Brian M. Argrow
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RESEARCH INTERESTS

Unmanned Aircraft Systems (UAS); computational, experimental, and analytical aero-gas dynamics

EDUCATION

Ph.D., Aerospace Engineering, University of Oklahoma, 1989, NSF Fellow, GEM Fellow

M.S., Mechanical Engineering, University of Oklahoma, 1986

B.S. with distinction, Aerospace Engineering, University of Oklahoma, 1983

PROFESSIONAL EXPERIENCE

Associate Dean for Education, College of Engineering and Applied Science, 8/07-present.

Alfred and Betty Look Professor of Engineering, Department of Aerospace Engineering Sciences, University of Colorado, 7/06-present

Co-Founder and Director, Research and Engineering Center for Unmanned Vehicles, 1/04-present

Associate Chair, Department of Aerospace Engineering Science, University of Colorado, 8/01-8/04

Associate Professor, Department of Aerospace Engineering Sciences, University of Colorado, 4/99-present

Assistant Professor, Department of Aerospace Engineering Sciences, University of Colorado, 8/92-4/99

AFOSR Summer Faculty Researcher, Wright Lab, Wright-Patterson AFB, OH, 5/92-7/92

Assistant Professor, School of Aerospace and Mechanical Engineering, University of Oklahoma, 5/89-8/92

Instructor, School of Aerospace and Mechanical Engineering, University of Oklahoma, 8/86-5/89

Tutor/Counselor, Minority Engineering Programs, University of Oklahoma, 8/82-8/88

Member of the Technical Staff, Summer Intern, Fluid Mechanics Dept., The Aerospace Corp., El Segundo, CA, 1983 and 1984

REVIEW BOARDS AND PANELS

NOAA ISETCSC NOAA Advisory Committee (2007-2010)

USAF Scientific Advisory Board (2005-2009)

NASA Academy of Program and Project Leadership, Management Operations Working Group (2003-05)

USAF Scientific Advisory Board (ad hoc member), UAV Study, Vehicles Panel (2003)

NASA LaRC Peer Review Panel (Jan. 2003)

Defense Science Study Group (IDA, DARPA) (1999–2001)

NASA Advisory Council, Aeronautics and Space Transportation Technology Advisory Committee, Airframe Systems Subcommittee, 1997-2000

Manufacturing Technology & Aerospace Proposal Review Panel, Texas Advanced Research/Advanced Technology Programs, Texas Higher Education Coordinating Board 1995-1997

TEACHING AWARDS

2007 University of Colorado Best Should Teach Award

2003 University of Colorado Marinus Smith Award

2003 Subaru Teaching Spotlight Award

University of Colorado President's Teaching Scholar, 2000 (lifetime guild appointment)

University of Colorado Boulder Faculty Assembly 1996-1997 Teaching Excellence Award

University of Colorado 1996 Charles A. Hutchinson Teaching Award

W. M. Keck Foundation's 1995 Engineering Teaching Excellence Award

PUBLICATIONS

1. Archival Publications

1.1. Pilinski, M, Argrow, B, and Palo, S., "A Semi-Empirical Model for Satellite Energy-Accommodation Coefficients," *Journal of Spacecraft and Rockets*, Vol. 35, pp. 266-272 (2010).

1.2. Argrow, B., Maute, K., Farhat, C., Nikbay, M., "F-function lobe balancing for sonic boom minimization," *Computational Fluid Dynamics Journal*, Vol. 17, No. 4, pp. 221-234 (2009).

1.3. Murphy, R. and Argrow, B., "UAS in the National Airspace System: Research Directions," *Unmanned Systems*, Vol. 27, No. 6, pp. 23-28 (2009).

1.4. Elston, J., Frew, E., Lawrence, D., Gray, P., and Argrow, B., "Net-Centric Communication and Control for a Heterogeneous Unmanned Aircraft System," *Journal of Intelligent and Robotic Systems*, Vol. 56, No. 1-2, pp. 199-232 (2009).

1.5. Argrow, B., Weatherhead, E., and Frew, E. W., "Real-Time Participant Feedback from the Symposium for Civilian Applications of Unmanned Aircraft Systems," *Journal of Intelligent and Robotic Systems*, Vol. 54, No. 1-3, pp. 87-103 (2009); published online July (2008).

1.6. Maute, K., Farhat, C., Argrow, B., and Nikbay, M., "Sonic boom mitigation via shape optimization using an adjoint method and application to a supersonic jet aircraft," *European Journal of Computational Mechanics*, **17**, 1-2, pp.217-243 (2008).

1.7. Frew, E., Dixon, C., Elston, J., Argrow, B., Brown, T., "Networked Communication, Command, and Control of an Unmanned Aircraft System," *Journal of Aerospace Computing, Information, and Communication*, **5**, No. 4, pp 84-107 (2008).

1.8. Brown, T., Argrow, B., Frew, E., Dixon, C., Hinkle, D., Elston, J., Gates, H., **Emerging Technologies in Wireless LANs: Theory, Design, and Deployment**, Ed. B. Bing, Cambridge University Press, Chap. 33, pp. 695-717, (2008).

1.9. Farhat, C., Maute, K., Argrow, B., and Nikbay, M., "Shape Optimization Methodology for Reducing the Sonic Boom Initial Pressure Rise," *AIAA Journal*, **45**, No. 5, 1007 (2007).

1.10. Guardone, A., Argrow, B., "Nonclassical gasdynamic region of selected fluorocarbons," *Physics of Fluids*, **17**, 116102 (2005).

1.11. Farhat, C., Argrow, B., Nikbay, M, and Maute, K., "Shape Optimization with F-Function Balancing for Reducing the Sonic Boom Initial Shock Pressure Rise," *International Journal of Aeroacoustics*, **3**, 361-378 (2004).

1.12. Guardone, A., Vigevano, L., and Argrow, B., "Assessment of thermodynamic models for dense gas dynamics," *Physics of Fluids*, **16**, 3878 (2004).

1.13. Fergason, S., Guardone, A., and Argrow, B., "Construction and Validation of a Dense Gas Shock Tube," *J. Thermophysics and Heat Transfer*. **17**, 326 (2003).

1.14. Fergason, S. H., Ho, T. L., Argrow, B. M., and Emanuel, G., "Theory for Producing a Single-Phase Rarefaction Shock Wave in a Shock Tube, *Journal Fluid Mechanics*, **445**, 37 (2001).

1.15. Brown, B. P. and Argrow, B. M., "Application of Bethe-Zel'dovich-Thompson Fluids in Organic Rankine Cycle Engines," *Journal of Propulsion and Power*, **16**, 1118 (2000).

1.16. Graves, R. E. and Argrow, B. M., "Bulk Viscosity: Past to Present," *J. Thermophysics and Heat Transfer*, **13**, 337 (1999).

1.17. Brown, B. P. and Argrow, B. M., "Characteristic Calculation of Equilibrium Flow in Minimum Length Nozzles," *Inverse Problems in Engineering*, **7**, 65 (1999).

1.18. Brown, B. P. and Argrow, B. M., "Nonclassical Dense Gas Flows for Simple Geometries," *AIAA Journal*, **36**, 1842 (1998).

1.19. Brown, B. P. and Argrow, B. M., "Two-Dimensional Shock Tube Flow for Dense Gases," *Journal Fluid Mechanics*, **349**, 95 (1997).

1.20. Argrow, B. M., "Shock Tube Flow for Dense Gases," *Shock Waves*, **6**, 241 (1996).

1.21. Aldo, A. C. and Argrow, B. M., "Dense Gas Flow in Minimum Length Nozzles," *Journal of Fluids Engineering*, **117**, 270 (1995).

1.22. Rohrs, H. W., Wickham-Jones, T., Ellison, G. B., Berry, D., and Argrow, B. M., "FTIR Absorption Spectroscopy of Jet-Cooled Radicals," *Review of Scientific Instruments*, **66**, 2430 (1995).

1.23. Emanuel, G. and Argrow, B. M., "Linear Dependence of Bulk Viscosity on Shock Wave Thickness," *Physics of Fluids*, **6**, 3203 (1994).

1.24. Argrow, B. M. and Cox, R. A., "A Quantitative, Second-Law Based Measure of Numerical Accuracy," *Thermodynamics and the Design, Analysis, and Improvement of Energy Systems*, AES-**30**/HTD-**266**, ASME, 49 (1993).

1.25. Cox, R. A., and Argrow, B. M., "Entropy Production in Finite-Difference Schemes," *AIAA Journal*, **31**, 210 (1993).

1.26. Borth, C. J. and Argrow, B. M., "Evaluation of Entropy Production and Numerical Entropy Change in Flowfield Solutions," *Second Law Analysis: Industrial and Environmental Applications*, AES-**25**/HTD-**191**, 101 (1991).

1.27. Argrow, B. M. and Emanuel, G. "Computational Analysis of the Transonic Flow Field of Two-Dimensional Minimum Length Nozzles," *Journal of Fluids Engineering*, **113**, 479 (1989).

1.28. Argrow, B. M. and Emanuel, G., "Comparison of Minimum Length Nozzles," *Journal of Fluids Engineering*, **110**, 283 (1988).

1.29. Argrow, B. M., Emanuel, G., and Rasmussen, M. L., "Entropy Production in General Nonsteady Coordinates," *AIAA Journal*, **25**, 1629 (1987) (Errata, **27**, 986 (1989)).

2. **Archival Publications** (pending)

2.1. Pilinski, M. D., Argrow, B. M., and Palo, S. E., "Drag Coefficients of Satellites with Concave Geometries: Comparing Models and Observations," *Journal of Spacecraft and Rocket* (to appear 2011).

2.2. Pilinski, M. D., Moe, K., Palo, S. E., and Argrow, B. M., "Measuring Absolute Thermospheric Densities and Accommodation Coefficients Using Paddlewheel Satellites: Past Findings, Present Uses, and Future Mission Concepts," *Journal of Astronautical Sciences* (to appear 2011).

2.3. Elston, J., Roadman, J., Stachura, M., Argrow, B., Houston, A., and Frew, E., "The Tempest Unmanned Aircraft System for In Situ Observations of Tornadic Supercells: Design and VORTEX2 Flight Results," *Journal of Field Robotics* (accepted).

2.4. Houston, A. L., Argrow, B., Elston, J., Lahowetz, J., Kennedy, P. C., "The Collaborative Colorado-Nebraska Unmanned Aircraft System Experiment," *Bulletin of the American Meteorological Society* (in review).

2.5. Pilinski, M. D., Argrow, B. M., and Palo, S. E., "Refinements in the Semi-Empirical Accommodation Coefficient Model for Satellites" *Advances in Space Research* (in preparation).

2.6. Elston, J., Argrow, B., Frew, E., Houston, A., and Straka, J., "Evaluation of Unmanned Aircraft Systems for Severe Storm Sampling using Hardware-in-the-Loop Simulations," ," *Journal of Aerospace Computing, Information, and Communication* (in preparation).

2.7. Roadman, J., Elston, J., Argrow, B., and Frew, E., "Performance of the Tempest UAS in Supercell Storms," *Journal of Aircraft* (in preparation).

3. **Editorial and Review Articles**

3.1. Argrow, B., Christianson, R., Francis, M, "Year in Review: Unmanned Systems," *Aerospace America*, **27**, No. 11, p. 73 (2009).

3.2. Argrow, B. M., "A Survey of Facilities for High-Temperature, High-Pressure Fluids Experiments," Special Feature, *Measurement Science and Technology*, **16** (2005).

4. **Conference Proceedings**

4.1. Jung, T., Starkey, R., and Argrow, B., "Survey Paper on Acoustic Advance Applied to Sonic Booms," 48th AIAA Aerospace Sciences Meeting, Orlando, FL, Jan. 2011.

4.2. Jung, T., Starkey, R., and Argrow, B., "Feasibility Study of Using a Small-Scale Vehicle to Replicate Sonic Booms in Supersonic Civil Aircraft, 48th AIAA Aerospace Sciences Meeting, Orlando, FL, Jan. 2011.

4.3. Elston, J., Argrow, B., Houston, A., and Frew, E., "Design and Validation of a System for Targeted Observations of Pre-Tornadic Supercells Using Unmanned Aircraft," In 2010 IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, Oct 2010.

4.4. Elston, J., Argrow, B., Frew, E., and Houston, A., "Evaluation of UAS Concepts of Operation for Severe Storm Penetration using Hardware-in-the-Loop Simulations," AIAA Paper 2010-8178, Guidance, Navigation, and Control Conference, Toronto, Ontario, Aug 2010.

4.5. Pilinski, M. D., Moe, K., Palo, S. E., and Argrow, B. M., "Measuring Absolute Thermospheric Densities and Accommodation Coefficients Using Paddlewheel Satellites: Past Findings, Present Uses, and Future Mission Concepts," AAS George H. Born Symposium, Boulder, CO, May 2010.

4.6. Elston, J., Argrow, B., Houston, A., and Lahowetz, J., "Distributed Atmospheric Sensing using Small UAS and Doppler Radar," AIAA Paper 2009-2023, Infotech@Aerospace & Unmanned Unlimited Conference, Seattle, WA, Apr 2009.

4.7. Houston, A., Argrow, B., Elston, J., and Lahowetz, J., "Unmanned Aircraft Observations of Airmass Boundaries: The Collaborative Colorado-Nebraska Unmanned Aircraft System Experiment," American Meteorological Society 24th Conference on Severe Local Storms, Savannah, GA, Oct. 2008.

4.8. Argrow, B., Weatherhead, E., Frew, E., "Real-Time Participant Feedback from the Symposium for Civilian Applications of Unmanned Aircraft Systems, International Symposium on Unmanned Aerial Vehicles, Orlando, FL, Jun 2008.

4.9. Argrow, B., Houston, A., "UAS for In Situ Sensing of an Atmospheric Airmass Boundary," AIAA Infotech@Aerospace Conference and Exhibit, Rohnert Park, CA, May 2007.

4.10. Bateman, T., Nelson, J., Argrow, B., "A Low-Cost, Rapid Construction UA Design," AIAA Infotech @ Aerospace Conference and Exhibit, Rohnert Park, CA, May 2007.

4.11. Elston, J., Frew, E. W., and Argrow, B., "Networked UAV Communication, Command, and Control," AIAA Guidance, Navigation, and Control Conference, Keystone, CO, August 2006.

4.12. Argrow, B., "Cooperative Mobile Sensing Systems for In Situ Measurements in Hazardous Environments," AGU Fall Meeting, San Francisco, 5-9 Dec 2005. (Invited)

4.13. Elston, J., Argrow, B., and Frew, E., "A Distributed Avionics Package for Small UAVs," AIAA Paper 2005-6984, Infotech@Aerospace, Sep. 2005.

4.14. Dixon, C., Frew, E., and Argrow, B., "Radio Leashing of an Unmanned Aircraft," AIAA Paper 2005-7030, Infotech@Aerospace, Sep. 2005. (Invited)

4.15. Frew, E., Dixon, C., Argrow, B., and Brown, T., "Radio Source Location by a Cooperating UAV Team," AIAA Paper 2005-6903, Sep. 2005.

4.16. Argrow, B., Rasmussen, E., and Lawrence, D., "UAV Systems for Sensor Dispersal, Telemetry, and Visualization in Hazardous Environments," AIAA Paper 2005-1237, 43rd AIAA Aerospace Sciences Meeting and Exhibit, Jan. 2005.

4.17. Bateman, T., Argrow, B., Sheek, M., Hanft, J., Dean, A., and Blakeley, B., "USAS, A Stability Augmentation System," AIAA Paper 2004-6587, AIAA 3rd Unmanned Unlimited Technical Conference, Workshop and Exhibit, Sep. 2004.

4.18. Brown, T., Argrow, B, Dixon, C., and Doshi, S., "Ad Hoc UAV Ground Network (AUGNet)," AIAA Paper 2004-6321, AIAA 3rd Unmanned Unlimited Technical Conference, Workshop and Exhibit, Sep. 2004.

4.19. Argrow, B, Farhat, C., Maute, K., and Nikbay, M., "Linear-Theory-Based Shape Optimization for Sonic Boom Minimization," IUTAM Symposium Transsonnicum IV, Göttingen, Germany, Sep. 2002. (Invited)

4.20. Farhat, C., Argrow, B., Maute, K., and Nikbay, M., "A Shape Optimization Methodology with F-Function Lobe Balancing for Mitigating the Sonic Boom," AIAA Paper 2002-5551, 9th AIAA/ISSMO Symposium and Exhibit on Multidisciplinary Analysis and Optimization, Atlanta, GA, Sep. 2002.

4.21. Argrow, B. M., "Proactive Teaching and Learning in the Aerospace Engineering Curriculum 2000," Proceedings of the ASEE Annual Conference and Exposition, Montreal, June 2002.

4.22. Argrow, B. and Curry, J., "Integration of UAV Senior Projects into the Curriculum 2000," AIAA Paper 2002-3485, 1st AIAA Unmanned Aerospace Vehicles, Systems, Technologies, and Operations Conference and Workshop, Portsmouth, VA, May 2002.

4.23. Dixon, C., Eheim, C., Argrow, B., and Palo, S., "Tornado Chaser: A Remotely Piloted UAV for In Situ Meteorological Measurements," AIAA Paper 2002-3479, 1st AIAA Unmanned Aerospace Vehicles, Systems, Technologies, and Operations Conference and Workshop, Portsmouth, VA, May 2002.

4.24. Farhat, C., Maute, K., Argrow, B., and Nikbay, M., "Shape Optimization Methodology for Reducing the Sonic Boom Initial Shock Pressure Rise," AIAA Paper 2002-0145, 40th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 2002.

4.25. Fergason, S. H. and Argrow, B. M., "Simulation and Experimental Verification of Rarefaction Shock Waves in a Single-Phase Vapor," 23rd International Symposium on Shock Waves, Ft. Worth, TX, July 2001.

4.26. Fergason, S. H. and Argrow, B. M., "Construction and Operation of a Dense Gas Shock Tube," AIAA Paper 2001-2747, 35th AIAA Thermophysics Conference, Anaheim, CA, June 2001. (Invited Paper)

4.27. Fergason, S. H. and Argrow, B. M., "Simulations of Nonclassical Dense Gas Dynamics," AIAA Paper 2001-2752, 35th AIAA Thermophysics Conference, Anaheim, CA, June 2001. (Invited Paper).

4.28. Graves, R. E. and Argrow, B. M., "Aerodynamic Performance of an Osculating-Cones Waverider at High Altitudes," AIAA Paper 2001-2960,,35th AIAA Thermophysics Conference, Anaheim, CA, June 2001.

4.29. Brown, B. P. and Argrow, B. M., "Application of Bethe-Zel'dovich-Thompson Fluids in Organic Rankine Cycle Engines," AIAA Paper 99-0462, 37th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan 1999.

4.30. Brown, B. P. and Argrow, B. M., "Nonclassical Dense Gas Flows for Simple Geometries," AIAA Paper 97-1881

4.31. Seebass, A. R. and Argrow, B. M., "Sonic Boom Minimization Revisited," AIAA Paper 98-2956, 2nd AIAA Theoretical Fluid Mechanics Meeting, Albuquerque, NM, June 1998.

4.32. Graves, R. E. and Argrow, B. M., "Bulk Viscosity: Past to Present," AIAA Paper 98-2576, 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, Albuquerque, NM, June 1998.

4.33. Miller, R. W., Argrow, B. M., Center, K. B., Brauckmann, G. J., and Rhode, M. N., "Experimental Verification of the Osculating Cones Method for Two Waverider Forebodies at Mach 4 and 6," AIAA Paper 98-0682, 36th Aerospace Sciences Meeting & Exhibit, Reno, NV, January, 1998.

4.34. Miller, R. W. and Argrow, B. M., "Subsonic Aerodynamics of an Osculating Cones Waverider," AIAA Paper 97-0189, 35th Aerospace Science Meeting & Exhibit, Reno, NV, January, 1997.

4.35. Aldo, A. C. and Argrow, B. M., "Dense Gas Flow in Minimum Length Nozzles," NASA CP-10122, 1995.

4.36. Argrow, B. M. and Emanuel, G. "Computational Analysis of the Transonic Flow Field of Two-Dimensional Minimum Length Nozzles," AIAA Paper 89-1822, 1989.

5. **Special Reports**

5.1. USAF Scientific Advisory Board (contributing author), "Virtual Training Technologies," SAB-TR-09-XX, Aug 2009 (not cleared for release).

5.2. USAF Scientific Advisory Board (contributing author), "Implications of Spectrum Management for the Air Force," SAB-TR-08-03, Aug. 2008.

5.3. USAF Scientific Advisory Board (contributing author), "Thermal Management Technology Solutions," SAB-TR-07-05, Sep. 2007.

5.4. USAF Scientific Advisory Board (contributing author), "Air Defense Against Unmanned Aerial Vehicles, Vol. 2," SAB-TR-06-01, Sep. 2006.

5.5. USAF Scientific Advisory Board (contributing author), "Unmanned Aerial Vehicles in Perspective: Effects, Capabilities, and Technologies, Vol. 1," SAB-TR-03-01, Sep. 2003.

5.6. Argrow, B. M., "Assessment of the Impact of Low-Cost Robotic Aircraft to National Security," IDA Paper-3704, Institute for Defense Analysis, Defense Science Study Group, Feb. 2002, pp.79-101.

RESEARCH FUNDING

- PI: "Forge Aeronautics Flight Operations Testing," Forge Aeronautics, LLC, $9,600, 10/22/10-3/31/11.
- Co-PI: "Collaborative Research: Planning Grant: I/UCRC for Unmanned Aircraft Systems," NSF, $10,000, 2/15/2010-2/15/2011.
- Co-PI: "Dream Chaser Dynamically Scaled Model," Sierra Nevada Corp., $184,284, 3/1/10-12/31/10.

- PI: “Collaborative Research: Development of Unmanned Aircraft System for Research in a Severe Storm Environment and Deployment within the VORTEX2, NSF, $45,667, 5/10/10-1/31/11.
- PI: “Collaborative Research: Development of Unmanned Aircraft System for Research in a Severe Storm Environment and Deployment within the VORTEX2,” NSF, $243,890 PI award, $499,678 total award, 2/1/09-1/31/11.
- Co-PI: “UAS Research Directions for the National Air Space,” NSF, $16,000, 5/2/08-2/28/09.
- Co-PI: “I3: Towards a Center for STEM Education,” NSF, $599,192, 9/22/08-9/21-11.
- Co-PI: “One Day's Pay: Educating K-16 Engineers to Create Affordable Innovations,” NSF, $498,613, 9/1/08-8/31/11
- Co-PI: “Networked Systems Test Bed Integration, Phase 1,” L3 Communications, 10/1/07-11/30/08, $300,636
- PI: SGER: Collaborative Research: UAS for In-Situ Sensing along Atmospheric Airmass Boundaries, NSF, 9/15/07-8/31/08, $51,424 PI award, $99,995 total award
- PI: Remote Operation of UAS and Technologies for Command, Control, Communications, and Computers, Dept. Transportation (FAA), total award, 8/22/07-8/21/08, $85,438
- PI: Wing-Integrated Antennas for Unmanned Aircraft, USAF SBIR, Phase 2, with First RF Corp., 6/07-5/09, $112,117
- Co-I: Atmospheric Neutral Density Prediction, AFOSR MURI, 5/07-4/12, Co-I award: $439,855, total UCB award: $3,389,855
- Co-PI: UAV Sensor Data Collection Phase 4, L-3 Communications, 8/1/06-8/30/07, $59,971
- PI: Small UA Prototype Construction and Test Project, EIM Corp., 9/06-3/07, $11,091
- PI: Design, Fabrication, and Test of a Wing-Integrated Antenna, USAF SBIR, Phase 1, with First RF Corp., 9/06-12/06, $15,384
- Co-PI: UAV Sensor Data Collection, L3 Communications, 1/06-6/06, $258,727
- Co-PI: Sea Ice Freeboard, Roughness and Topography from UAV Laser Profilometry, Satellite and Surface Observations: Relationships to Ice Dynamical and Thermodynamical Properties, NSF, 10/05-4/08, $333,064
- PI: SNC Spartan UAV Prototype: Design, Fabrication, Assembly, and Test, Sierra Nevada Corp., 6/05-12/05, $40,994
- Co-PI: Ad Hoc UAV-Ground Networking (AUGnet) Project and Networked UAV C3: Integration, Deployment, and Test Plan, L3Communications, 7/03-6/05, $590,000.
- Co-PI: Supersonic Aircraft Shaping Technology for a Constrained Shock Pressure Rise, NASA, 10/1/02-9/30/03, $150,000
- PI: Vertical Integration in the Aerospace Engineering Curriculum 2000, Lockheed Martin, 6/1/2002-5/31/2005, $150,000
- Co-PI: Shape Optimization for Sonic Boom Minimization, DARPA, 1/1/01-12/31/01, $350,000
- PI: Supplemental Equipment for a Dense Gas Shock Tube, NSF, 3/15/00, $18,270
- Co-PI: Applications of Aerosondes to Long Term Measurements of the Atmosphere and Sea Ice Surface in the Beaufort/Chukchi Sector of the Arctic Ocean, NSF, 6/99-5/04, $3,997,402
- PI: Experimental Investigation of Dense Gas Dynamics, NSF, 6/99-6/02, $260,000
- Co-PI: A Workshop on Dense Gas Dynamics, NSF, 2/99-1/00, $10,100 ($2,600 CU, $7,500 Institute for Advanced Physics)
- Co-PI: Optimization and Analysis of a Waverider Vehicle for Global Spaceplane Trajectories, AFOSR, 1/98-12/98, $25,000
- PI: Engineering Applications of Dense Gases, Phase 1: Advanced Computational Methods, NSF, 7/96-6/97, $50,000
- PI: Subsonic and Supersonic Testing of Osculating-Cones Derived Waveriders, NASA, 7/96-6/98, $44,000.
- Co-PI: Measurements of Vertical Air Velocities from Radar (ARMAR) and DC-8 Aircraft, NASA, 7/94-6/95, $22,000
- PI: Numerical Entropy Production in Navier-Stokes Solutions, EPSCoR/NSF, 1/90-3/92, $60,000

SELECTED TALKS & SEMINARS

- "NetUASC3: An Unmanned Systems Command, Control, Communication, and Sensing Architecture," Phoenix AIAA/SAE Annual Meeting, Phoenix, Arizona, Feb. 2011.
- "NetUASC3: An Unmanned Systems Command, Control, Communication, and Sensing Architecture," IEEE Globecom Workshop on Wireless Networking for Unmanned Aerial Vehicles, Miami, FL, Dec. 2010.
- "Unmanned Aircraft in VORTEX2," AMS Severe Local Storms Conference, Denver, CO, Oct 2010 (Presented by Adam Houston, Eric Frew Co-author).
- "VORTEX2 Unmanned Aircraft System," AUVSI Unmanned Systems North America 2010, Denver, CO, Aug. 2010 (Adam Houston, Eric Frew Co-authors).
- "Refinements in the Semi-Empirical Accommodation Coefficient Model for Satellites," 38th COSPAR Scientific Assembly, Bremen, Germany, July 2010 (presented by PhD Candidate M. Pilinski, S. Palo Co-author).
- "Capstone Projects in the College of Engineering and Applied Science," 2010 Capstone Design Conference, Boulder, CO, June 2010.
- "Small Satellite Approaches to Measuring Neutral Winds and Density," CNOFS Science Meeting, Breckenridge, CO, May 2010 (presented by PhD Candidate M. Pilinski, J. Forbes, Scott Palo Co-authors).
- "Research Directions and Best Practices for UAS in the NAS," IDGA UAV Workshop, Vienna, VA., Apr 2010.
- "UAS in VORTEX2: Goals and Challenges," 5th FAA UAS Conference, San Diego, CA, Feb 2010.
- "Supercell Thunderstorm Penetration by UAS in VORTEX 2," Ball Aerospace Corp., Boulder, CO, Feb 2010.
- "Supercell Thunderstorm Penetration by UAS in VORTEX 2," NOAA Earth Systems Research Laboratory, Boulder, CO, Jan 2010.
- "Unmanned Air Systems: The Next Generations," 48th AIAA Aerospace Sciences Meeting New Horizons Forum, Orlando, FL, Jan 2010.
- "UAS in VORTEX 2," FAA UAS Staff Meeting, San Diego, CA, Jul 2009.
- "Preparing for the Future Perspective of Academia II," AUVSI 2008 Unmanned Systems Program Review," Washington, D.C., Feb 2008.
- NOAA: *Cooperative Mobile Sensing Systems for In Situ Measurements in Hazardous Environments*," Dec. 2005
- Lockheed Martin: *Ad Hoc UAV Ground Network (AUGNet)*, Lockheed Martin, Nov. 2004
- Dept. Aerospace Engineering and Mechanics, University of Minnesota *Research and Engineering Center for Unmanned Vehicles*, May 2004
- DARPA 2003 QSP Technology Exchange Meeting: *Linear Theory Based Optimization for Sonic Boom Minimization*, Nov. 2003
- University of Colorado Faculty Teaching Excellence Program Symposia on Teaching and Learning: *Pro-Active Teaching & Learning*, Sept. 1999, Feb. 2003
- Computer Science Dept., Colorado State University *Pro-Active Teaching & Learning*, June 2001
- DARPA QSP Kickoff Meeting: *Supersonic Aircraft Shaping Technology for Constrained Shock Pressure Rise*, Dec. 2000
- University of Colorado, College of Engineering and Applied Sciences Excellence in Teaching Series: *Pro-Active Teaching & Learning in the AES Curriculum 2000*, Feb. 1999

COURSES TAUGHT

Undergraduate: Introduction to Thermodynamics and Aerodynamics, Aerodynamics, Thermodynamics, Gas Dynamics, Space Science and Systems, Dynamics, Introduction to Engineering Computing.

Graduate: Unmanned Aircraft Systems in the National Airspace System, Real Gas Dynamics, High-Speed Aerodynamics, Rarefied Gas Dynamics, DSMC Gas Dynamics, Spaceflight Dynamics, Advanced Engineering Analysis.

GRADUATE STUDENTS

Graduated Ph.D.: Brady Brown (1997), Rick Graves (1999), Stephen Fergason (2001), Vivek Kaila (2010)

Graduated M.S. with thesis: Alok, Gautam (1992), Charles Aldo (1993), Brady Brown (1994), Gregory Melvin (1995), Rolf Miller (1998)

Current Ph.D candidates: Marcin Pilinski, Craig Turansky, Jason Roadman

CONFERENCES AND WORKSHOP ORGANIZATION

Technical Events Chair, Infotech@Aerospace 2011, St. Louis Missouri (Mar 2011)

Chair IDGA UAV Workshop, Vienna, VA., (Apr 2010)

Co-Chair, *UAS Research Directions for the National Airspace System*, Unmanned Unlimited Conference and Exhibit, Seattle, WA (Apr 2009)

Co-Chair, NSF/AUVSI/FAA/DHS *Workshop on UAS Research Directions for the National Air Space*, AUVSI North America Conference, San Diego, CA (Jun 2008)

Conference Co-Chair, *Civilian Applications of Unmanned Aircraft Systems*, Boulder, CO (Oct 2007)

Technical Program Committee *Infotech@Aerospace Conference*, Washington, DC (2005)

Technical Program Committee, *Unmanned Unlimited Conference, Workshop, and Exhibit*, Chicago (2004)

Technical Program Co-Chair, *2nd Unmanned Unlimited Conference Systems Technologies, and Operations—Aerospace, Land, and Sea Conference, Workshop, and Exhibit*, San Diego (2003)

Technical Program Co-Chair, *1st Unmanned Aerospace Vehicles, Systems, Technologies, and Operations Conference and Workshop*, Portsmouth, VA (2002)

PROFESSIONAL MEMBERSHIPS

Associate Fellow, American Institute of Aeronautics and Astronautics

American Physical Society

American Society of Engineering Education

CONSULTING

- ITT Industries, Systems Division "Architecture for Unmanned Aircraft Transport of Scientific Data from the South Pole to McMurdo Station" (2010)
- Lockheed Martin, "Aerocapture Inflatable Decelerator" (2004)
- Williams Professional Services, LLC (2002)
  "Kaiser-Hill Independent Safety Assessment," Contract No. WPS-SUB02-003
  "Evaluation of DOE Standard 3013-2000," Contract No. DE-AT01-01EW07005
- Krispin Technologies, Inc., "Innovative Organic Rankine Cycle Engines," National Science Foundation SBIR Contract No. 9860391 (1998)
- ITT Industries, Systems Division, "High Altitude Scoping," Contract No. DASG6098-C-0099 (1999-2000)