KC & BR Elbing (2020) “Deployment of a mobile four sensor infrasound array for severe weather,” *APS-DFD Annual Meeting*, E02.1, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
49. TC Wilson, RJ KC, BR Elbing & M Van Den Broeke (2020) “Infrasound propagation in the atmospheric conditions of tornado producing storms,” *APS-DFD Annual Meeting*, E02.2, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
50. B Lindsey, BC White, I Faruque & BR Elbing (2020) “Infrasound measurements of tornadoes and other severe storm events at close range,” *APS-DFD Annual Meeting*, E03.5, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).

51. BR Elbing (2020) “Polymer drag reduction: Impact on near-wall structure,” *APS-DFD Annual Meeting*, G07.14, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
52. BC White, CE Petrin, I Faruque & BR Elbing (2020) “System identification approaches to modeling of tornado acoustic mechanisms,” *APS-DFD Annual Meeting*, H09.5, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
53. A Vance, J Jacob & BR Elbing (2020) “Atmospheric observations from high altitude solar balloons,” *APS-DFD Annual Meeting*, H12.11, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
54. RJ KC, H Schulz, S Mohagheghian, I Park, BR Elbing & A Ghajar (2020) “[Sensitivity of the annular flow film thickness to inclination angle](#),” *APS-DFD Annual Meeting*, X05.8, virtual (Nov 22-24); abstract in *Bull. Am. Phys. Soc.* Vol. 65(13).
55. A Vance, JD Jacob & BR Elbing (2020) “Preliminary observations from high altitude solar balloons,” *AGU Fall Meeting*, P050-10, virtual (Dec 1-17).
56. BR Elbing & CE Petrin (2020) “The silent sounds of tornadoes and their potential fluid mechanism,” *AGU Fall Meeting*, A134-05, virtual (Dec 1-17) (doi.org/10.1002/essoar.10504829.1).
57. BC White, B Lindsey, I Faruque & BR Elbing (2020) “Infrasound measurements of tornadoes and other severe storm events at close range,” *179<sup>th</sup> Meeting of the Acoustical Society of America*, virtual meeting (7-11 Dec).
58. CE Petrin, R KC & BR Elbing (2020) “Severe weather observations from a deployable four sensor infrasound array,” *179<sup>th</sup> Meeting of the Acoustical Society of America*, virtual meeting (7-11 Dec).
59. TC Wilson, RJ KC, BR Elbing & MS Van Den Broeke (2020) “Modeling infrasound propagation from tornado producing storms,” *179<sup>th</sup> Meeting of the Acoustical Society of America*, 4pCAa2, virtual meeting (7-11 Dec). **(Best Paper Award – Computational Acoustics)**
60. S Krishnamoorthy, Q Brissaud, A Komjathy, JA Cutts, MT Pauken, DC Bowman, JM Jackson, BR Elbing, A Vance, J Jacob, RF Garcia & D Mimoun (2021) “Earth-analog experiments for detecting seismicity on Venus using balloons,” *52<sup>nd</sup> Lunar and Planetary Science Conference*, poster 2755, virtual (15-19 Mar).
61. A Vance, J Jacob & BR Elbing (2021) “Flight testing a Venus aerial platform in Earth’s atmosphere,” *2021 Scientific Ballooning Technologies Workshop*, P3, virtual meeting, (12-14 May).
62. Z Yap, E Hough, JD Jacob, BR Elbing, L Martire, S Krishnamoorthy & D Bowman (2021) “Data collection from zero pressure solar balloons for gravity wave detection,” *APS-DFD Annual Meeting*, P30.4, Phoenix, AZ (Nov 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 66(17).
63. E Hough, Z Yap, JD Jacob, BR Elbing, L Martire, S Krishnamoorthy & D Bowman (2021) “Infrasound detection from zero pressure solar balloons,” *APS-DFD Annual Meeting*, P30.5, Phoenix, AZ (Nov 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 66(17).
64. ZD Morrison, T Wilson & BR Elbing (2021) “Atmospheric boundary layer characterization via UAS wind speed measurements,” *APS-DFD Annual Meeting*, P30.6, Phoenix, AZ (Nov 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 66(17).
65. TC Wilson & BR Elbing (2021) “Background noise characterization and event detection at an infrasound array in Oklahoma,” *APS-DFD Annual Meeting*, T31.2, Phoenix, AZ (Nov 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 66(17).
66. RJ KC, S Higginbotham, I Park, BR Elbing & A Ghajar (2021) “Annular flow film thickness measurement and comparison,” *APS-DFD Annual Meeting*, T28.4, Phoenix, AZ (Nov 21-23); abstract in *Bull. Am. Phys. Soc.* Vol. 66(17).
67. L Martire, S Krishnamoorthy, A Komjathy, D Bowman, J Jacob, B Elbing, E Hough, Z Yap, M Lammes, H Linzy, Z Morrison, T Swaim, A Vance & PM Simmons (2021) “A midsummer flights’ dream: Balloon-borne infrasound-based aerial seismology,” *181st Meeting of the Acoustical Society of America*, Seattle, WA (Nov 29-Dec 3); abstract in *Journal of the Acoustical Society of America*, Vol. 150(4), A180 (doi.org/10.1121/10.0008050).
68. S Krishnamoorthy, L Martire, A Komjathy, M Pauken, JA Cutts, DC Bowman, Q Brissaud, JM Jackson, R Garcia, D Minoun, J Jacob, BR Elbing, E Hough, Z Yap, M Lammes, H Linzy, Z Morrison, T Swaim, A Vance & PM Simmons (2021) “[Progress towards balloon-based seismic studies on Venus](#),” *AGU Fall Meeting*, P45A-07, New Orleans, LA and [virtual](#) (Dec 13-17).
69. CE Petrin, T Wilson & BR Elbing (2021) “[Atmospheric infrasound & seismic observations during severe storms from the IRIS USArray](#),” *AGU Fall Meeting*, S55C-0149, New Orleans, LA and [virtual](#) (Dec 13-17).
70. J Jacob, S Smith, AL Houston & BR Elbing (2021) “[Wind sensing in urban environments with uncrewed systems](#),” *AGU Fall Meeting*, A11C-08, New Orleans, LA and [virtual](#) (Dec 13-17).
71. T Wilson, CE Petrin & BR Elbing (2021) “[Event detection at an infrasound array in Oklahoma](#),” *AGU Fall Meeting*, S53C-05, New Orleans, LA and [virtual](#) (Dec 13-17).

72. E Hough, Z Yap, J Jacob, BR Elbing, S Krishnamoorthy, L Martire & DC Bowman (2021) "[Zero pressure solar balloons for infrasound detection on earth and beyond](#)," *AGU Fall Meeting*, S55C-0164, New Orleans, LA (Dec 13-17).
73. Z Yap, E Hough, J Jacob, BR Elbing, L Martire, S Krishnamoorthy & DC Bowman (2021) "[Zero pressure solar balloons for observing gravity wave detection](#)," *AGU Fall Meeting*, SA45A-2209, New Orleans, LA (Dec 13-17).
74. S Krishnamoorthy, DC Bowman, E Hough, Z Yap, L Martire, J Wilding, J Jacob, BR Elbing, A Komjathy, JA Cutts, JM Jackson, RF Garcia, D Mimoun, MT Pauken & Q Brissaud (2022) "Progress towards balloon-based seismology on Venus in 2021-2022," *Int Planetary Probe Workshop*, Poster Session I-50, Santa Clara, CA (Aug 29 – Sep 2).
75. CE Petrin & BR Elbing (2022) "A comparison of wind filters for deployable remote infrasound monitoring," *APS-DFD Annual Meeting*, A11.4, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
76. T Swaim, BR Elbing, JD Jacob, E Hough & Z Yap (2022) "Development of high altitude balloon based sensing of low frequency sounds from severe storms," *APS-DFD Annual Meeting*, A11.7, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
77. BB Lindsey, BR Elbing & I Faruque (2022) "Development and deployment of an infrasound sensor system with tornado chasers," *APS-DFD Annual Meeting*, A11.8, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
78. RJ KC, BR Elbing & AS Alexander (2022) "Study of 3D backwards facing step to improve wind turbine blade performance," *APS-DFD Annual Meeting*, L3.2, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
79. JD Jacob, BR Elbing & K Kara (2022) "Micro flyer requirements for urban wind field observations," *APS-DFD Annual Meeting*, Q3.5, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
80. TC Wilson, BR Elbing & JD Jacob (2022) "Assessment of UAS based atmospheric boundary layer sampling of wind speed," *APS-DFD Annual Meeting*, U33.5, Indianapolis, IN (Nov 20-22); abstract in *Bull. Am. Phys. Soc.* Vol. 67(19).
81. S Krishnamoorthy, DC Bowman, E Hough, Z Yap, J Jacob, BR Elbing, L Martire, A Komjathy, MT Pauken, JA Cutts, RF Garcia, D Mimoun, JD Wilding, JM Jackson & Q Brissaud (2022) "Progress towards balloon-based seismic studies on Venus," *AGU Fall Meeting*, P26B-05, Chicago, IL (Dec 12-16).
82. E Hough, Y Yap, J Jacob, BR Elbing, S Krishnamoorthy, DC Bowman & A Komjathy (2022) "Solar balloon trajectory performance prediction and evaluation," *AGU Fall Meeting*, P55D-1607, Chicago, IL (Dec 12-16).
83. Z Yap, E Hough, J Jacob & BR Elbing (2022) "Solar balloon communication and altitude control for multi-balloon sensor swarms," *AGU Fall Meeting*, P55D-1606, Chicago, IL (Dec 12-16).
84. J Jacob, G Azevedo, BR Elbing, B Revard & T Wilson (2022) "Urban impacts on UAS observations," *AGU Fall Meeting*, A15G-1321, Chicago, IL (Dec 12-16).
85. T Swaim, K Spillman, E Hough, Z Yap, J Jacob & BR Elbing (2023) "Infrasound noise mitigation on high altitude balloons," *184<sup>th</sup> Meeting of the Acoustical Society of America*, 2pCA6, Chicago, IL (May 8-12); abstract in *Journal of the Acoustical Society of America*, Vol. 153(3), A142 (doi.org/10.1121/10.0018442).
86. S Krishnamoorthy, D Bowman, E Hough, Z Yap, JD Wilding, J Jacob, BR Elbing, L Martire, A Komjathy, M Pauken, J Cutts & J Jackson (2023) "Development of balloon-based seismology for Venus through Earth-analog experiments and simulations," *184<sup>th</sup> Meeting of the Acoustical Society of America*, 4aPAa1, Chicago, IL (May 8-12); abstract in *Journal of the Acoustical Society of America*, Vol. 153(3), A278 (doi.org/10.1121/10.0018837).
87. Z Yap, E Hough, J Jacob & BR Elbing (2023) "Solar balloon communication and altitude control for multi-balloon sensor swarms," [2023 Scientific Ballooning Technologies Workshop](#), Fri-1-5, Minneapolis, MN (May 17-19).
88. E Hough, Z Yap, J Jacob, BR Elbing, S Krishnamoorthy, D Bowman & A Komjathy (2023) "Solar balloon trajectory performance," [2023 Scientific Ballooning Technologies Workshop](#), P10, Minneapolis, MN (May 17-19).
89. K Spillman, T Swaim, RJ KC & BR Elbing (2023) "Mitigation of infrasound noise on stratospheric solar powered balloons," *APS-DFD Annual Meeting*, A05.8, Washington, DC (Nov 19-21).
90. BR Elbing, AS Alexander & RJ KC (2023) "Low frequency sounds from tornadoes," *APS-DFD Annual Meeting*, A05.9, Washington, DC (Nov 19-21).
91. RJ KC, BR Elbing & AS Alexander (2023) "Study of serrated backwards facing steps in an adverse pressure gradient via computational methods," *APS-DFD Annual Meeting*, J06.6, Washington, DC (Nov 19-21).
92. EA Silber, DC Bowman, S Krishnamoorthy, CG Carr, RA Haaser, BR Elbing, MA Garces, P Liu, PS Blom, S Albert, D Eisenberg, LB Beardslee, B Beck, E Berg, JW Bishop, G Bracht, JA Cutts, LR Danielson, C Donahue, KB Eack, A Goel, E Hough, J Izraelevitz, J Jacob, RJ KC, A Komjathy, L Martire, E McGhee, LO Giraldo, MR Giannone, K Spillman, G Srinivas, C Van Beek, L Viens, JD Webster, N Weinstein, T Wilson, Z Yap & CP Zeiler (2023) "The OSIRIS-REx sample return capsule re-entry: A coordinated seismo-acoustic observational campaign for the study of meteor phenomena," *AGU Fall Meeting*, S02-07, San Francisco, CA (Dec 11-15).

93. S Krishnamoorthy, DC Bowman, EA Silber, MJ Fleigle, JS Izraelevitz1, A Goel, M Samnani, L Martire, MR Giannone, Z Yap, E Hough, C Carr, BR Elbing, JD Jacob, A Komjathy, JA Cutts, L Beardslee, LR Danielson, C Donahue, L Viens & E McGhee (2023) “Detection of the OSIRIS-REx re-entry vehicle using balloon-borne infrasound,” *AGU Fall Meeting*, S11G-0334, San Francisco, CA (Dec 11-15).
94. S Krishnamoorthy, DC Bowman, E Hough, Z Yap, S G erier, J Wilding, L Martire, T Swaim, J Jacob, BR Elbing, A Komjathy, JA Cutts & JM Jackson (2023) “Progress towards balloon-based seismic studies on Venus,” *AGU Fall Meeting*, P31F-3147, San Francisco, CA (Dec 11-15).
95. T Wilson, EA Silber, BR Elbing & T Colston (2023) “Estimation of bolide entry characteristics through infrasound observations,” *AGU Fall Meeting*, S02-08, San Francisco, CA (Dec 11-15).
96. J Jacob, Z Yap, E Hough, BR Elbing, DC Bowman & S Krishnamoorthy (2023) “Balloon borne infrasound noise identification and reduction,” *AGU Fall Meeting*, S11G-0336, San Francisco, CA (Dec 11-15).

#### GOVERNMENT, UNIVERSITY AND INDUSTRIAL REPORTS (non-refereed)

1. BR Elbing, K Adkins & HS Lee (2003) “Acoustic characteristics of pool boiling,” *National Science Foundation (NSF) – Research Experience for Undergraduates (REU) Report*, MAE-03-04.
2. BR Elbing, AJ Zuckerwar & GC Herring (2004) “High-frequency calibration of microphones by means of free-field measurements,” *NASA Langley Research Center LARSS Report*.
3. BR Elbing, ES Winkel, KA Lay, SL Ceccio, DR Dowling & M Perlin (2007) “Air-layer induced skin-friction drag reduction,” *Univ of Michigan Dept of Naval Architecture and Marine Engineering*, Report 352.
4. M Krane, RS Meyer, M Weldon, M McPhail, BR Elbing, D DeVillbis & RL Campbell (2011) “Hybrid multi-material rotor program phase I: water tunnel test,” *ARL-PSU TR*, N00024-02-D-6604 DO664.
5. BR Elbing, NB Kimerer, JP Welz & RS Meyer (2011) “GTWT safe and arm calibration experiment: cavitation results,” *Applied Research Laboratory – Penn State Technical Report*, TR 11-030.
6. MJ Beam, BL Kline, BR Elbing, JA Mickey, DF Kerstetter, JM Walsh, WA Straka & AA Fontaine (2011) “Marine hydrokinetic turbine power-take-off design for DOE reference model 1,” *Applied Research Laboratory – Penn State Technical Report*, TR 11-044.
7. BR Elbing, JP Welz & RF Kunz (2012) “Pratt & Whitney gear lubrication project: ARL experimental effort,” *Applied Research Laboratory – Penn State Technical Memorandum*.
8. BR Elbing, SD Young, ML Jonson, RL Campbell, BA Craven, RF Kunz & KL Koudela (2014) “Hybrid Multi-Material Rotor (HMMR) Phase 2: A low-frequency, high amplitude hydrodynamic fluid-structure-interaction experiment,” *DARPA Technical Report*, TR 13-004 (public release).
9. MJ Moeny, TA Camp, BR Elbing, MH Krane, MJ Weldon, & JP Welz (2014) “Stereo particle-image velocimetry system for the measurement of high-speed flows,” *ARL-PSU*. TR 14-003.

#### TEACHING

##### COURSES TAUGHT († new preparation; # co-taught course; \* permanent addition to curriculum)

1. CE 360, Fluid Mechanics, undergraduate course Pennsylvania State University
  - Fall 2012 69 students Instructor 5.9/7.0 Course 5.7/7.0
2. ENSC 3233, Fluid Mechanics, undergraduate course Oklahoma State University
  - Fall 2015<sup>†</sup> 179 students<sup>#</sup> Instructor 4.4/5.0 Course 3.5/4.0
  - Spring 2017<sup>†</sup> 211 students<sup>#</sup> Instructor 4.1/5.0 Course 3.2/4.0
  - Fall 2017 109 students<sup>#</sup> Instructor 4.6/5.0 Course 3.5/4.0
  - Spring 2019 88 students<sup>#</sup> Instructor 4.4/5.0 Course 3.2/4.0
  - Fall 2019 55 students<sup>#</sup> Instructor 4.4/5.0 Course 3.4/4.0

3. MAE 3333, Fundamental Fluid Dynamics, UG course Oklahoma State University
  - Fall 2020<sup>†,\*</sup> 48 students<sup>#</sup> Instructor 4.4/5.0 Course 4.3/5.0
  - Spring 2021<sup>†</sup> 127 students<sup>#</sup> Instructor 3.5/5.0 Course 3.5/5.0
  - Spring 2022 172 students Instructor 3.8/5.0 Course 3.5/5.0
  - Fall 2022 62 students Instructor 4.3/5.0 Course 4.0/5.0
  - Fall 2023 49 students Instructor 4.1/5.0 Course 3.6/6.0
  
4. MAE 4273, Experimental Fluid Dynamics, UG/grad course Oklahoma State University
  - Spring 2014<sup>†</sup> 15 UG students Instructor 5.0/5.0 Course 3.9/4.0
  - Fall 2014 16 UG/3 Grad Instructor 4.8/5.0 Course 3.5/4.0
  - Spring 2016 9 UG students Instructor 5.0/5.0 Course 3.8/4.0
  - Fall 2016 17 UG/2 Grad Instructor 4.6/5.0 Course 3.3/4.0
  - Spring 2018<sup>†</sup> 13 UG/1 Grad Instructor 4.5/5.0 Course 3.2/4.0
  - Fall 2018<sup>†</sup> 14 UG students Instructor 4.2/5.0 Course 3.4/4.0
  - Spring 2020 6 UG students Instructor 4.7/5.0 Course 3.7/4.0
  
5. MAE 5010, Scientific Ballooning, graduate course Oklahoma State University
  - Fall 2021 4 students<sup>#</sup> Instructor 5.0/5.0 Course 4.7/5.0
  
6. MAE 5233, Viscous Fluid Dynamics, graduate course Oklahoma State University
  - Fall 2013<sup>†</sup> 22 students Instructor 4.1/5.0 Course 3.7/5.0
  
7. MAE 5233, Advanced Fluid Dynamics I, graduate course Oklahoma State University
  - Fall 2015<sup>†</sup> 15 students Instructor 4.2/5.0 Course 4.5/5.0
  - Fall 2017 11 students Instructor 3.8/5.0 Course 3.9/5.0
  - Fall 2019<sup>†</sup> 4 students NA NA
  - Fall 2021 14 students Instructor 4.8/5.0 Course 4.6/5.0
  
8. MAE 5273, Advanced Fluid Dynamics II, graduate course Oklahoma State University
  - Spring 2015<sup>†,\*</sup> 5 students Instructor 4.6/5.0 Course 3.6/4.0
  - Spring 2017 7 students Instructor 4.0/5.0 Course 3.0/4.0
  - Spring 2019 8 students Instructor 4.5/5.0 Course 3.5/4.0

## UNDERGRADUATE RESEARCH OPPORTUNITIES

### 1. Undergraduate Research Supervision

	Year	Student Name	Program/Activity	Project Title/Description
1	2006	Laëtitia Decoster	ENSTA ParisTech RA	Polymer drag reduction in a turbulent boundary layer
2	2007	Valentine Jaillant	ENSTA ParisTech RA	Analysis of polymer drag reduction results
3	2010	Karen Dowling	CalTech, RA	Non-Newtonian cylinder wake structure
4	2010	Gisele Papo	Univ of Michigan, RA	Non-Newtonian cylinder wake structure
5	2014	Arnesha Threatt	Research Assistant	Experimental testing of bat ear tubercles
6	2014-2015	Eric Ruhlmann	<i>W.W. Allen Scholar</i>	Design of a system for water degassing
7	2014-2015	Chris Petrin	Research Assistant	Influence of tubercles on bat ear aerodynamics
8	2014-2016	Dalton Dunlap	Research Assistant	Design of a pressure regulation system for water tunnel
9	2014-2016	Madison Likins	<i>Wentz Semester Research Grant</i>	Attenuation of infrasound within the atmosphere
10	2016	Muhammad Raza	Research Assistant	Analysis of bubble images within a column



	<b>Year</b>	<b>Student Name</b>	<b>Program/Activity</b>	<b>Project Title/Description</b>
11	2016	Kevin Moseni	Research Assistant	Characterization of bubble sizing within a VBC
12	2016	Shannon Maher	Research Assistant	Design, fabrication & installation of infrasonic array
13	2016	Trenton Brown	Research Assistant	Infrasound setup for 2016 CLOUD-MAP field demo
14	2016-2017	Brandon Whitney	Research Assistant	Wall locations within wall bounded PIV data
15	2016-2017	Tyler Hinds	Research Assistant	Refurbishing of a custom shaker table
16	2016-2017	Trevor Wilson	Research Assistant	Image automation for bubble position and sizing
17	2016-2017	Real KC	Research Assistant	Characterization of flow over a BFS and CVG
18	2016-2017	Erin Peterson	Research Assistant	Molecular weight analysis of PEO polymer solutions
19	2016-2017	Sarah Bonk	Research Assistant	Characterization of polymer solution
20	2016-2017	Melissa Duncan	Research Assistant	Influence of polymer preparation on Mw
21	2016-2017	Alec Barker	Research Assistant	Model fabrication for Edge Aerodynamix exp
22	2016-2017	Jacquelyne Baade	Research Assistant	Polymer degradation caused by an injector
23	2016-2017	Jalen Golphin	Research Assistant	Investigation of earthquake infrasound
24	2016-2018	Bret Valenzuela	Research Assistant	Design and fabrication of bubble measurement methods
25	2016-2018	Savannah Robisch	<i>W.W. Allen Scholar</i>	Characterization of a laminar BL on an airfoil
26	2016-2018	Jacob Niles	Research Assistant	Experimental CVG characterization
27	2017-2018	Logan King	Research Assistant	Assistance with polymer drag reduction experiments
28	2017-2018	Katrine Hareland	Research Assistant	Analysis of atmospheric infrasonic sources
29	2018	Mason Keesling	Research Assistant	Fabrication of conformal vortex generators
30	2018	Christian Coletti	Research Assistant	2D modeling of a conformal vortex generator
31	2017-2019	Jared Hartzler	Research Assistant	Identification of infrasound from hail events
32	2017-2019	JW Wallace	<i>UG Research Scholar</i>	Polyethylene oxide hydration time scaling
33	2018-2019	Lauren Jones	Research Assistant	Lift generated from bat ear tubercles
34	2017-2020	Shelby Webb	<i>UG Research Scholar</i>	Development of an infrasound source
35	2019-2021	Bryce Lindsey	Research Assistant	Maintenance of infrasound array
36	2016-2021	Alexis Vance	<i>W.W. Allen Scholar Goldwater Scholar</i>	Heliotrope launch operations
37	2020-2022	Payton Simmons	Research Assistant	Launching heliotropes for NASA PSTAR
38	2022-present	Madison Hill	<i>UG Research Scholar</i>	Latent heat impact of swirling jets
39	2022-present	Kate Spillman	<i>UG Research Scholar</i>	Infrasound from above severe storms
40	2022-present	Stephen Young	<i>UG Research Scholar</i>	GPS tracking of a mobile infrasound sensor
41	2022-present	Tommy Colston	Research Assistant	Atmosphere turbulence measurements from drones

## 2. Senior Capstone Design Team Advising

- Madison Likins, Jacob Bertrand, Jacob Nichols and Max Niemeyer (2016) “Early tornado detection,” MAE Senior Capstone Design Final Report, spring semester.
- Sarah Bonk, Erin Peterson, Melissa Duncan and Alec Barker (2017) “Low volumetric flow rate injection system,” MAE Senior Capstone Design Final Report, spring semester.
- Doug Fox, Jerad Wunder and Daxton Ruger (2018) “Senior Design Project: Rotary subwoofer,” MET 4123 Senior Design Project, Mechanical Engineering Technology, fall semester.
- Willam Van Dyke, Blake Hopp, Kyle Richards and Nathan Seaton (2023) “Nationwide eclipse ballooning project final report,” MAE Senior Capstone Design Final Report, fall semester.

## SERVICE TO THE PROFESSION

### 1. Professional Societies and Associations

*American Physical Society (APS) – Division of Fluid Dynamics (DFD)*; member

- Committee Member; Media & Science Relations Committee (2020-2023)
- Session Chairman (2014-2016, 2018, 2022)

*American Institute of Aeronautics and Astronautics (AIAA)*; member

- Session Chairman (2017)

*American Society of Mechanical Engineers (ASME)*; member

- Article Reviewer (2016)

*Acoustical Society of America (ASA)*; member

*American Society of Engineering Education (ASEE)*

- Evaluation Panelist; DoD SMART Scholarship Evaluation Panel

*Oklahoma AIAA/ASME Symposium*

- Organizing Committee Member, [35<sup>th</sup> Symposium](#), Stillwater, OK (April 18, 2015).
- Session Chairman (2014-2016)

### 2. Technical Proposal Review Panels

- NSF Review Panelist; CBET – Fluid Dynamics, 2015.
- NASA, Missouri Space Grant/EPSCoR Program (2015).
- Technology Foundation STW (Dutch funding agency) (2015).
- Swiss National Science Foundation (2018)
- NSF Reviewer; AGS – Physical & Dynamic Meteorology, 2020

### 3. Journal Article Reviews

- Public profile: [publons.com/a/480485/](https://publons.com/a/480485/)
- Total papers reviewed (verified): **140**.
- Select Journals: *Science*, *Journal of Fluid Mechanics*, *AIAA Journal*, *Geophysics*

## SERVICE TO THE PUBLIC

### 1. Transitioning basic fluid mechanics research to real-world applications

- Invited Member; ONR Workshop on Polymer Drag Reduction for Surface Ships, Arlington, VA, September 6-7, 2007; Identified a fundamental scaling law that set limits on its use [Elbing et al., 2011, JFM]
- Proposed a fundamental scaling law for air layer drag reduction that predicted its success when it was later implemented on a Japanese ship and saved ~10% fuel [Steven Ashley, “[Slippery ships that float on air](#),” *Scientific American*, Dec 30, 2008; “Airships of the sea,” *The Economist*, Dec 11, 2010; Elbing et al., 2013, JFM]
- Proposed and experimentally verified a polymer hydration scaling law that was used to develop a polymer drag reduction system for the *2010 America’s Cup* (BMW/Oracle Racing Team) [John Casey, “[Blow your mind](#),” *Sailing Anarchy*, published Feb 19, 2010; the “slick system” for drag reduction]
- Experimentally developed scaling laws for the lubrication of the *Pratt & Whitney geared turbofan* that was immediately implemented and improved the performance
- Designed a water tunnel experiment for helicopter rotor hub that identified an error in computational models that had been impacting helicopter designs for decades. Now all rotor hub experiments are performed in water tunnels, which has led to a revolution in modelling efforts since being shown in 2013.

## 2. Broadening participation in STEM

- Research Advisor for 26 women; Advised research activity for 2 Phd student (1 graduated), 5 MS students (3 graduated), and 19 undergraduate (17 graduated).
- Research Advisor for at least 8 Under-Represented Minorities (URM); Advised 4 URM M.S. students (2 graduated) and 4 undergraduates (4 graduated).
- *Oklahoma-Louis Stokes Alliance for Minority Participation (OK-LSAMP)*
- *Bucknell University Externship Program*, mentored a sophomore female ME student, 2013.
- International Activities
  - Fall 2014, Course Mentor; OSU-Southwest Jiaotong University (SWJTU) Faculty Training Program
  - Summer 2017, Lab Tour, Northwest A&F University (西北农林科技大学).
  - 2017-2018, Xue Jing, Visiting Scholar, Inner Mongolia Agricultural University, visiting for 1 yr.

## 3. K-12 STEM Outreach

- *Oklahoma State Science and Engineering Fair (OSSEF)*, Scientific Review Committee; reviewed projects for compliance with the Regeneron International Science and Engineering Fair (ISEF) rules, 2023
- *Upward Bound Program*, First-generation-college and/or low-income high school students job shadow me and my graduate students for 5 weeks during the summers, 17 students, 2016-2019
- *National Laboratory Day*, Hosts a Hands-On Laboratory Demonstration: “Slippery when wet” (2016-2019)
- *CEAT Summer Bridge Program*

## 4. Selected media coverage of research

- Television: *National Geographic Channel, Weather Channel*, local news (Oklahoma, Missouri, N. Carolina, etc.)
- Radio/Podcast: *NPR All Things Considered, WeatherBrains, Business Weather, Texas Standard*
- Articles: *Washington Post, Physics Today, Wired, CNET, USA Today, Scientific American, Economist*
- International Coverage: Australia, Canada, China, Germany, Indonesia, Italy, Japan, Korea, Spain, UK

## SERVICE TO THE UNIVERSITY

1. [university] CEAT Member, Oklahoma State University Equity Working Group, 2021-2022
2. [university] CEAT Primary Faculty Member, University Technology Services Fee Committee, 2015-2017
3. [college] CEAT Faculty Advisory Council, 2022-present
4. [college] Chair, Fluids & Hydraulics Lab Course Development Committee, 2019-2022
5. [college] Member; ENSC 3233 (Fluid Mechanics) Oversight Committee, 2014-2021
6. [college] ENDEAVOR Undergraduate Laboratory Building Planning & Development, 2014 – 2018
  - Member; Flow Lab Committee, (2017-2018)
  - Member; Flow System Laboratory Working Group, (2015-16)
  - Member; Instrumentation/Mechatronics Working Group (Fall 2015)
  - Member; Energy Production & Transport Lab Design Charrette (July 2015)
  - Member; Process & Environmental Lab Committee (Spring 2015)
  - Member; Undergraduate Laboratory Building Planning Team (Spring 2014)
7. [college] Faculty Search Committee, Mechanical Engineering Technology, Fall 2018-Spring 2019.
8. [department] Search Committee, MAE Department Head, 2020-2021 (chair – Andy Arena).
9. [department] Faculty Search Committee, 2014-2015 (chair – Afshin Ghajar).