**Michael J. Benson, Ph.D., P.E.**

**Fellow, American Society of Mechanical Engineering**

**PERSONAL INFORMATION**

**Current Position:**

Mechanical Engineer

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**ACADEMIC BACKGROUND**

**Education:**

Doctor of Philosophy, Mechanical Engineering, Stanford University, 2011

Degree of Engineer, Mechanical Engineering, Stanford University 2003

Master of Science, Mechanical Engineering, Stanford University, 2003

Bachelor of Science, Mechanical Engineering, United States Military Academy, 1994

**Academic Positions:**

Professor of Mechanical Engineering, 2020 - present

Associate Professor, D/C&ME, USMA, 2015- 2020

Assistant Professor, D/C&ME, USMA, 2011-2015

Assistant Professor, D/C&ME, USMA, 2005

Instructor, D/C&ME, USMA, 2003-2004

**PROFESSIONAL QUALIFICATIONS**

Professional Engineer, 1998, Missouri License No. 029624

Private and Instrument Rated Pilot Licenses 2000-2003

Society Membership: American Society of Mechanical Engineers (ASME) 1994-Present, American Society of Engineering Education (ASEE) 2011-Present, Phi Kappa Phi 1994-Present, Army Engineer Association (AEA) 1994-Present, American Physical Society (APS) 2011-Present, American Institute for Aeronautics and Astronautics (AIAA) 2016-Present

**TECHNICAL MILITARY EXPERIENCE**

**Iraq Resident Office, Officer in Charge, Middle East District, Transatlantic Division, U.S. Army Corps of Engineers (USACE), Baghdad, Iraq (2015).**

Installed a fully instrumented real time monitoring system to assess changes in conditions at the Mosul Dam in Ninevah Province, Iraq. Oversaw construction projects in Iraq in excess of $120 Million and coordinated and led the return of USACE into Iraq after over 15 months outside the country. Advised the most senior U.S. leaders across multiple agencies on the conditions of the Mosul Dam to include the subsequent U.S. strategy for the facility which involved the commitment of over $1.5 Billion from the World Bank and the United States.

**Battalion Operations Officer, 3rd BSTB, 25th Infantry Division, Schofield Barracks, HI (2007-2008).**

Coordinated the training and operations for a 500 Soldier battalion that provided the essential communications architecture, intelligence, engineer, and chemical support for a Brigade Combat Team.

**Brigade Engineer, 3rd IBCT, 25th Infantry Division in support of Operation Iraqi Freedom, Kirkuk, Iraq (2006-2007).**

Coordinated reconstruction efforts in Northern Iraq in excess of $100 million. Liaised with provincial officials daily to ensure they could track, sustain, and resource over 100 projects as diverse as water treatment, educational institutions, medical facilities, and road construction. Additionally, implemented counter-improvised explosive device operations for the Brigade Combat Team, to include identification and removal of devices and roadway repair missions.

**B/91st Engineer Company Commander, Ft. Hood, TX (1999-2001).**

Commanded a company of approximately 90 engineer Soldiers in support of mechanized infantry units of the 1st Cavalry Division. Employed mechanized bridging assets, earthmoving equipment, and sappers to support maneuver commanders through mobility assurance, general engineering, field fortifications, and defensive strategies.

**91st Engineer Battalion S4, Ft. Hood, TX (1998-1999).**

Logistical officer for a 400 Soldier battalion that deployed in support of Operation Enduring Freedom to Bosnia-Herzegovina in support of peacekeeping operations. Coordinated movement of personnel and material into and out of theater through ports of embarkation in Houston, TX and Zagreb, Croatia.

**65th Engineer Battalion S1, Schofield Barracks, HI (1997-1998).**

Personnel officer for a 350 Soldier battalion that provided combat engineering expertise to the 25th Infantry Division (Light). Deployed personnel throughout the Pacific Rim including Japan, Korea, Australia, and Thailand. Responsible for administrative functions including awards, evaluations, and promotions.

**65th Engineer Assault & Obstacle Platoon Leader, Schofield Barracks, HI (1996-1997).**

Led the only heavy equipment platoon in the 25th Infantry Division (Light). Supported maneuver units through combat engineering and field fortifications worldwide, including multiple deployments to Pohakaloa Training Area, Hawaii, and the Joint Readiness Training Center at Ft. Polk, LA.

**1/C/65th Platoon Leader, Schofield Barracks, HI (1995-1996).**

Led 28 Sappers in combat engineering missions in support of 2-27 IN Wolfhounds. Responsible for coordinating the engineer planning in support of Task Force requirements. Provided combat engineering expertise for mobility, counter-mobility, and survivability operations throughout the Pacific theater, including deployment to the Joint Readiness Training Center at Ft. Polk, LA.

**TEACHING**

**Courses Taught (**Courses in **Bold** include classroom instruction**):**

**ME 201** (USMA) Introduction to Mechanical Engineering (1 semester)

**ME 301** (USMA) Thermodynamics (4 semesters, including 3 semesters as Course Director)

**ME 350** (USMA) Army Applications of Thermal Fluid Systems (1 semester, incl Course Direct.)

**ME 370** (USMA) Computer Aided Design and Engineering (1 semester)

**MC 311** (USMA) Thermal Fluid Systems 1 (5 semesters)

**MC 312** (USMA) Thermal Fluid Systems 2 (2 semesters, both as Course Director)

ME 389/489/a (USMA) Adv Individual Study in Mechanical Engineering, (15 semesters – 57 students, 2 semesters as Course Director)

**ME 404 (**USMA) – Mechanical Engineering Design (12 semesters as capstone advisor, 1 semester as Course Director)

**ME 480** (USMA) – Heat Transfer (9 semesters, including 6 semesters as Course Director)

**ME 491** (Stanford University) Ph.D. Teaching Experience (1 quarter). Taught classes in **Jet Engine** and **Convective Heat Transfer**

**ME 496** (USMA) Capstone Design, (11 semesters, including 2 semesters as Course Director)

**SCHOLARSHIP**

**Journal Articles (Refereed journals):**

1. Owkes, M, Homan T, **Benson M**, Banko A., High fidelity simulations of contaminant dispersion in urban environment with comparison with magnetic resonance measurement. *Wind Engineering and Industrial Aerodynamics* 2023, *submitted*.
2. **Benson, M**., Banko, A., Elkins, C., An, D., Song, S., Bruschewski, M., Grundmann, S., Bandopadhyay, T., Roca, L., Sutton, B., Han, K., Hwang, W., Eaton, J. MRV challenge 2: phase locked turbulent measurements in a roughness array. *Exp Fluids,* 64, 28 (2023). <https://doi.org/10.1007/s00348-023-03572-4>.
3. Dacunto, P., Ng A., Moser, D., Tovkach A., Scanlon, S., Benson, M. 2022. Effects of location, classroom orientation, and air change rate on potential aerosol exposure: an experimental and computational study. *Environmental Science: Processes and Impacts*, 24, 557-566, <https://doi.org/10.1039/D1EM00434D>.
4. Bruschewski, M., John, K, **Benson, M**., Grundmann, S. Combined Temperature and Velocity Field Measurements in Thermal Fluid Systems with Magnetic Resonance Velocimetry. *Tm- Technisches Messen*, 2022. <https://doi.org/10.1515/teme-2021-0122>.
5. Davidson, T., Helmer, D., Parker, C., Cox, L., Kahn, K., Elkins, C., Clark, J., Humbert, N., Van Poppel, B., and **Benson, M**. Detailed velocity and heat transfer measurements of an advanced insert for impingement cooling. *Int J Heat Mass Transf*, April 2022; 185. <https://doi.org/10.1016/j.ijheatmasstransfer.2021.122066>
6. **Benson, M. J**., Bindon, D., Cooper, M., Davidson, F., Duhaime, B., Helmer, D., Woodings, R., Van Poppel, B. P., Elkins, C. J., and Clark, J. P. Detailed Velocity and Heat Transfer Measurements in an Advanced Gas Turbine Vane Insert Using Magnetic Resonance Velocimetry and Infrared Thermometry." ASME. *J. Turbomach*. February 2022; 144(2): 021009.  <https://doi.org/10.1115/1.4052310>
7. Homan TA, **Benson MJ**, Banko AJ, Elkins CJ, Chung DH, Rhee J, Mooradian LD, Eaton JK, Magnetic Resonance Imaging measurements of scalar dispersion for a scaled urban transient release, *Building and Environment* 2021, <https://doi.org/10.1016/j.buildenv.2021.108163>.
8. Dacunto, P., Moser, D., Ng, A., **Benson, M**. Classroom Aerosol Dispersion: Desk Spacing and Divider Impacts. *Int J Environ. Sci. Technol.* 2021*.* <https://doi.org/10.1007/s13762-021-03564-z>
9. Brown, A., Clemenson, M., **Benson, M**., Elkins, C., Jones, S. An Urban Dispersion Inspired Scenario for CFD Model Validation. *Fire Safety Journal* 2020. <https://doi.org/10.1016/j.firesaf.2020.103130>.
10. **Benson, M**., Elkins, C., Song, S., An, Don-Gwan, Bruschewski, M., Grundman, S., John, K., Banko, A., Borup, D., Eaton, J. The 2019 Magnetic Resonance Velocimetry Challenge. *Experiments in Fluids* 2020*,* <https://doi.org/10.1007/s00348-020-02986-8>*.*
11. Owkes, M., **Benson, M**., Elkins, C., Wilde, N., Van Poppel, B. Three-Dimensional Velocity and Concentration Measurements and Simulations of a Scaled Jack Rabbit II Mock Urban Array. *Atmospheric Environment* 2020, [https://doi.org/10.1016/j.atmosenv.2020.117520](https://nam02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdoi.org%2F10.1016%2Fj.atmosenv.2020.117520&data=02%7C01%7Cmichael.benson%40westpoint.edu%7Cf8e8d87d15d84fda6ea608d7f29f4e94%7C99ff8811351740a9bf1045ea0a321f0b%7C0%7C0%7C637244638349766461&sdata=FUydywZc3ZvmXjaoe%2B04IQEf5lN9rGroicVksfHAjqs%3D&reserved=0).
12. Wang, Y., **Benson, M.** (2020)Large-eddy simulation of turbulent flows over an urban building array with the ABLE-LBM and comparison with 3D MRI observed data sets. *Enviro Fluid Mech*, <https://link.springer.com/article/10.1007/s10652-020-09770-6>.
13. Banko, A., **Benson, M.,** Gunady, I., Elkins, C, Eaton, J. An Improved 3-Dimensional Concentration Measurement Technique Using Magnetic Resonance Imaging. *Exp Fluids* 2020, **61**, 53, <https://doi.org/10.1007/s00348-020-2889-9>.
14. **Benson, M**., Wilde, N., Brown, A., Elkins, C. Detailed Magnetic Resonance Imaging Measurements of a Contaminant Dispersed in an Oklahoma City Model. *Atmospheric Environment* 2019*,* <https://doi.org/10.1016/j.atmosenv.2019.117129>*.*
15. **Benson, M.**, Van Poppel, B., Elkins, C. and Owkes, M. Three Dimensional Velocity And Temperature Field Measurements Of Internal And External Turbine Blade Features Using Magnetic Resonance Thermometry. *J Turbomach* 2019, 141(7), 071011, <https://doi.org/10.1115/1.4043151>.
16. Shim, G., Prasad, D., Elkins, C., Eaton, J., **Benson, M**. 3D MRI Measurements of the Effects of Wind Direction on Flow Characteristics and Contaminant Dispersion in a Model Urban Canopy. *Environ Fluid Mech* 2019*,*[https://doi.org/10.1007/s10652-019-09676-y](%20https:/doi.org/10.1007/s10652-019-09676-y).
17. Coletti, F., **Benson, M.**, Sagues, A., Miller, B., Fahrig, R., Eaton, J. Three-Dimensional Mass Fraction Distribution of a Spray Measured by X-Ray Computed Tomography, *J. Eng. Gas Turbines Power* 2014, 136(5), 051508, <https://doi.org/10.1115/1.4026245>.
18. Coletti, F., **Benson, M**., Ling, J., Elkins, C., Eaton, J. Turbulent Transport in an Inclined Jet in Crossflow. *Intl J Heat Fluid Flow* 2013, 43, 149-160, <https://doi.org/10.1016/j.ijheatfluidflow.2013.06.001>.
19. **Benson, M.**, Yapa, S., Elkins, C, Eaton, J. Experimental-Based Redesigns for Trailing Edge Film Cooling of Gas Turbine Blades. *J Turbomach* 2013, 135(4), 041018, <https://doi.org/10.1115/1.4007601>.
20. Ling, J., Yapa, S., **Benson, M.**, Elkins, C., Eaton, J. Three-Dimensional Velocity and Scalar Field Measurements of an Airfoil Trailing Edge with Slot Film Cooling: The Effect of an Internal Structure in the Slot. *J Turbomach* 2013, 135(3), 031018, <https://doi.org/10.1115/1.4007520>.
21. **Benson, M.**, Laskowski, G., Elkins, C., Eaton J. Film-cooled trailing edge measurements: 3D Velocity and Scalar Field. *J Turbomach* 2012, 135(1),011030-7, <https://doi.org/10.1115/1.4006425>.
22. **Benson, M.**, Elkins, C., Yapa, S., Ling, J., Eaton J. Effects of Varying Reynolds Number, Blowing Ratio, and Internal Geometry on Trailing Edge Cutback Film Cooling. *Experiments in Fluids* 2012*,* <https://doi.org/10.1007/s00348-012-1260-1>.
23. **Benson, M.**, Elkins, C., Eaton J. Measurements of 3D velocity and scalar field for a film-cooled airfoil trailing edge. *Experiments in Fluids* 2011*,* <https://doi.org/10.1007/s00348-011-1062-x>.
24. Arnas, O., Boettner, D, Tamm, G, Norberg, S, Whipple, J, **Benson, M.**, Van Poppel, B. On the Analysis of the Aerodynamic Heating Problem. *J Heat Trans* 2010*, 132, 124501-4*., <https://doi.org/10.1115/1.4001754>.
25. Tamm, G, Boettner, D., Van Poppel, B, **Benson, M.**, Arnas, O. On the Similarity Solution for Condensation Heat Transfer*.*  *J Heat Trans* 2009*, 131(11), 11501-5*, <https://doi.org/10.1115/1.3154920>.
26. **Benson, M.**, Elkins, C, Mobley, P., Alley, M., Eaton J. Three-dimensional concentration field measurements in a mixing layer using magnetic resonance imaging. *Experiments in Fluids* 2009*, 49,* 43-55, <https://doi.org/10.1007/s00348-009-0763-x>.
27. **Benson, M.**, Tanaka, T., Eaton, J. The Effects of Wall Roughness on Particle Velocities in a Turbulent Channel Flow. *J Fluids Engr* 2005*, 127(2)*, 250-256, <https://doi.org/10.1115/1.1891149>.

**Conference Proceedings (Refereed proceedings):**

1. Banko, A. Gehl, J., Ellwein, B., Iliff, S., Ederle, P., **Benson, M., “**Measurements of Natural Ventilation Within a Model Sports Stadium Using Magnetic Resonance Imaging and Planar Laser Induced Fluorescence.” *Proceedings of the ASME 2023 International Mechanical Engineering Congress and Expo:* New Orleans, LA, paper no. IMECE2023-112397.
2. Banko, A., Benson, M., Davidson, F., Zia, W., Bordbar, A., Boyce, C., Thole, K. “Effects of Surface Roughness on Three-Dimensional Flow Structure Within Shaped Film Cooling Holes.” *2023 IGTI Turbo Expo Conference: Accepted.*
3. Hirn, M.., Rodriguez, A., Owkes, M**.,** Dacunto, P., Ng, A., Rogers, J., **Benson, M., “**Aerosol Dispersion Modeling With a Low-Cost Flow Simulation Tool: Analysis of Performance and Boundary Condition Sensitivity.” *Proceedings of the ASME 2022 International Mechanical Engineering Congress and Expo:* Columbus, OH, paper no. IMECE2022- 95997.
4. Eckstein, A., Banko, A., **Benson, M., “**Unsteady Dynamics of a Low Aspect Ratio Mixing Layer.” *Proceedings of the ASME 2022 International Mechanical Engineering Congress and Expo:* Columbus, OH, paper no. IMECE2022-94876.
5. Banko, A., Homan, T., **Benson, M.,** Elkins, C., “Measurements of 3D Transport Boundaries with Urban Canopies Using Magnetic Resonance Imaging.” *12th International Symposium on Turbulence and Shear Flow Phenomenon*: Virtual Conference, 19-22 July 2022, paper ID 296.
6. Colpo, M., Homan, T., Zalar, Z., **Benson, M.,** Banko, A., “Three-Dimensional Measurements of Flow and Scalar Dispersion Through a Stadium Using MRI.” *12th International Symposium on Turbulence and Shear Flow Phenomenon*: Virtual, 19-22 July 2022, paper ID 443.
7. Doshi, P., Fuhrman, G., Moser, D**., Benson, M., “**Three-Dimensional Velocity and Concentration Measurements of Contaminant Release in a Scaled Urban Array.” *Proceedings of the ASME 2021 International Mechanical Engineering Congress and Expo:* DOI: <https://doi.org/10.1115/IMECE2021-73756>.
8. Humbert, N.**,** Galante, J., Davidson, F.T., Helmer, D., Elkins, C., Tamm, G., **Benson, M.** “Velocity and Heat Transfer Studies of an Impinging Jet using Magnetic Resonance Velocimetry and Infrared Thermometry.” *Proceedings of the ASME 2021 International Mechanical Engineering Congress and Expo:* DOI: <https://doi.org/10.1115/IMECE2021-71713>.
9. Dacunto, P., Moser, D., Tovkach, A., Scanlon, S., Ng, A., **Benson, M.** “Classroom Aerosol Dispersion: Impact of Classroom Orientation and Instructor Location on Potential Exposure.” *ISIAQ* *Healthy Buildings*2021*– America***,** paper no. 222**.**
10. **Benson, M**.**,** Chung, D.**,** Fuhrman, G., Helmer, D., Homan, T., Mooradian, L.,Rhee, J., Elkins, C., Banko, A. “Three-Dimensional Concentration and Velocity Measurements of a Pulsatile Contaminant Release in a Model of Oklahoma City.” *Proceedings of the ASME 2020 International Mechanical Engineering Congress and Expo:* DOI: <https://doi.org/10.1115/IMECE2020-23648>.
11. **Benson, M.**, Bindon, D., Cooper, M., Davidson, F., Duhaime, B., Helmer, D., Woodings, R., Van Poppel, B., Elkins, C., Clark, J. “Detailed Velocity and Heat Transfer Measurements in an Advanced Gas Turbine Vane Insert using MRV and IR Thermometry.” *2020 IGTI Turbo Expo Conference:* DOI: <https://doi.org/10.1115/GT2020-14984>.
12. Brown, A., Jones, S., Clemenson, M., **Benson, M.,** Elkins, C., “3D Analysis of Concentration and Flow Using the MRC/MRV 90 Degree Flow Data and CFD.” *2nd Pacific Rim Thermal Engineering Conference*, Maui, HI, paper no PRTEC-24360.
13. **Benson, M.,** Wilde, N., Brown, A., Clemenson, M., Elkins, C. “Detailed Experimental Measurements and Simulations in Oklahoma City: Joint Urban 2003.” *CBD S&T Conference 2019*, Cincinnati, OH, poster.
14. Brown, A., Clemenson, M., **Benson, M.,** Elkins, C. “Detailed Advection and Diffusion Validation of CFD with MRC/MRV 3D Data.” *CBD S&T Conference 2019*, Cincinnati, OH, poster.
15. **Benson, M.,** Wilde, N., Elkins, C., Owkes, M., Van Poppel, B., Helmer, D. “Experimental and Simulation Comparisons within the Jack Rabbit 2 Mock Urban Array.” *CBD S&T Conference 2019*, Cincinnati, OH, poster.
16. **Benson, M**., Elkins, C., Cooper, M., and Van Poppel, B. “Magnetic Resonance Thermometry: An Emerging Three-dimensional Temperature Diagnostic Technique.” ASME *2019 Summer Heat Transfer Conference*, Bellevue, Washington, DOI: <https://doi.org/10.1115/HT2019-3484>.
17. Bellocchio, A., **Benson, M.,** Van Poppel, B., Norberg, S., Benz, R. “A Re-envisioned Gas Turbine Laboratory for an Undergraduate Mechanical Engineering Program.” *2019 IGTI Turbo Expo Conference*: Phoenix, AZ, DOI: <https://doi.org/10.1115/GT2019-91616>.
18. Brown, A., Clemenson, M, Lance, B., Elkins, C., **Benson, M**. “Atmospheric Flow Validation for Contaminant Transport.” *2019 American Society of Mechanical Engineering Verification and Validation Symposium*: Las Vegas, NV, paper no VVS2019-5191.
19. Tamm, G., Cooper, M., **Benson, M**., and Van Poppel, B. “Experimental Study of a Turbulent Impinging Jet in an Undergraduate Heat Transfer Laboratory.” *American Society of Thermal and Fluids Engineers (ASTFE) 4th Thermal and Fluids Engineering Conference*, Las Vegas, NV, paper no TFEC-2019-27644.
20. Fisk, B, Van Poppel, B., **Benson, M**., Tamm G., Peters, A., and German, A., “Undergraduate Internal Flow Convection Heat Transfer Laboratory.” *American Society of Thermal and Fluids Engineers (ASTFE) 4th Thermal and Fluids Engineering Conference*, Las Vegas, NV, paper no TFEC-2019-27539.
21. Brown, A., Benavidez, E., Clemenson, M., **Benson, M.**, Elkins, C. “Contaminant Dispersion Validation Simulations for an Urban Inspired Scenario.” *American Society of Thermal and Fluids Engineers (ASTFE) 4th Thermal and Fluids Engineering Conference:* Las Vegas, NV, paper no TFEC-2019-27454.
22. Siegel, N., Schlenker, A., Sullivan, K., Valdez, I., Rodebaugh, G., Elkins, C., Van Poppel, B., **Benson, M.** “Design and Analysis of a Spin Stabilized Projectile Using Magnetic Resonance Velocimetry.” *2019 AIAA Science and Technology Forum and Exposition*, San Diego, CA, DOI 10.2514/6.2019-0843.
23. Siegel, N., Schlenker, A., Sullivan, K., Valdez, I., Snow, C., **Benson, M**., Van Poppel, B., Elkins, C., Rodebaugh, G. “An Experimental Setup to Characterize Boundary Layer Asymmetry on a Spinning Projectile Using Magnetic Resonance Velocimetry.” *Proceedings of the ASME 2018 International Mechanical Engineering Congress and Expo*: Pittsburgh, PA, DOI doi:10.1115/IMECE2018-87472.
24. **Benson, M. J**., Norberg, S., Ashcraft, T., Miller, M. “Teaching Experimental Design in a Fluid Mechanics Course.” *2018 American Society for Engineering Education Annual Conference*: Salt Lake City, UT, paper no 22990.
25. **Benson, M.**, Van Poppel, B., Elkins, C. and Owkes, M. “Three Dimensional Velocity And Temperature Field Measurements Of Internal And External Turbine Blade Features Using Magnetic Resonance Thermometry." *2018 IGTI Turbo Expo Conference*: Oslo, Norway, DOI 10.1115/GT2018-76874.
26. Williams, E., Davis, G., Caniano, D., Ferrell, A., **Benson, M**., Van Poppel, B., Elkins, C. (2017). “Three Dimensional Measurements of a Turbine Blade using Magnetic Resonance Thermometry and Magnetic Resonance Velocimetry.” *Proceedings of the ASME 2017 International Mechanical Engineering Congress and Expo*: Tampa, FL, DOI 10.1115/IMECE2017-71482.
27. Youn, E., Waugh, A., Livingston, Z., **Benson, M.,** Van Poppel, B., VerHulst, C., Elkins, C., Silton, S. (2017). “Aerodynamic Analysis of a High Maneuverability Airframe Utilizing Magnetic Resonance Velocimetry and Reynolds-Averaged Navier-Stokes Simulations.” *2017 AIAA Science and Technology Forum and Exposition*, Grapevine, TX, AIAA 2017-1662, DOI 10.2514/6.2017-1662.
28. Chewning-Kulick, T., Lewis, M., Keena, J., Posner, M., **Benson, M**., (2016). “Risk Assessment of Air Cannons at Sporting Events.” *Proceedings of the ASME 2016 International Mechanical Engineering Congress and Expo*: Phoenix, AZ, DOI 10.1115/IMECE2016-67213.
29. Williams, E., Spirnak, J., Samland, M., Tremont, B., McQuirter, A., Verhulst, C., Van Poppel, B., Elkins, C., Burton, L., Eaton, J., **Benson, M**., (2016). “Magnetic Resonance Thermometry Experimental Setup: A Portable Heat Transfer Experiment.” *Proceedings of the ASME 2016 International Mechanical Engineering Congress and Expo*: Phoenix, AZ, DOI 10.1115/IMECE2016-67818.
30. **Benson, M.,** Cremins, C., LaChance, A., Verhulst, C., Snow, C., VanPoppel, B., Rodebaugh, G., Elkins, C. (2016). “Experimental and Computational Flow Analyses of a Single Jet Impinging on a Flat Plate.” *2016 AIAA Joint Propulsion Conference*: Salt Lake City, UT, DOI 10.2514/6.2016-4856**.**
31. Spirnak, J., Samland, M., Williams, E., McQuirter, A., Tremont, B., Van Poppel B., Elkins, C., **Benson M**., (2016).Applications of Film Cooling in Turbine Blades using Magnetic Resonance Velocimetry and Thermometry Techniques. *2016 AIAA Joint Propulsion Conference*: Salt Lake City, UT, DOI 10.2514/6.2016-4741.
32. Wells, M., Snow, C., Coyle, C., Coulter, A., Spirnak, J., Youn, E., **Benson, M**., Elkins, C., Silton, S., (2016). “Validation of Steady RANS Simulations Conducted on the High Maneuverability Airframe using Magnetic Resonance Velocimetry Water Channel Testing.” *2016 AIAA Science and Technology Forum and Exposition*, San Diego, CA, DOI 10.2514/6.2016-2022.
33. Rodebaugh, G., Stratton Z., Laskowski, G.**, Benson, M.**, (2015). “Assessment of Large Eddy Simulation Predictive Capability for Compound Angle Round Film Holes.” *2015 IGTI Turbo Expo Conference*: Montreal, Canada, DOI 10.1115/GT2015-43602.
34. Ryan, M., Tennis, J., Eichner, D., Lee, Z., Sowell, T., **Benson, M.,** Van Poppel, B.**,** Kurman, M., Kweon, C. (2014). “Experimental Results of an Electrostatic Injector.” *Proceedings of the 26th Annual Conference on Liquid Atomization and Spray Systems*, Portland, OR.
35. Vazquez Guzman, P., Eaton, J., Fahrig, R., Coletti, F., **Benson, M.** (2014). “Near-Field Spray Measurements Using X-Ray Computed Tomography.” *Proceedings of the 26th Annual Conference on Liquid Atomization and Spray Systems*, Portland, OR.
36. Lee, Z., Vasquez-Guzman, P. A., Eichner, D., Ryan, M. D., Tennis, J. D., Sowell, T. W., **Benson, M.**, Van Poppel, B., Nelson, T., Fahrig, R., Eaton, J., Hinshaw, W., Kurman, M. S., Kweon, C. M. (2014). “A Comparison of Shadowgraphy and X-ray Computed Tomography in Spray Analysis.” *Proceedings of the ASME 2014 International Mechanical Engineering Congress and Expo*: Montreal, Canada, DOI 10.1115/IMECE2014-38770.
37. **Benson, M.,** Lee, Z., Lowe, S., St. Leger, A**,** Van Poppel, B., (2014). “Upgrading the Undergraduate Gas Turbine Lab.” *2014 IGTI Turbo Expo Conference*: Dusseldorf, Germany, DOI 10.1115/GT2014-25943.
38. Thomas, H., Nowatkowski, M., Hoyer, B., **Benson, M.**, Floersheim, B., Luznik, L, Anderson, W., Condly, S. (2014). Optimizing Summer Externships. *Proceedings of the 2014 American Society of Engineering Education Annual Conference and Exposition*, Indianapolis, IN, paper no 9282.
39. **Benson, M.,** Reed, S., Thomas H., Floersheim, B., Condly, S. (2013). Leveraging Summer Immersive Experiences into ABET Curricula. *Proceedings of the 2013 American Society of Engineering Education Annual Conference and Exposition*, Atlanta, GA, paper no 5969.
40. Ling, J., **Benson, M.**, Yapa, S., Elkins, C., Eaton, J. (2013). “Measurements of a Trailing Edge Slot Film Cooling Geometry Designed for Reduced Coolant Flowrate and High Surface Effectiveness.” *2013 IGTI Turbo Expo Conference:* San Antonio, TX, DOI 10.1115/GT2013-94292.
41. Boettner, D., **Benson, M**., Bluman, J., Van Poppel, B, Arnas, A. (2012). “Explaining Exergy – A Cycle Approach.” *Proceeding of the ASME 2012 Intl Mechanical Engineering Congress and Expo:* Houston, TX, DOI 10.1115/IMECE2012-86388.
42. Ling, J., Yapa, S., **Benson, M.**, Elkins, C, Eaton, J. (2012). “3D Velocity and Scalar Field Measurements of an Airfoil Trailing Edge with Slot Film Cooling: The Effect of an Internal Structure in the Slot.” *2012 IGTI Turbo Expo Conference:* Copenhagen, Denmark, DOI 10.1115/GT2012-68364.
43. Arnas, Ö., and **Benson, M.** (2005). “On the Teaching of Thermodynamics by Design of Experiments and Virtual Laboratories.” *6th World Conference on Experimental Heat Transfer, Fluid Mechanics, and Thermodynamics:* Matsushimi, Miyagi, Japan, April 2005.
44. **Benson, M.**, Boettner, D., Arnas, O., and Van Poppel, B. (2004). “A Virtual Gas Turbine Laboratory.” *2004 Remote Engineering and Virtual Instrumentation Conference*: Villach, Austria, Sept. 2004*.*
45. Arnas,Ö, Boettner, D., **Benson, M**., Van Poppel, B. (2004). “On the Teaching of Condensation Heat Transfer.” *2004 International Mechanical Engineering Congress*: Anaheim, CA, Nov 2004, DPO 10.1115/IMECE2004-59277.
46. **Benson, M.**, Van Poppel, B, Boettner, D., Arnas, O. (2004). “A Virtual Gas Turbine Laboratory Exercise for an Undergraduate Thermodynamics Course.” *2004 IGTI Turbo Expo Conference*: Vienna, Austria, June 2004, DOI 10.1115/GT2004-53489*.*
47. Van Poppel, B., **Benson, M.**, Boettner, D., Arnas, Ö. (2004). “Virtual Laboratory Development for Undergraduate Engineering Courses.” *5th Int. Conf. on Information Technology Based Higher Education and Training*: ITHET ’04, Istanbul, Turkey, May 31 – June 2, 2004.

**Other Publications and Presentations:**

1. Homan, T., **Benson, M**., Elkins, C., Banko, A. (2021)“Time-resolved Three-dimensional Measurements of Scalar Dispersion from Two Transient Sources in a Mock Urban Geometry.” *2021 American Physical Society, Division of Fluid Dynamics:* Phoenix, AZ, Nov 2021.
2. Banko, A., Homan, T., **Benson, M**., Elkins, C. (2021)“3D Measurements of Transient Dispersion in an Urban Canopy Model: A Green’s Function Approach.” *2021 American Physical Society, Division of Fluid Dynamics:* Phoenix, AZ, Nov 2021.
3. Elkins, C., Banko, A., **Benson, M**., Helmer, D., Eaton, J. (2021)“The 2021 MRV Challenge: Introduction and Stanford-USMA Results.” *2021 American Physical Society, Division of Fluid Dynamics:* Phoenix, AZ, Nov 2021.
4. **Benson, M**., Elkins, C., Banko, A., Grundmann, S., Song, S., Hwang, W., Villafane, L., Eaton, J, Helmer, D. (2021)“2021 MRV Challenge: Results and Comparisons.” *2021 American Physical Society, Division of Fluid Dynamics:* Phoenix, AZ, Nov 2021.
5. Brown, A., Clemenson, M., Homan, T., Banko, A., **Benson, M**., Elkins, C. (2021)“Computational Comparisons to the Multi-stack MRC/MRV Dispersion Dataset.” *25th Annual* *George Mason University Conference on Atmospheric Transport and Dispersion Modeling:* Virtual, Oct 2021.
6. **Benson, M**., Banko, A., Homan, T., Owkes, M., Elkins, C. (2021)“Measuring the 3D Structure of Flow & Dispersion in the Urban Canopy using MRI:  Experiments for Model Development & Validation.” *25th Annual* *George Mason University Conference on Atmospheric Transport and Dispersion Modeling:* Virtual, Oct 2021.
7. Homan, T**., Benson, M**., Owkes, M., Elkins, C., Banko, A., Chung, D., Rhee, J., Mooradian, L. (2020)“Comparisons of Simulations Statistics and Experimental Data from a Scaled Oklahoma City Dispersion Study.” *24th Annual* *George Mason University Conference on Atmospheric Transport and Dispersion Modeling:* Virtual, Dec 2020.
8. Homan, T**., Benson, M**., Banko, A., Elkins, C. (2020)“Oklahoma City Contaminant Dispersion: 3D Velocity and Concentration Data Analysis for a Scaled Puff Release Experiment.” *2020 American Physical Society, Division of Fluid Dynamics:* Virtual, Nov 2020.
9. Banko, A., Homan, T., Benson, M., Elkins, C., Eaton, J. “Measurements of Three-Dimensional Transient Dispersion in the Urban Canopy using Magnetic Resonance Imaging: A Green’s Function Approach.” *2020 American Geophysical Union Conference:* San Francisco, CA, abstract ID 682682.
10. Homan, T., Wilde, N., Owkes, M., **Benson, M**., Elkins, C.(2020). Jack Rabbit 2: 3D Velocity and Concentration Field Measurements in a Scaled Water Channel Model. *American Meteorological Society* *21st Joint Conference on the Application of Air Pollution Meteorology*, Boston, MA, January 2020.
11. Wang, Y., Zeng, X., Decker, J., **Benson, M.**, (2020). Large Eddy Simulations of Urban Turbulent Flows using a GPU Accelerated Atmospheric Boundary Layer Environment - Lattice Boltzmann Model. *American Meteorological Society* *15th Symposium on the Urban Environment,* Boston, MA, January 2020.
12. Gunady, I., Banko, A., **Benson, M.,** Elkins, C., Eaton, J. (2019). A Method for Improving Magnetic Resonance Concentration Measurements Using Low Flip-Angle and Multiple Concentrations. *2019 American Physical Society, Division of Fluid Dynamics*: Seattle, WA, Nov. 2019.
13. Siegel, N., Schlenker, A., Van Poppel, B., **Benson, M.**, Elkins, C., Rodebaugh, G. (2019). Magnetic Resonance Velocimetry of a Projectile Spinning at Constant Rotation with Sub-Millimeter Resolution. *2019 American Physical Society, Division of Fluid Dynamics*: Seattle, WA, Nov. 2019.
14. **Benson, M.,** Elkins, C., Banko, A., Song, S., Grundman, S, Bruschewski, M., Borup, D. (2019). 2019 MRV Challenge: Results and Comparisons. *2019 American Physical Society, Division of Fluid Dynamics*: Seattle, WA, Nov. 2019.
15. Elkins, C., Banko, A., **Benson, M.,** Eaton, J. (2019). The 2019 MRV Challenge Experiment at Stanford University. *2019 American Physical Society, Division of Fluid Dynamics*: Seattle, WA, Nov. 2019.
16. Escalle, T., Helmer, D., **Benson, M.** (2019). Multi-Jet Impingement Array Performance. *2019 American Physical Society, Division of Fluid Dynamics*: Seattle, WA, Nov. 2019.
17. Lance, B., Clemenson, M., Brown, A., Elkins, C., Dowding, K., **Benson, M.** (2019). Atmospheric Flow Validation for Contaminant Transport. *2019 Verification and Validation Symposium*: Las Vegas, NV, May 2019.
18. Brown, A., Clemenson, M., **Benson, M.,** and Elkins, C.(2019). Detailed Advection and Diffusion Validation of CFD with MRC/MRV 3D data. *9th International Seminar on Fire and Explosion Hazards*: Las Vegas, NV, May 2019.
19. **Benson, M.,** Shim, G., Eaton J., Elkins, C.(2018). 3D-3C Mean Velocity Measurements Below the Building Height in an Urban Canopy Flow. *2018 American Physical Society, Division of Fluid Dynamics*: Atlanta, GA, Nov. 2018.
20. **Benson, M.**, Elkins, C. (2018). Advanced Methods for Temperature Field Measurements in Complex Geometries. *2018 Turbine Engine Technology Symposium*: Dayton, OH, Sept 2018.
21. **Benson, M.**, Elkins, C. (2018). Oklahoma City Contaminant Dispersion. *22nd Annual George Mason University Conference on Atmospheric Transport and Dispersion Modeling*: Fairfax, VA, June 2018.
22. Prasad, D., Divito, N., Byers, M., White, W., **Benson, M.,** Van Poppel, B., and Elkins, C. (2017). Three-dimensional Measurements of Flow Field and Contaminant Dispersion in Urban Environments using Magnetic Resonance Imaging. *American Physical Society, Division of Fluid Dynamics:* Denver, Colorado, Nov. 2017.
23. Ivanosky, A., Brezzard, E., **Benson, M.**, and Van Poppel, B.(2017). Undergraduate Laboratory on a Turbulent Impinging Jet. *American Physical Society, Division of Fluid Dynamics:* Denver, CO, Nov. 2017.
24. Delaforge, J. **Benson, M.,** Van Poppel, B., Elkins, C. Experimental evaluation of a system of multiple angled impinging jets in a turbulent water flow. *American Physical Society, Division of Fluid Dynamics:* Denver, CO, Nov. 2017.
25. Siegel, N., Rodebaugh, G., Elkins, C., Van Poppel, B., **Benson, M**., Cremins, M., LaChance, A., Ortega, R., VanderYacht, D., Design and Analysis of A Spin-Stabilized Projectile Experimental Apparatus, *American Physical Society, Division of Fluid Dynamics:* Denver, Colorado, Nov. 2017.
26. Cremins, M., Rodebaugh, G., VerHulst, C., **Benson, M**., and Van Poppel, B. (2016). Reynolds Averaged Navier-Stokes Analysis of the Magnus Moment on a Spin-stabilized Projectile. *2016 American Physical Society, Division of Fluid Dynamics*: Portland, OR, Nov. 2016.
27. Ryquist, G., Owkes, M., **Benson, M.,** VerHulst, C., Van Poppel, B., Elkins, C. (2016). Validation of Magnetic Resonance Thermometry by Computational Fluid Dynamics. *2016 American Physical Society, Division of Fluid Dynamics*: Portland, OR, Nov. 2016.
28. Irhoud, A., **Benson, M.**, VerHulst, C., Van Poppel, B., Elkins, C., and Helmer, D. (2016) Magnetic Resonance Velocimetry Analysis of an Angled Impinging Jet. *2016 American Physical Society, Division of Fluid Dynamics*: Portland, OR, Nov. 2016.
29. **Benson, M.** (2016). Validation of Magnetic Resonance Thermometry (MRT) through Experimental and Computational Approaches. *2016 Turbine Engine Technology Symposium*: Dayton, OH, Sept 2016.
30. Spirnak, J., **Benson, M**., Van Poppel, B., Elkins, C., Eaton, J. (2015) Experimental Analysis of Flow over a Highly Maneuverable Airframe. *2015 American Physical Society: Division of Fluid Dynamics*: Boston, MA, Nov 2015.
31. Nelson, T., Bravo, L., **Benson, M.**, Van Poppel, B., Sowell, T., Lee, Z., Beck, J., Glass, T., Vazquez Guzman, P., Fahrig, R., Eaton, J., Hinshaw, W., Kurman, M., Tess, M., Kweon, C. (2014). Eulerian Modeling of Hollow Cone Sprays. *2014 American Physical Society, Division of Fluid Dynamics*: San Francisco, CA, Nov 2014.
32. Sowell, T., Lee, Z, **Benson, M.**, Van Poppel, B., Nelson, T., Vazquez Guzman, P., Fahrig, R., Eaton, J., Hinshaw, W., Kurman, M., Tess, M., Kweon, C. (2014). Validation of X-Ray CT-measured Liquid Concentration against LIF. *2014 American Physical Society, Division of Fluid Dynamics*: San Francisco, CA, Nov 2014.
33. Reibman, B**.**, **Benson, M.**, Rodebaugh, G., Helmer, D. (2013) Impact of Model Fidelity on Jet Impingement Simulations. *2013 American Physical Society, Division of Fluid Dynamics*: Pittsburgh, PA, Nov 2013.
34. Ryan, M**.**, Tennis, J., Kweon, C., **Benson, M.**, Van Poppel, B. (2013) Analysis of an Electrostatic Spray Injector. *2013 American Physical Society, Division of Fluid Dynamics*: Pittsburgh, PA, Nov 2013.
35. **Benson, M.** (2012) Leveraging Advanced MRI Techniques in Gas Turbine Blade Design. *2012 Turbine Engine Technology Symposium*: Dayton, OH, Sept 2012.
36. **Benson, M.**, Elkins, C, Eaton, J. (2011) Redesigning a Film-Cooled Airfoil Trailing Edge using MRI Techniques. *2011 American Physical Society: Division of Fluid Dynamics Conference*: Baltimore, MD, Nov 2011.
37. **Benson, M.** (2011) Measurements of 3D Velocity and Scalar Field for a Film-Cooled Airfoil Trailing Edge. Dissertation. Stanford University. Print.
38. **Benson, M.**, Elkins, C, Eaton, J. (2010) Measurements of 3D Velocity and Scalar Field for a Film-Cooled Airfoil Trailing Edge. *2010 American Physical Society: Division of Fluid Dynamics Conference*: Long Beach, CA, Nov 2010.
39. **Benson, M.**, Mobley, P., Elkins, C, Eaton, J. (2008) Quantitative Mixing Measurements using MRI of the D2O, H2O system. *2008 American Physical Society: Division of Fluid Dynamics Conference*: San Antonio, TX, Nov 2008.
40. **Benson, M.**, Rogers, R., Eaton, J. (2003) Wall Roughness Effects on the Particle Velocity Field in a Fully Developed Channel Flow. *2003 American Physical Society: Division of Fluid Dynamics Conference*: E. Rutherford, NJ, Nov 2003.
41. **Benson, M.** (2003) The Effects of Wall Roughness on the Particle Velocity Field in a Fully Developed Channel Flow. Dissertation. Stanford University. Print.

**External Funding:**

**Principal Investigator:** Contaminant Dispersion Experimental Program, ($254,000 Defense Threat Reduction Agency). Fiscal Year 2022

**Principal Investigator:** Contaminant Dispersion Experimental Program, ($250,000 Defense Threat Reduction Agency, $110,000 Sandia National Laboratory). Fiscal Year 2021

**Principal Investigator:** Contaminant Dispersion Experimental Program, ($150,000 Defense Threat Reduction Agency). Fiscal Year 2020

**Principal Investigator:** Contaminant Dispersion Experimental Program, ($90,000 Defense Threat Reduction Agency). Fiscal Year 2019

**Principal Investigator:** Ancho Canyon Scalar Dispersion Study, ($75,000 Sandia National Laboratory). Fiscal Year 2018

**Principal Investigator:** Advanced Temperature Measurement Diagnostic for Gas Turbine Blade Design, ($288,000 Air Force Research Laboratory Funding). 2016-2020

**Principal Investigator:** Contaminant Dispersion Experimental Investigation, currently funded at ($190,000 by USMA, Armaments Research and Development Command, High Performance Computing Modernization Office, and the Army Research Laboratory). 2016-2018

**Principal Investigator:** Experimental and Computational Study of the ARL High Maneuverability Airframe, ($60,000 Army Research Laboratory Funding). 2014-2016

**Co-Investigator:** Development of X-Ray CT Techniques for use with Liquid Sprays, ($100,000 Army Research Laboratory Funding with Stanford University). 2013-2014

**Principal Investigator**: Development of Magnetic Resonance Velocimetry measurements at the GE Global Research Center, Niskayuna, NY ($1,000 AOG Gift, Sept. 2011). *Technical* *Liaison for the Cooperative Research and Development Agreement: USMA-GE*.

**Principal Investigator**: Turbulent Mixing Simulations and Various Experimental Studies, ($92,500 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration). 2012-2019.

**Principal Investigator**: X-Ray CT Experimental Study of Combustion Sprays, ($8,000 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration, Jan 2012).

**Principal Investigator**: Turbomachinery Related Simulations Using High Performance Computing, ($10,000 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration, Jan 2013).

**Principal Investigator**: Electrically Charged Fuel Injection Study, ($10,000 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration, Jan 2013).

**Advisor**: Service Academy Design Challenge 2011-2017. Sponsored by the Air Force Research Laboratory $225,000 total).

**Principal Investigator**: Study of Combustion Sprays, continued ($12,000 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration, Jan 2014).

**Principal Investigator**: High Maneuverability Airframe MRI project, ($13,000 Mathematical Sciences Center of Excellence funding as part of the ARL/USMA Collaboration, Sept 2014).

**Consulting:**

Paid contributor for Michael Moran and Howard Shapiro textbook, *Fundamentals of Engineering Thermodynamics*, 5th Ed., 2004

**Research and Development Experience:**

Experimental Studies in Gas Turbine Engine applications, 2008-present

MRI Diagnostic Development for Turbulent Engineering Flows, 2008-present

Advanced Aerodynamic Analysis of Projectiles, 2014-present

Principal developer: MC311 Thermal Fluid Systems, 2005

Engineering Education (Gas Turbine, Thermodynamics, and Virtual Laboratory), 2003-present

Combined Heat & Power Applications for the U.S. Army, 2003-present

Wall Roughness Effects on Multiphase Turbulent Flows, 2001-2003

**SERVICE**

**Professional Service:**

Division Chair, Mechanical Engineering Division (1000+ members in Division), American Society for Engineering Education (ASEE), 2017-2018

Program Chair, and Incoming Division Chair, Mechanical Engineering Division (1000+ members in Division), American Society for Engineering Education (ASEE), 2016-2017

Program Chair-Elect, Mechanical Engineering Division (1000+ members in Division), American Society for Engineering Education (ASEE), 2015-2016

Session Chair, Experimental Methods in Internal Heat Transfer, International Gas Turbine Institute Conference 2014-present

Member, International Gas Turbine Institute and ASME K-14 Heat Transfer Committee (2013 – present)

Secretary/Treasurer, Mechanical Engineering Division (1000+ members in Division), American Society for Engineering Education (ASEE), 2014-2015

ME News Editor and WebMaster, Mechanical Engineering Division (1000+ members in Division), American Society for Engineering Education (ASEE), 2011-2014

Senior Mentor, ASCE ExCEEd Teaching Workshop, 2011

Junior Mentor, ASCE ExCEEd Teaching Workshop, 2003

**USMA Institutional Service:**

USMA Math/Science/Engineering Scholarship Chair (Hertz, NSF, NPS, LL Military Fellows, Draper Lab Military Fellows, Churchill) and Scholarship committee member 2011-present. Over 200 graduate scholarship winners from USMA Cadets.

Thayer Honors Program: Governance sub-committee chair, 2013- 2015

Admission Committee Member 2011-2013

Coordination Lead: USMA Research Collaboration with Sandia National Laboratories 2004.

**Department Service:**

Director, Center for Innovation and Engineering (27 Feb 2014-1 June 2015)

Advanced Individual Academic Development Coordinator, 2012-present

Principal Developer: C&ME Department Video, 2005

Principal Developer: C&ME Gas Turbine Virtual Laboratory project 2003-2004

**Other External Service:**

Cornwall-on-Hudson Elementary School, 3rd Grade USMA Annual Tour Facilitator 2013-2014

Vice President: West Point Wrestling Club. 2012-2013

Invited Reviewer: International Gas Turbine Institute Turbo Expo 2012- present, Heat Transfer Division

Invited Seminar Presenter: General Electric Global Research Corporation, Oct 2011, for work with Magnetic Resonance Imaging in Technological Flows.

**FACULTY DEVELOPMENT**

Presenter, XH497 Critical Thinking (Technical Scholarship Opportunities)

Presenter, MA153/255 Advanced Mathematics Invited Lecture (250-300 students annually) – 2014-2020

Presenter, Department OPD program, “3D Velocity and Scalar Field Diagnostics using MRI,” 2011

Instructor Summer Workshop, presented demonstration classes and assessed new instructor classes, 2011-present

Presenter, Department OPD program, “Wall Roughness Effects on the Particle Velocity Field in a Fully Developed Channel Flow,” 2003.

**CADET DEVELOPMENT**

Assistant OIC Water Polo Team, 2011

Mechanical Engineering Program Summer Internship Coordinator, 2011-2017

Cadet Sponsor (approx. 6-10 cadets annually), 2001-2003, 2011-Present

BS&L PL300 Counseling Lab Mentor, 2011-2015 (11 Cadets)

OIC Water Polo Team, 2003-2005, 2012 - present

Assistant OIC, Mechanical Engineering Club (DCA Sanctioned Club), 2003-2005, 2011-Present

**ACADEMIC AND PROFESSIONAL AWARDS AND HONORS**

Donald N. Zwiep ‘*Innovation in Engineering Education”* Award Winner, American Society of Mechanical Engineers, 2021

Fellow, American Society of Mechanical Engineers, 2019

Dean’s Distinguished Scholarship Award, USMA, 2018

Phi Kappa Phi Senior Scholastic Award Winner, USMA, 2018

Phi Kappa Phi Scholastic Award Winner, USMA, 2005

Army Engineer Association de Fleury Medal; Bronze Award, 2001

Honor Graduate, Engineer Officer Advanced Course, 1998

Distinguished Honor Graduate, Engineer Officer Basic Course, 1994

Member, The Honor Society of Phi Kappa Phi, 1994-Present

Dean’s List, USMA, 1991 – 1994

**Patents**:

A New Design for Turbine Blade Trailing Edge Film Cooling with an Overhanging Tapered Land (Provisional Patent) S10-388/PROV, Filing Date: 1/19/2011

[Gun Launched Anchor Projectile for Climbing](https://patents.google.com/patent/US9074856B1/en), Serial No. 61/813,230, Filing Date: 4/18/2013

[Universal Gap Crossing System](https://patents.google.com/patent/US9617696B1/en) Serial # US/9617696B1 , Filing Date: 5/2/2013